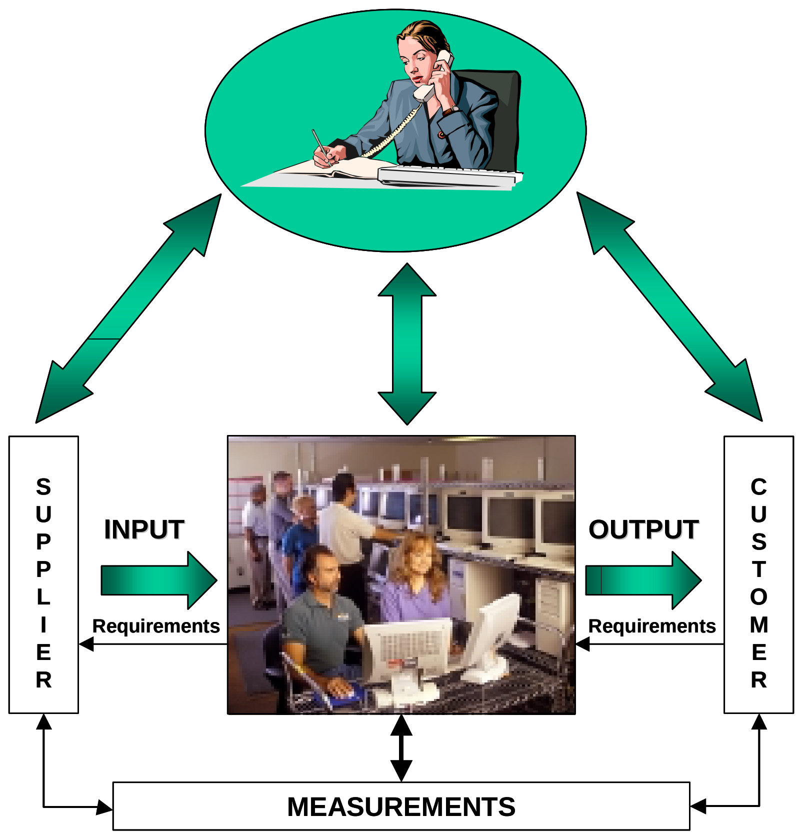
Moving Closer to the Ideal

Guidelines for Process Management



CITY OF MESA

Great People, Quality Service!

Moving Closer to the Ideal

Guidelines for Process Management

Is there a need for process management?

Why is it important for a city government to do a good job? That's a pretty basic question and it verges on being a bit philosophical, but it is the right place to begin these guidelines. A city is a place where together, people live, work, and play. It is a place for many of us, where the stories of our lives unfold. Each day our citizens strive to reach their individual dreams while facing the challenges of life. The services that the City of Mesa provides directly impact the quality of life for over 400,000 people.

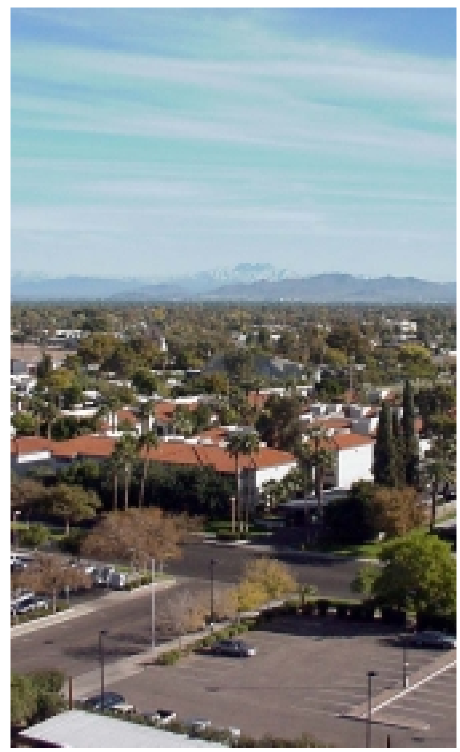
Police and Fire employees protect our citizens from harm and are there to help in the most dire moments of need. Utilities staff ensure that drinking water is safe and clean, keeping our citizens healthy. Economic Development staff strive to encourage top paying employers to build their businesses here in Mesa. Community Services employees work to create opportunities for recreational and cultural activities that renew and inspire our citizens. And there are many other similar examples. In short, the City of Mesa is in business to provide its citizens with a high quality of life. But the services we provide come with a price tag that is paid by our citizens through various taxes.

Today's citizens have grown to expect a high level of service and return for their tax dollar. Many of the current governmental bureaucracies at federal, state, and municipal levels were built during the depression of the thirties, or grew out of the needs of that era. Many basic human needs were not being met for a large section of the public. At that time, mass production of "one size fits all" services was the most efficient and effective means of government meeting those needs. But as the standard of living increased, an increasing demand was being placed on government for a greater variety and quality of services.

The public's view of minimal acceptable standards of service increased as the private sector became more responsive. In past decades, private service and production companies suffered from intense domestic and foreign competition. In response, they sought ever-increasing methods of pleasing their customers and quality management practices evolved. At one time, people didn't mind waiting 20 minutes in line at the post office, dealing

"The significant problems we face cannot be solved at the same level of thinking we were at when we created them."

Albert Einstein



with a grumpy attendant, and getting their parcel delivered in seven days. Then, Federal Express picked your parcel up at your door, always with a smile, and delivered the package by noon tomorrow. No longer was the previous standard of service acceptable for the Federal postal system. The public now compares governmental service with that provided by the private sector.

Some would argue that the City of Mesa is monopoly, like any governmental entity, and that it doesn't respond to the same competitive and profit driven pressures as the private sector. Well, that may be partially true. However, the political reality is that today's public will only support those programs that fulfill a critical public need, and get the job done in a cost effective manner. In the language of business, citizens will only pay for those products or services that provide the greatest benefit for the least cost. The cost of government programs and whether those programs provide meaningful results does matter greatly to citizens and civic leaders.

Process Management is a rigorous, scientific approach to managing work. It evolved from research beginning in the 1930's and was largely developed by two history making pioneers; Dr. W. Edwards Deming and Dr. Joseph Juran. Process management has become a standard management practice worldwide that was developed to:

- be responsive to meeting changing customer needs,
- ensure that quality service is delivered every time,
- ensure that quality services are provided at the least cost, and
- improve continually and forever.

The City of Mesa is committed to providing its citizens with a high quality of life, making Mesa the employer and community of choice. Process Management grew out of the need for consistent, quality, low-cost service to occur by design, and not happen by chance.

What is a process?

All work can be categorized as either a process or a project. A process is the steps taken in producing a product or service. The process of baking a cake consists of buying supplies at the grocery store, mixing the ingredients, pouring the mixture into the pan, baking in the oven, cooling, and applying frosting. Each step in the process of baking the cake is called a task. A process is defined not by the things people do, but instead by the sequence of tasks performed to produce the output.

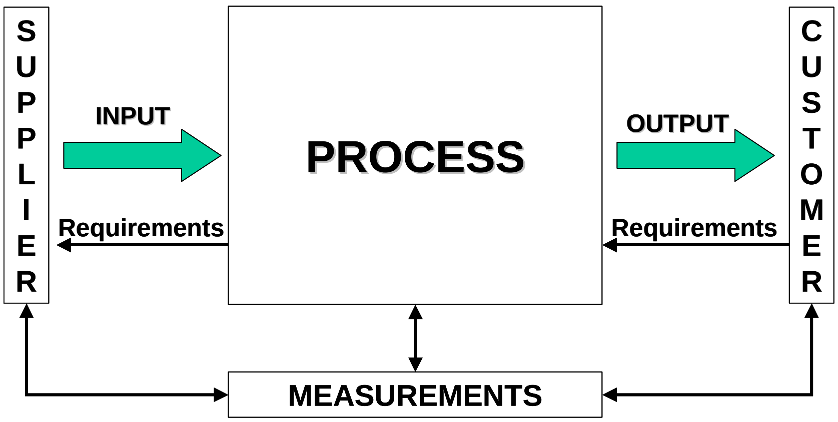
Dr. W. Edwards Deming (1901 – 1994)

In 1947, Dr. W. Edwards Deming, worked as a statistician for the Census Bureau when he visited Japan to help with postwar reconstruction. Dr. Deming's methods, including statistical process control, helped Japan become the dominant global economic force throughout the 1970's.

Ford Motor Company first heard about Deming in 1978, when they conducted a fact finding mission to Japan to discover the reasons Japan was out-competing American auto producers. It was not until 1979, that Deming acquired his first American client, Nashua Corporation. His success with Nashua led to a 1980 NBC television documentary entitled '*If Japan Can, Why Can't We?*', that credited Japan's postwar industrial success to Deming's ideas and gained him notoriety. Finally in 1981, summoned to a meeting of Ford's top executives, Deming surprised them with his message. He wanted to talk about process and people.

Over the past two decades Deming's work influenced history by sparking a major change in how businesses and government are operated. He continued to advise numerous major American corporations until he died in 1994. During his final year of life, at the age of 93, he led 30 four-day seminars teaching a new way to manage organizations.

All processes transform materials or information coming into the process, called inputs, into a product or service, called outputs. In the process example above, flour, milk, and eggs are transformed into a cake. The resources consumed by the process, the flour, milk, eggs, and even electricity for the oven, are the inputs. The final product, the cake, is the output. Something comes into the process; work is performed to transform the input; and a resulting output is produced. Any work that fits this form is called a process.



A project, on the other hand, is a group of tasks performed in a definable time period, to meet a specific set of objectives. A project is a unique, one-time event. In contrast, a process is a sequence of steps that is continually repeated. Construction of a new factory would be a project, whereas the ongoing manufacturing of a product in that factory would be a process. The topic of project management is beyond the scope of this manual, and is an entirely separate field of study. But for now, just be aware that a project and process are different.

Why process management?

There are three reasons why top performing organizations manage their work as processes.

- fragmentation
- processes evolve to greater complexity
- quantity/quality of work is determined by process, not people

Fragmentation: Many organizations are structured by functional departments so that people doing the same thing can work together and help each other. So we typically see functional departments as Finance & Accounting, Budgeting, Fire Department, Building Safety, and others. But the processes through which the work is really accomplished cuts across department boundaries. Obtaining a building permit, for

Dr. Joseph Juran
(1904 -)

Like Deming, Dr. Joseph Juran is a pioneer in the field of quality, and was also a major contributor to the post-war reconstruction of Japan. Because of his contributions to the Japanese economy, Emperor Hirohito awarded Dr. Juran with the highest award given to a non-Japanese, the Order of the Sacred Treasure.

He joined Western Electric (AT&T) in 1924 and spent most of his career as a corporate industrial engineer. Dr. Juran wrote several landmark books on quality and statistical process control that are used today by many major American corporations.

Dr. Juran taught that in managing work, it is essential to focus on those “vital few” things that will improve performance and separate them from the “useful many.”

example, may touch employees from Zoning, Planning, Building Safety, Customer Service, and the Fire Department.

While there are many benefits from such a structure, one downside is that each functional department tends to be more concerned about meeting their own goals than meeting the goals of the entire process. A customer might be sent to one department to fill out Form A, and then sent to a second department to fill out Form B. Of course, the same information is requested on both forms. Anytime work passes from one functional department to the next, opportunities arise for delays, complexity, and mistakes. Unless managed well, a conceptually smooth process becomes fragmented into pieces done by each functional department.

Management experts Michael Hammer and James Champy, in Reengineering the Corporation, perhaps captured the concept of fragmentation best when they wrote, "[poor productivity]…is a consequence of what we call the Humpty Dumpty School of Organizational Management. Companies take a natural process, such as order fulfillment, and break it into lots of little pieces—the individual tasks that people in the functional departments do. Then, the company has to hire all the king's horses and all the king's men to paste the fragmented work back together again."

Processes Evolve to Greater Complexity: As time goes by, a new need arises in a process and a step is added. Then that need goes away but we keep doing that step anyway. In the meantime, the only person who knew why we did that step retired, and now no one knows why we have to do that step at all. But we keep doing that step over and over because…it's the way we've always done it. This is the mechanism through which processes become redundant and filled with unnecessary steps. All processes become increasingly complex over time. Unless managed well, the performance of all processes erodes over time.

One way that you can tell whether a poor process is in place is to focus on the thing passing through the process. Consider a permit being reviewed for approval. In an ideal process the permit would never be idle and only meaningful, value added work would be performed. But if you see that people and machines are busy, and the permit is sitting idle in some in basket for most of the time, then the process is in need of improvement. More time and energy is spent on working the process, not transforming the thing passing through the process.

Process Largely Determines Performance: Whenever a customer complains, or a shipment is late, or perhaps there is an error in a report, what is the most common reaction? We look for someone, some person to blame. But in reality, it isn't quite that simple.

Variation in the quantity and quality of the products or services we provide is caused by either the process itself, or sources outside the process. If the variation is caused by the process itself, then it's called Common Cause variation. The name implies that all the steps in common, cause the variation. Examples might be a process that requires multiple signatures, a form that is lengthy and complicated to understand, or a software system that is difficult to enter information. Performance problems, variation, is built into the process.

Alternatively, Special Cause variation is result of lightening bolts that strike at random from out of nowhere. Examples of special causes of variation might be a computer failure, you encounter a customer that's having a bad day and takes especially long to serve, or perhaps an employee is struggling with a family problem and is unable to concentrate. Being able to separate causes of variation into these two types gives managers direction about how to solve problems, when to take action, and when not to take action.

Management research over the years developed the 85/15 Rule. About 85% of all performance problems are due the systems or processes, that is, Common Causes of variation. Only about 15% of all performance problems are under the workers' control or random events. The conclusion, which is a fundamental principal of quality, is that if performance problems are due to common causes of variation, then change the process, but don't blame people. Only by changing the process can you improve performance. If performance problems are due to special causes of variation, then immediately react (or fix) each specific cause, but do not change the process. If you change the entire process in response to a lightening strike, then typically, steps are added to a process and performance gets worse. This is called *tampering* with the process.

If you remember no other message in all of your training in quality, please remember this point. ***Process largely determines performance.***

We have learned that work processes, the steps we take to do the work, largely determines our productivity, cost, and service quality. But as time goes by, these processes become unnecessarily complex and redundant. Additionally, the way that organizations are divided into functional departments can break up the work into fragments that make the work prone to delays and mistakes. Managing and controlling the process through which work is done is the best way to ensure that our

"Different people in the same situation tend to produce similar results. When there are problems, or performance fails to live up to what is intended, it is easy to find someone or something to blame. But more often than we realize, systems cause their own crises, not external forces or individuals' mistakes."

Peter Senge

Examples of variation.

- The weatherman says that today's normal temperature is 70 degrees, but it's actually 74.
- On average it takes me 20 minutes to drive to work, but today it took 30 minutes because of traffic.
- Our body temperature is supposed to be 98.6, but right now my temperature in 98.8. Notice that it is easier to see variation when the unit of measure is more refined. Would we detect more variation if we measured our temperature in 1/100 degree?
- When trying on clothes, two shirts of the same size and brand fit differently.
- One time, it took forever for them to serve your food at your favorite restaurant.

services are provided in a consistent, quality, low-cost manner, by design, not by chance.

Variation

Think about times when service that you received was inconsistent; where one time it was good and the next time it wasn't so good, or maybe even poor. What does it communicate to you as a customer when you receive inconsistent service? Inconsistent service communicates:

- Can't trust you
- You aren't reliable
- You aren't responsive to my needs
- I'm not important

Inconsistent service is one example of variation in a work process. We define variation as simply the difference between the ideal outcomes in a perfect world and the actual outcomes in the real world we live in. Variation is so much a part of our lives that we take it for granted. Have you ever used the phrases "it depends", "it's always different", "it's never the same", "it varies" ?

No doubt, variation exists in the world around us, and it exists in the work that we do and the services we provide. But let's say for a moment that we could control the variation and deliver perfect service every time. Because we know that process largely determines performance, it would require an ideal process to produce ideal performance.

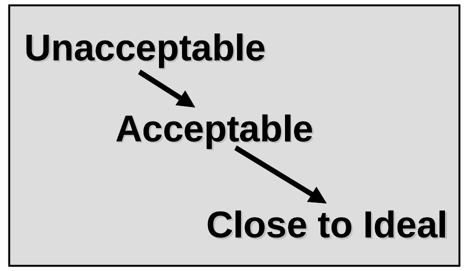
The ideal process…

- provides the customer
  - exactly what they want
  - when they want
  - in the manner they expect
  - and it solves their problem or meets their need
- never varies; it is always perfect
- no errors, no rework, no waste
- requires the least amount of time possible
- requires the least cost possible

But in the real world,

- we don’t always meet customer needs
- nothing is ever perfect
- errors, mistakes, defects happen
- things take too long
- things cost more that we expect

The goal of process management is to control variation from being unacceptable to being acceptable. The goal of process management is to move as close as possible to the ideal, and keep it there as often as possible. We know that all work processes will normally vary, even under the best of conditions. The power of process management lies in being able to monitor this variation on an ongoing basis and take action when it becomes unacceptable.

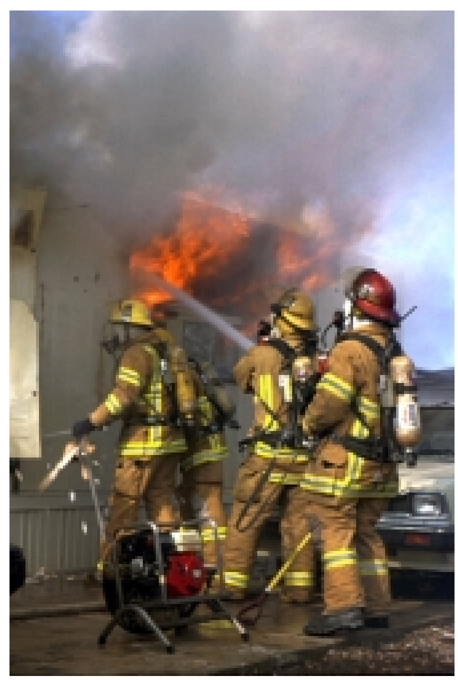


There are several reasons that unacceptable variation in our work processes, reflected in our products and services is bad.

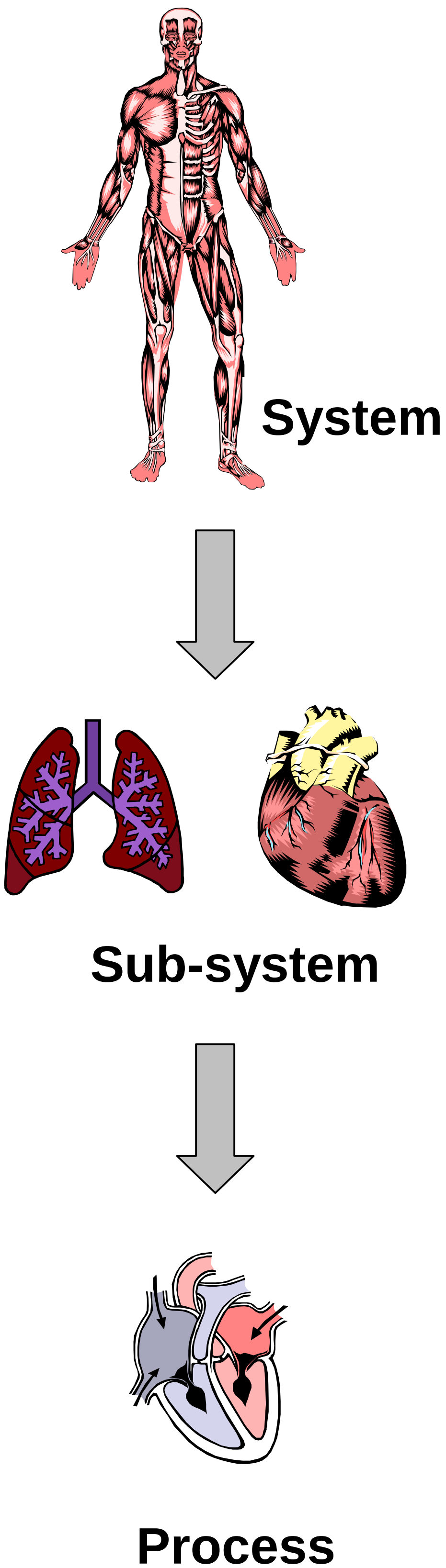
- When product or services are outside what the customers specify they want, we say that a defect is present. Excessive variation leads to defects, which lead to customer dissatisfaction.
- Excessive variation means that there are problems in the process and we are probably spending (wasting) more effort and money than necessary.
- Excessive variation means that we are probably going back to fix jobs that weren’t done right the first time. We are probably also responding to customer complaints to recover for poor service.

System, Subsystem, Process

Organizations, such as the City of Mesa, can be tremendously complex things. The City provides hundreds of services to literally thousands of customers on a daily basis. To complicate matters, the work units and departments depend on each other and are interrelated. The work products of one work unit are often needed and used by another work unit to do their job. With process management, we hope to develop a system to control productivity, quality, and cost. But where do we begin? How can we begin to make sense of such a large, complex, interrelated organization?



Once again, we turn to the discipline of science to help answer this question. A standard practice in science has been to break



apart a problem into increasingly smaller pieces until each remaining piece is small enough to understand. Large organizations can be subdivided into smaller and smaller pieces (from Departments to Divisions, to individual work units), until we can better understand the work that is being done. However, such a hierarchical structure doesn't reflect the workflow through an organization, but reflects only the grouping of similar functions and the chain of reporting authority.

An alternative way of viewing the organization is extremely useful in managing work, and that is to view the organization as a system. A system is a collection of parts (subsystems) integrated to accomplish an overall goal. A system of people is an organization. There are many types of systems, and the human body is an example of a biological system that can be divided into its major components or subsystems. The body is composed of the circulatory, respiratory, digestive, nervous, and other subsystems. Each subsystem is in turn made up of processes, like how the blood courses through the body delivering oxygen and removing carbon dioxide.

A system is a set of interacting and interdependent processes. The outputs of one process, or subsystem, are needed as input to another. The circulatory subsystem delivers oxygen to the musculatory subsystem, which in turn, burns the oxygen to produce movement. The defining characteristic of a system is the interaction or feedback between the parts. If one part of the system is removed, then the nature of the system is changed. A pile of sand is not a system. If a particle of sand is removed, it still remains a pile of sand. However, a functioning car is a system. Remove the carburetor and it is no longer a functioning car.

Managing an organization as a system is a powerful way to manage productivity, quality and cost. A system view of an organization does not consider functional departments or the chain of reporting authority, but instead, focuses on the workflow and steps taken to provide service to our customers. A process produces outputs (products or services) that have a common purpose for the customer. A subsystem is a group of interdependent processes that share a common purpose. For example, the Land Management System is composed of the Long Range Planning, Current Planning, Zoning Administration, Land Development, and Post-construction Compliance subsystems. Core Plan Review is one process within the Land Development subsystem.

Traditional management in past years typically looked at one part of the organization, say Payroll, to focus on improvements. The problem with this management style is that an organization could have excellent departments that work well by themselves, but not work well with each other to provide service to the customer. Consequently, the organization as a whole, and customer service, would suffer. From a system perspective, on the other hand, improvement efforts would focus on the process through which service is provided as it cuts across the organization. It focuses on how the parts of the organization interact with each other to provide that service. Success is measured by the degree to which the service is provided in a quality and cost effective manner.

One word of caution; be careful when beginning process management to avoid trying to improve the entire system at once. Truly understanding one process of even a limited scope can be a daunting task. Trying to understand the complexity of several processes simultaneously and all their interrelationships can overwhelm a team to the point of giving up on the project. After several individual processes are well understood, then the structure of a higher-level system will begin to emerge.

"Excellent firms don't believe in excellence, only in constant improvement and constant change."

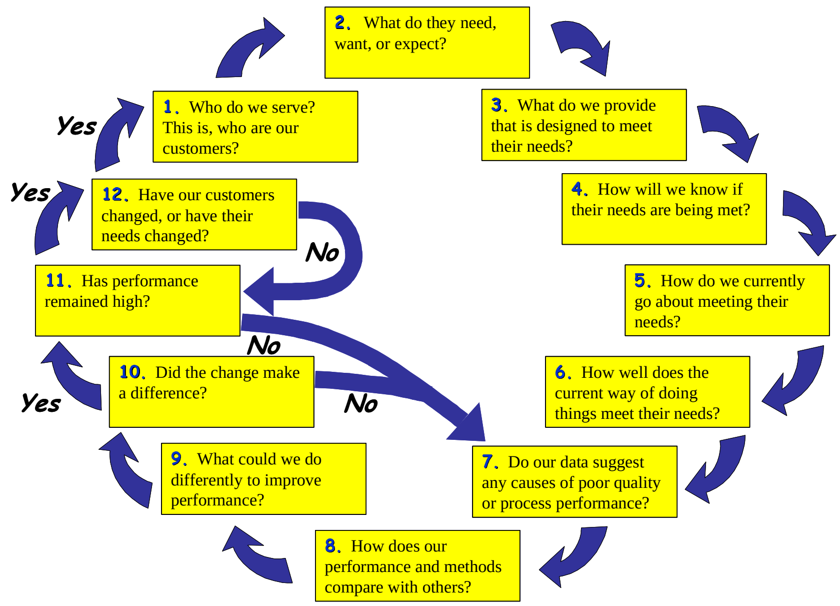
Tom Peters

12 Steps to Process Management

The continual, never ending, scientific study and improvement of work processes is called process management, or continuous process improvement. Process management is a structured team activity that never ends. It is a standard way for teams to work together to make sure that their customers get exactly what they need, every time.

Process management begins by getting all the people together who contribute to completing a job from start to finish. Let's say, for example, that citizens complain that it takes too long to get approval for a permit, and the process of approving permits must be improved. All the employees who handle the permit application from the moment the citizen delivers it to the City, until the permit is approved are needed to improve the process. After all, only they know the steps through which the application must pass before being approved. And only they know best how to fix the problem. This process improvement team would then answer the following questions through a series of structured team meetings.

12 Steps to Process Management



Who do we serve? That is, who are our customers?

Step 1: Identify Customers, Suppliers, and Stakeholders

The first step is to brainstorm and list the customers, suppliers, and stakeholders that you serve. The team may then be asked to prioritize this list to identify critical customers. While private companies can ignore certain groups of customers, public sector organizations are tasked the job of serving all citizens. However, trying to be everything to everyone will also lead to problems. Prioritizing critical customers can help gain focus about those customers whose needs are immediate, serious, and urgent.

What do they need, want, and expect?

Step 2: Identify customers' needs, wants, and expectations.

All organizations or businesses essentially do two things: 1) they solve customers' problems and 2) they leave an impression with customers, hopefully a good feeling about the product or service they received. The products and services that we provide are intended to serve our customers by solving their problems. So the fundamental starting point is finding out what problems our customers need solved, and to understand what they need, want and expect from receiving our services. In other words, we must determine what our customers require of us, called customer requirements.

The only person who really knows what our customers require of us, is the customer. Understanding customer requirements begins by asking the customer through focus groups, surveys, or market research, what they need, want, and expect. At some point in time, it is necessary to translate what the customer tells us in common language into measurable service standards. For example, if the customers say they need a short waiting time, then how long is a short wait? Five minutes or fifteen minutes?

In this work session the team identifies what problems customers need and want solved, and lists their needs, wants, and expectations. Initially, the team may have little data from which to base conclusions. It may be necessary to brainstorm customer needs, wants, and expectations as a starting point.

Step 3: Identify the products and services currently being delivered.

What do we provide that is designed to meet their needs?

The team develops an inventory of current products and services provided by the process. Process improvement teams often find that they were not fully aware of the number and diversity of products and services provided by the process. Equally important, the customer may not even want some products or services currently being offered. A comparison of current services provided with customer requirements often leads to better focus and ultimately, increased customer satisfaction. It is often beneficial here to distinguish those services that the customer absolutely requires of us from those services that are nice to have, but not absolutely necessary or expected. Lastly, the team identifies which products and services are directly designed to meet customer requirements, and to evaluate if any requirements are not being addressed by a current product or service.

"Quality is never an accident; it is always the result of high intention, sincere effort, intelligent direction and skillful execution; it represents the wise choice of many alternatives."

Willa A. Foster

Once a complete list of products and services is developed, the team then groups together similar products and services that share a common purpose. For products or services to be considered similar, they should be produced or provided in a relatively similar manner. These groupings define processes.

Step 4: Identify process performance measures.

How will we know if their needs are being met?

Data-based decision making is a fundamental principle of quality management. Perhaps the concept is best captured by the old adage, *'If you don't measure it, then you can't manage it.'* Performance measures for the process management team are much like the cockpit flight instruments for a jet pilot. These instruments tell the pilot the aircraft's speed, altitude, direction, and fuel consumption. To try to manage work without performance measures is like flying blind. Process performance measure are needed to:

> *"If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it."*
>
> *H. James Harrington*

- measure what happened in the past (history)
- prepare for improvement (baseline)
- focus improvement (feedback)
- demonstrate that goals have been accomplished (feedback)

The process management team generates a list of process performance measures as a way to know what success looks like. This work session identifies the beginning and ending points of the process and lists potential performance measures. The team prioritizes and selects only the most important, critical few performance measures for data collection. Without process performance measures, it is impossible to know if any changes or improvements did any good.

There are five types of performance measures. Each evaluates a different aspect of how a process is performing. The aircraft pilot needs to look at multiple instruments simultaneously and process all the information to determine whether the aircraft is on course and stable. It probably wouldn't be a good idea to fly on a commercial airline if their jets only had a fuel gauge as its single instrument. Just like the aircraft pilot, a process owner needs a suite of measures to assess whether work is progressing as it should. Following is a discussion of each type of process performance measure.

Inputs: Input performance measures identify the resources required to produce a product or service and/or the demand for services. They can include the amount of labor, materials, equipment, facilities and/or supplies needed. Input indicators can be used to show:

- The demand for a service
- The mix of resources needed to provide a service
- Financial costs

Outputs: Output performance measures show the quantity of a service or product being produced. They measure the amount of products or services provided or the number of customers served, and are largely volume-driven. Output indicators are:

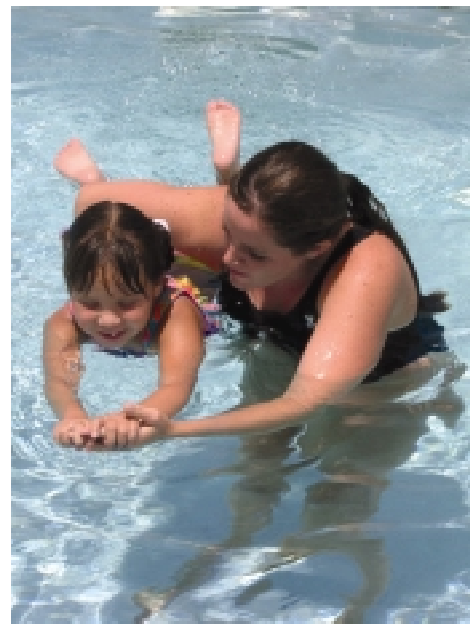
- Useful for resource allocation decisions.
- Limited, because they do not show whether program goals have been accomplished; nor do they reveal anything about the quality or efficiency of service.

Efficiency: Efficiency performance measures show how much resources were used to provide a product or service. They measure productivity and cost-effectiveness. They can show workloads and can gauge the timeliness of services provided. They help processes to improve service delivery. Efficiency can be shown by:

- Quantity used divided by quantity produced
- Cost per product or service
- Cycle time
- Backlog
- Cost of poor quality

Quality: Quality performance measures evaluate excellence. Are customers getting what they want, when they want it, and how they want it? They reflect effectiveness in meeting the expectations of customers and stakeholders and are typically shown by:

- Accuracy
- Responsiveness
- Reliability
- Courtesy
- Customer satisfaction
- Convenience
- Credibility



Outcomes: Outcome performance measures evaluate overall success; the ultimate purpose of the product or service provided. They measure results and assess program impact and effectiveness. Outcome measures are the most important performance measures because they show whether or not expected results are being achieved. They give an indication of how well we were able to solve our customers' problems. Outcome indicators relate to:

- Service impact
- Results achieved

Step 5: Map the current process.

How do we currently go about meeting their needs?

The team next identifies the individual steps through which current products or services are provided to customers. The relationship of these steps to each other is displayed in a flow chart diagram called a process map (see Quality Tool Sheet, page59). The process map allows the team to have a clear picture of how business is currently done, and to identify ways of improving the process.

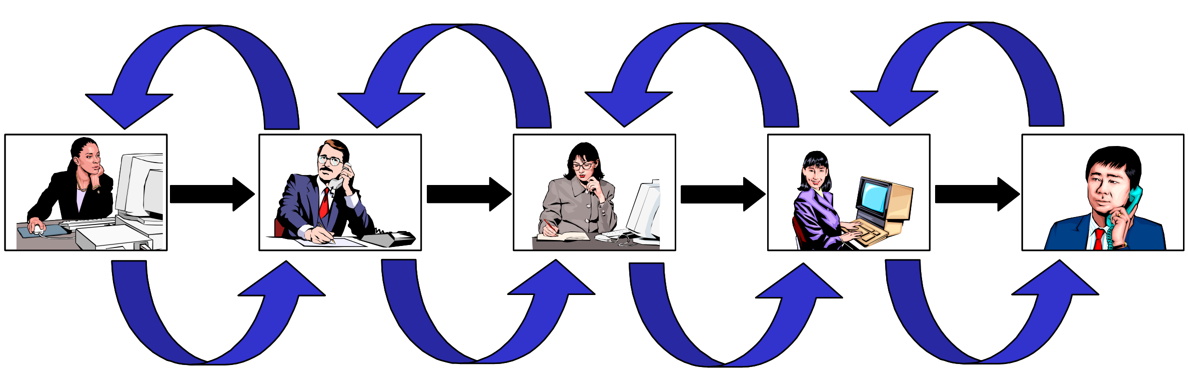
Begin the team work session by discussing and identifying the beginning and end of the process being examined. All processes must have only one beginning and one end, which many times is not obvious. This is an important step because is sets boundaries on the scope of work. It is very easy for process mapping work sessions to start expanding into different but related processes. In fact, one of the most common problems that teams face is attempt to study and improve an entire system at once, and not focus on improving one process at a time.

> *"Facts are stubborn things; and whatever may be our wishes, our inclinations, or the dictates of our passion, they cannot alter the state of facts and evidence."*
>
> John Adams

Now that the process is given boundaries, next identify the thing that is moving through the process. All processes have inputs that are transformed into outputs. Remember that in the example of baking the cake, the flour and other ingredients is the thing passing through the process. Process mapping follows the steps through which this thing must move in order to be transformed into the final output. So pause for a moment, and imagine that you are this thing, even if the thing is information that is being written in a report. Imagine what physically must happen to this thing as it is transported and processed. Record each one of these steps using the standard flow-charting symbols and rules (see Quality Tool Sheet, page 59). Only when all the steps and logic flow of a process have been identified can we begin to find clues about how to improve performance.

Process mapping also helps team members focus on the needs of their internal customers. The thing passing through the process, in many cases, passes from one person to the next along the way. A service order, for example, might get entered into a computer at the front counter, approved by a manger, sent to a scheduler, then the scheduled work order delivered to a field technician. Process management requires that we treat the next person in the process as the customer. The next person in your process is the customer, your internal customer. Ask the next person in your process what they require in order to do their job well, and then deliver that service to them correctly every time. In this way, quality can be maintained 100% of the time throughout the process from beginning to end. Requirements are passed upstream in the process, while conformance to those requirements is met for every downstream person.

Requirements passed upstream



Conformance met downstream

Step 6: Collect baseline data.

How well does the current way of doing things meet their needs?

Let's say that the process map sparks an idea about how to eliminate a particular problem and improve performance. If we made that change right away before collecting any baseline data, how would we know if the change did any good? A reasonable amount of baseline data must be collected before any changes to the process are made.

Designated team members identify the means by which process performance can be measured, and then collect and tabulate that information for actual work under way. For example, assume that the time it takes to provide a service was selected as a process performance measure. Selected team members might decide who would record the elapsed time, how the information will be recorded, and how a summary of times would be produced. Work will be allowed to run for a period of time while baseline data are collected. Availability of historical data would speed up data collection. This information is summarized after enough time has elapsed to give a quantified description and assessment of the 'as is' process performance. If we do not measure our starting point, then we cannot know whether any changes or improvements did any good.

A very useful technique when collecting baseline data for the first time is to keep track of the type and number of problems that hurt process performance. Check sheets are an effective tool to accomplish this (see Quality Tool Sheet, page 55).

Step 7: Identify root causes of poor process performance.

Do our data suggest any causes of poor quality or process performance?

One part of measuring and tracking process performance is to find out where the product or service provided didn't live up to expectations. When were we late? When and where were there errors? When did the customer come back to us with a complaint? After measuring process performance for a period of time, and keeping track of the times when service wasn't provided as expected, problem areas may become apparent. We want to change how we do things to prevent these problems from ever arising again. But what steps in our work process cause these problems to happen in the first place?

The team first identifies possible causes of poor process performance, perhaps using a check sheet. Then, graph the actual frequency of occurrence of these problems as what is called a Pareto chart (see Quality Tool Sheet, page 58). Vilfredo Pareto (1848-1923) was an economist who first stated the principle that 80% of the wealth is generally held by 20% of the population. Dr. Joseph Juran (see page 3) many years later

Dr. Kaoru Ishikawa (1915 – 1989)
Finding Root Cause

Dr. Kaoru Ishikawa, Professor of Engineering at Tokyo University, developed an effective tool to discover the root causes of a problem. Dr. Ishikawa used a diagram, called a cause-and-effect diagram (or fishbone diagram), to brainstorm and think through the possible chain of all linked causes of a complex problem. See Quality Tool Sheet, page 56, for more details.

How does our performance and methods compare with others?

developed the Pareto Principle that 20% of process problems will provide 80% of the opportunity for improvement. In other words, correcting only a vital few causes of lower performance will provide most of the improvement possible.

Most of the time problems are result of a chain reaction of causes. If you don't fix the very first cause, the real cause of the problem, then the problem will keep reappearing. But if we correct the root cause, then the problem is solved forever. An old rule of thumb states that if you ask why 5 times, then most of the time you will have found the root cause of the problem.

A secretary received the wrong office supplies from the warehouse, again. Why? After researching the problem, we discovered that purchasing staff did order the wrong supplies. Why? The person in purchasing misread the printed order. Why? The printer in the purchasing office isn't working properly. Why? The toner cartridge in the printer is faulty and no one fixed it. Why? No one was given the responsibility or was accountable for maintaining the printer.

The problem was that a secretary received the wrong office supplies. The root cause of the problem was that no one in purchasing was accountable for maintaining the printer. If the root cause is not corrected, then the problem will keep happening over and over. In all likelihood, the purchasing employee who placed the order would have been criticized for his error. But the lack of accountability for maintaining the printer was built into the office procedures. This example is also a demonstration that process largely determines performance. Fix the root cause of the process problem, and you improve performance.

Step 8: Benchmark best in class organizations.

Benchmarking is a term that means studying the best organizations to find out why they are so good, and then copying their methods. Sometimes people believe that the problems they face in the workplace are unique because no one else really does the exact same kind of work that we do. But in reality, many organizations have more in common than differences, even if they are in two very different lines of business. For example, the world's best company in managing warehouse inventory could probably teach other companies in very different lines of business, a great deal about managing their warehouses. So when we are looking for ways to improve how we work, a very good place to start is to find out what the best organizations do.

"Benchmarking is not a numbers-only exercise. Setting quantitative goals, often called metrics, through benchmarking is arguably the best way to set goals, but keep in mind that setting goals comparable to or beyond those of the best-in-class without understanding the underlying processes that enable the best-in-class to achieve their results can be useless or worse. Understanding how the companies you study achieve their results is usually more important and valuable than obtaining some precisely quantified metrics." (Boxwell 1994)

Benchmarking is a team process that asks a great deal of the organization being benchmarked. It involves a quantitative assessment of the other company. Sometimes questionnaires are used where at other times specific data are requested or measured. Which data to analyze, or questions to investigate should be carefully planned.

Background research must be conducted to select a comparative organization. The obvious objective is to find another organization that is best in class. However, we may not want to look only to our direct counterparts or competitors for best practices. For example, any organization might benchmark a training program against that of Motorola, or perhaps benchmark customer service processes against that of the Ritz-Carlton. The point is to be open minded when looking for another organization to benchmark, and to think about the processes at which they excel, not their specific line of business.

Conclusions reached from benchmarking can be put to use in two ways. First, change and adapt existing processes based on what you learned. Then follow up by monitoring performance to see if those changes really worked. Second, the information discovered from benchmarking can radically change performance targets and standards by which we evaluate ourselves.

Step 9: Redesign the process.

The purpose of developing the process map is to give clues where changes can be made or steps eliminated to improve performance. But how do we know which steps are candidates for elimination or changing? The answer is to first identify those process steps that matter most, or have value in the customer's eyes. *Value* is such an important process management concept that it warrants further explanation.

All processes transform inputs into outputs while adding value in the transformation. A cake sold in a bakery costs more than the cost of the individual ingredients. In the customer's eyes, the baker added value to the raw ingredients by baking the cake.

Dr. Michael Hammer (1948 -)
Reengineering

A former Computer Science professor at MIT, Dr. Michael Hammer is recognized as the father of reengineering, which became a major business practice in the 90s. Hammer teaches that sometimes you won't be able to meet customer needs by just improving existing processes. It might be best to start over from scratch, and beginning with a blank piece of paper, design a completely new process, perhaps utilizing new equipment and technology.

Reengineering, as this tactic is called, is a radical methodology to be undertaken by three types of companies. Companies that …

- "…have hit the wall and are lying injured on the ground."
- "…are cruising along at high speed, but see something rushing toward them. Could it be a wall?"
- "… are out for a drive on a clear afternoon, with no obstacles in sight. What a splendid time, they decide, to stop and build a wall for the other guys."

What could we do differently to improve performance?

Consider strategies for improving processes.

- Eliminate non-value added steps
- Eliminate redundant steps
- Reduce complexity and streamline
- Make sequential steps parallel
- Place checks (if necessary) as close to the work as possible
- Use fail-safing methods or error-proofing
- Reduce the number of handoffs
- Subordinate all steps to the slowest step
- Increase the capacity of the slowest step
- Reduce batch size to reduce waits
- Cross-train employees for peak times
- Take advantage of technology

Fail-safing or Poka-yoke

Shigeo Shingo, a Japanese engineer from Toyota, found that processes could be designed to make it virtually impossible to make mistakes. For example, surgical trays are designed with indentations for each instrument. This simple feature makes it easier to account for every instrument at the end of a surgery.

A City building plans examiner adds value during the permitting process by ensuring that construction plans meet building codes. Regardless whether customers are dealing with private sector companies or public sector agencies, what really matters to customers is value.

Value is defined as what customers receive in proportion to what it costs. In other words, value is the Got:Cost ratio. If a customer got an exceptional seven-course dinner for the normal price of a hamburger, then she would likely conclude that it was a good value. On the other hand, if she had to wait in line for 10 hours to get the same meal and price, then she would likely conclude that the meal was an extremely poor value. Customer perceptions of cost include both price and the customer burden or hassle they must endure to receive the service.

The ideal process would contain only those steps that add value to the product or service. Again from the customer's eyes, the step of putting icing on the cake adds value. However, carrying the cake from the baking room to the icing room does not add any value. The baker could even move the cake several times before putting icing on it and the value of the cake would not change because it was carried from room to room. If we could identify only those steps in a process that add value, and eliminate all other steps, then the ideal process would result.

The process management team begins the value added analysis by walking through the process map, step by step, to identify each value added step. Value added steps are flagged to be kept. Steps that take an exceptional amount of time or are especially costly are also flagged to be changed or eliminated. These three criteria, time, cost, and value can be used to identify high priority steps to be retained or modified.

There are three specific conditions that must be met in order for a step to be value added:

- It physically changes the thing passing through the process.
- The step is done right the first time.
- The customer is willing to pay for it.

Two exceptions to this rule may also be used to consider a step as value added:

- It is a legitimate legal requirement.
- It is necessary to allow the survival of the organization (e.g. payroll).

Some tasks almost always indicate a non-value added step and can serve as a red flag to identify candidate steps for elimination. The most common and important sources of waste in processes are rework, inspection, and transportation. Anytime a product or service must be reworked to fix a problem or correct a mistake, both time and cost increases while leading to poor customer service. Inspection implies rework because the job wasn't done right the first time. If inspection is necessary and it occurs only at the end of the process, then all of the work occurring after an error early in the process is wasted. Lastly, no work is being performed while a product or document is being moved or is in storage. Anytime rework, inspection, or transportation is seen, look for ways to eliminate or reduce those actions.

Once the team has identified all the value added and non-value added steps, then we are finally ready to begin to redesign the new ideal process. The team may either make a few minor changes to the existing process map, or start entirely with a blank sheet of paper. In either case, the team should be creative and map the process as if we lived in an ideal world. Be daring to imagine what it would take to cut the service time by 75%, for example. Many times it is only when people are faced with monumental challenges do we rise to the occasion and explore radically new ideas. What technology would we need? How might we organize our employees? Allow your creativity to make the ideal process. Only when the ideal process map is finished can we step back to reality, and evaluate how much we can change now, and how much we can plan for the future.

Red Flag indicators of non-value added steps.

- Rework
- Inspection
- Transportation
- Complexities
- Redundancies
- Delays
- Storage
- Bottlenecks/backlog
- Bureaucracy
- Travel (distance)

Step 10: Implement the change on a trial basis and monitor for improvement.

Appropriate managers implement the changes as shown by the new process map on a trial basis. Performance data collection continues as was done for the baseline data. The new process is allowed to continue for as long as necessary to find out if the performance measures improved. If the redesign was successful in improving performance, then the process is made permanent and standard throughout the organization. Otherwise, the team will meet again and develop new ideas about how to change the process to improve performance. Steps 7 through 10 are repeated as many times as necessary until a successful approach is discovered.

The implications of this step are much greater than you might consider at first. Being able to try experiments means that we don't need to worry excessively about getting it completely right the first time. While no one will accept careless or shoddy work, it is expected that good ideas, executed correctly, may not work. Under process management, not only are such failure expected, but greatly desired.

Did the change make a difference?

"I have not failed 700 times. I have not failed once. I have succeeded in proving that those 700 ways will not work. When I have eliminated the ways that will not work, I will find the way that will work."

Thomas Edison

Has performance remained high?

Have our customers changed, or have their needs changed?

Step 11: Make the change permanent and monitor for high performance.

The process owner monitors performance data continually to ensure that performance remains high. If performance substantially declines at any point in time, then the process improvement team may re-evaluate potential causes of the poor performance and make changes to the process by repeating steps 7 through 10 all over again. This cycle continues forever. Regular staff meetings change to focus on a review of the latest performance measures and to develop new ideas about how to improve the process. These continual meetings and experiments are the source of the term *Continuous Process Improvement*.

Step 12: Monitor customers' needs periodically to identify any changes.

Periodically, the process owner should initiate a repeat customer survey to find out if customer needs have changed. Changes in performance measures and/or increasing customer complaints may indicate that conditions have changed for the customer, instead of a change in the work process. When sufficient time has elapsed that inefficiencies may have crept into the work process, or customers' needs may have changed, then it is time to start the complete process management cycle over again.

Statistical Process Control

Remember earlier we said that the goal of process management is to control variation from being unacceptable to being acceptable. The goal of process management is to move as close as possible to the ideal, and keep it there as often as possible. An area of mathematics, called statistics, can help understand the sources of variation and bring variation in process performance under control. This next section will present the principals and concepts of what is known as statistical process control.

Two Types of Variation. Recall that variation in the quantity and quality of the products or services we provide is caused by either the process itself, or sources outside the process. If the variation is caused by the process itself, then it's called Common Cause variation. The name implies that all the steps in common cause the variation. Alternatively, Special Cause variation is result of lightening bolts that strike at random from out of nowhere. Being able to separate causes of variation into these two types gives managers direction about how to solve problems, when to take action, and when not to take action.

Management research over the years developed the 85/15 Rule. About 85% of all performance problems are due the systems or processes, that is, Common Causes of variation. Only about 15% of all performance problems are under the workers' control or random events. The conclusion, which is a fundamental principal of quality, is that if performance problems are due to common causes of variation, then change the process but don't blame people. Only by changing the process can you improve performance.

If performance problems are due to special causes of variation, then immediately react (or fix) each specific cause, but do not change the process. If you change the entire process in response to a lightening strike, then typically, steps are added to a process and performance gets worse. This is called *tampering* with the process.

The lack of widespread and deep understanding of this principle allows two management mistakes that lead to many of our frustrations and headaches in our daily workplace. They account for a large portion of lost worker productivity.

- Treating a common cause as a special cause.
- Treating a special cause as a common cause.

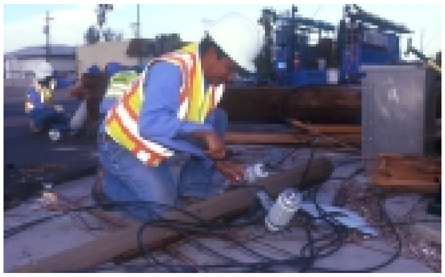
Let's take a look at each one of these mistakes a little closer. Have you ever worked in a place where the work unit could not keep up with workload, and yet you were asked to work harder, longer, and do better? But if performance is largely controlled by process, and the process is working at maximum capacity, then reprimanding employees will only make the situation worse. The performance was controlled by common cause (the work process), but the action taken to improve things (reprimanding employees) was directed at a special cause (the employees' behavior). Consequently, nothing will improve.

Consider a second example. Last week it was discovered that an employee had taken sick leave for four days, but was seen at a nearby bowling center competing in a tournament. In response to the incident, management implemented the following policy, which was distributed throughout the organization. *All persons returning from sick leave shall provide written documentation from their physician about the nature of the illness and estimated reasonable time for recovery.*

This example is one where a special cause (an employee's behavior) was treated as if it were result of a common cause

"A basic principle presumed here is that no one should be blamed or penalized for performance that he can not govern."

W. Edwards Deming

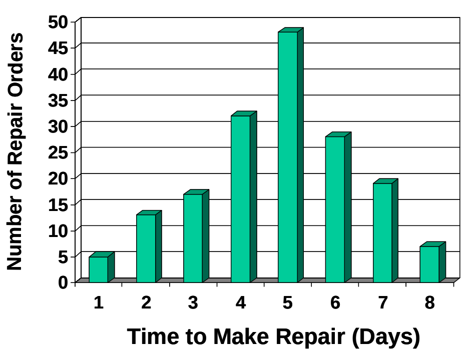


(the sick leave policy). The new policy would add an unnecessary step to the sick leave process, increased gossip about trusting employees, and reduced employees' feelings of being trustworthy. All of these effects are costly waste. A special cause was treated as common cause. This tampering resulted in the lost productivity of the entire work unit that could have been prevented by disciplining one employee.

Distinguishing Between Common Cause and Special Cause. So, now we know that when a process is not performing well because of common causes of variation, then we must change the process. And, when we see a special cause, then we should respond to that specific issue head on. But how do we know when to start looking for a common cause or a special cause? What raises a flag to let us know that performance has changed and we need to look for a common cause or special cause? To answer this question we must use

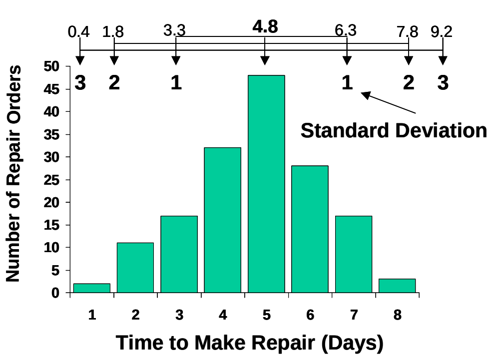
- statistical analysis of data, and
- Run-Control charts.

An area of math, called statistics, is used to describe variation. Remember that variation is just the difference between actual and ideal performance. Now let's take a look at how variation is described in such a way that it will give a clue whether common causes or special causes are present.



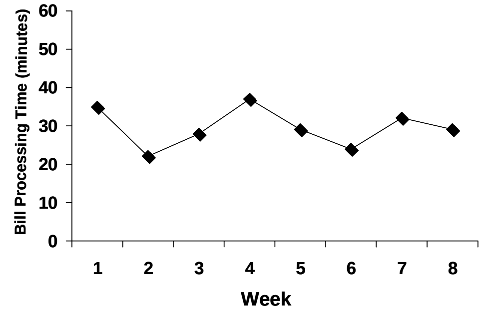
We start by measuring our work repeatedly over time. For example, how long does is take to process a permit application, a water bill, or a repair order. Then we would graph the frequency of measurements, number of days to make a repair in this example. Finally, we ask if the average performance and the scatter around the average is acceptable according to our customers. The scatter of measurements around the average is one description of variation, how close all the performance measurements are to the average.

Standard Deviation is a statistical term used to describe variation around an average. Do you remember the bell curve from school grades? In process management, Standard Deviation is used to tell us how far away from the average that we must be to include 99% of all our performance measurements. Don't worry about how it is calculated or its technical definition. For now, just be aware that



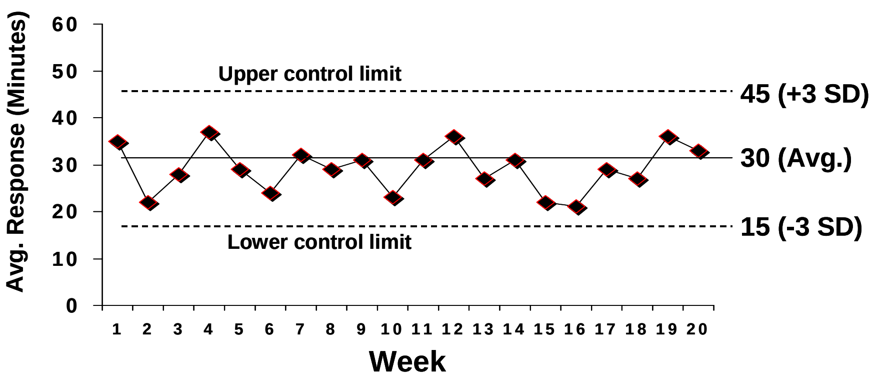
- 1 Std. Dev. from the average, above and below, includes 68% of all measurements in a bell curve
- 2 Std. Dev. includes 95% of all measurements, and
- 3 Std. Dev. includes 99% of all measurements.

When the standard deviation is used to draw a special kind of chart, it can tell us great deal about whether common causes or special causes are affecting process performance. This chart is called a *run control chart*. A run chart is simply a line graph of performance data over time. Let's say for example, that every week we process 100,000 water bills. Each week 500 water bills are randomly sampled to measure how long it took to process them. If we plot the average time of the 500 sampled for each week, then we have produced a run chart. It shows trends in performance over time.



Run chart

Now let's add two things to the run chart. First, we add a line that shows the grand average for all weekly samples. This is the average of all measurements for the entire time period. Next, two lines are added that represent 3 Standard Deviations above and below the average. Remember that 3 Std. Dev. above and below the average includes 99% of all measurements. The upper line is called the "upper control limit"; the bottom line is called the "lower control limit." This is now a run-control chart.



Run control chart

If the process that is producing these numbers is only being affected by common causes of variation, then there is a 99% chance that all the weekly averages will fall between the upper and lower control limits. To put it another way, if the weekly averages stay between the upper and lower limits, and the trend line bounces up and down randomly, then the variation in performance is caused by the steps in the process only. The variation is under the control of the process.

This means leave everything alone and don't mess with it. Don't react. Trying to reduce this variation by tinkering with employees or equipment will only make the variation worse.

This process is in control.

- All weekly averages lie within the control limits.
- The variation of points around the average (center line) is random.
- This process is stable.
- Only common cause variation is present.

The variation is under the control of the process and the only way to change performance is to change the process.

But if all of a sudden, one of the weekly averages falls outside of the control limits, then a special cause problem has developed. A lightening bolt, a random event has happened that affected performance. The process has become unstable.

Stable and Unstable Processes. Run-control charts also show us that there are two types of processes; stable and unstable. When processes are stable, they are predictable. We know how much variation is normal. All the weekly averages, in our example, fall between the control limits in a random pattern. Stable processes that look like this are said to be "in control". And this is a very good thing!

Unstable processes are unpredictable. Some of the weekly averages fall outside the control limits or we see a pattern or trend over time. This raises a red flag to tell us that special causes of variation are at work. Something has happened to an employee, equipment, materials or other possible reasons. A lightening bolt just struck and performance, variation, is unacceptable. Customers are receiving bad service or defective product. Now it is time for us to react immediately, discover the source of the problem, figure out how to fix it, and carry out the correction. An unstable process is said to be "not in control" because special causes and not the process itself dominate performance.

To summarize, run-control charts tell us when to act and how. When processes are not in control, we must act immediately to find and eliminate the special causes of variation. When processes are in control, then and only then, can we methodically experiment with changing the process to improve to overall average and reduce variation. However, we must not tamper with special causes of variation when the process is in control. We leave things alone when variation is normal and acceptable.

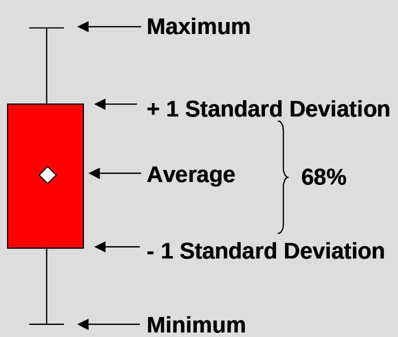
Process improvement changes should not be made while a process is unstable and not in control. Because wild swings in performance are not due to the process itself, there is no way to know if a process change really worked. If the special causes remain after we attempt to improve the process, then any real improvement could be hidden by the special cause. Consequently, it is necessary to bring a process in control before beginning any experimental changes to the process to improve performance. Finally, consider that just because a process is in control, it does not necessary follow that performance is good. It just means that performance is

"Stability, or the existence of a system, is seldom a natural state. It is an achievement, the result of elimination of special causes, one by one on statistical signal, leaving only the random variation of a stable process."

W. Edwards Deming

Box-Whisker Plot

Another very useful charting method to portray variation is the box-whisker plot. A dot at the center of the box shows the average; the surrounding box is 1 standard deviation above and below the mean; the tails of the whiskers show the minimum and maximum values. At one glance you can tell a great deal about the variation of a sample. See Quality Tool Sheet, page 53.

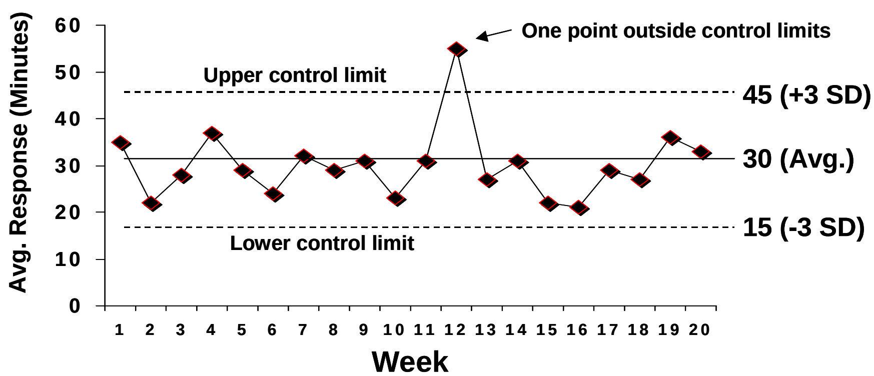


consistent, predictable, and under the control of the process steps.

While there are some very technical ways in statistics that can tell us when a process is not in control, there are a few very easy rules of thumb. A process is not in control when…..

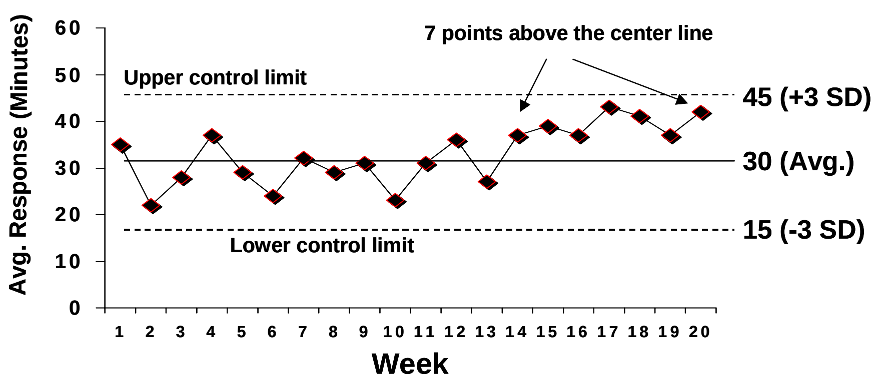
- any point lies outside the control limits
- you see a run of 7 points. This means either 7 points on one side of the mid-line, or a trend of 7 points up or down.
- or you see any non-random pattern. Examples of this might be a cycle, hugging the mid-line, hugging the control limits, or even a completely erratic and wildly fluctuating pattern.

Any of these signs tell us that the process is not in control.



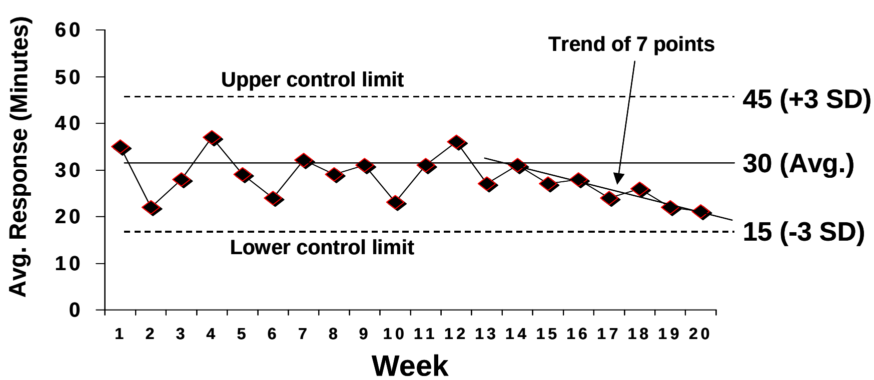
This process is <u>not</u> in control.

- One point is outside the control limits.
- Probably one special cause event brought about a problem in the process.



This process is <u>not</u> in control.

- 7 points are above the center line.
- In week 14, a shift in the process average occurred.
- Typically, such a shift in the average is result of an external influence that affects the process.
- This external influence may be considered a special cause.

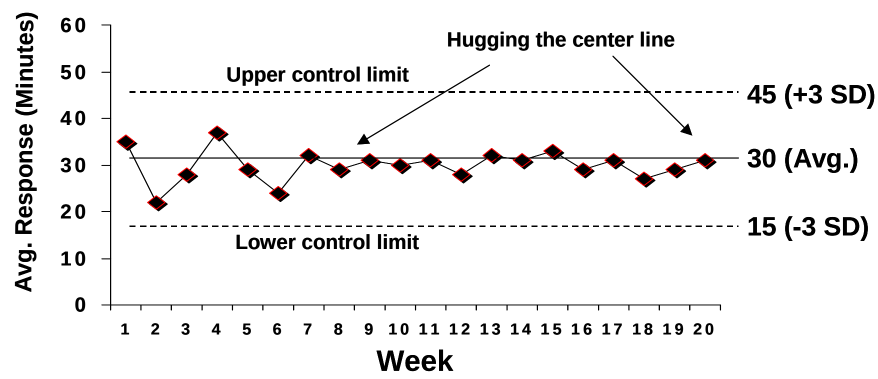


This process is <u>not</u> in control.

- An obvious trend is established.
- Something is gradually affecting the process.
- Examples of possible causes might include a piece of equipment that is wearing, or employees are learning job skills.

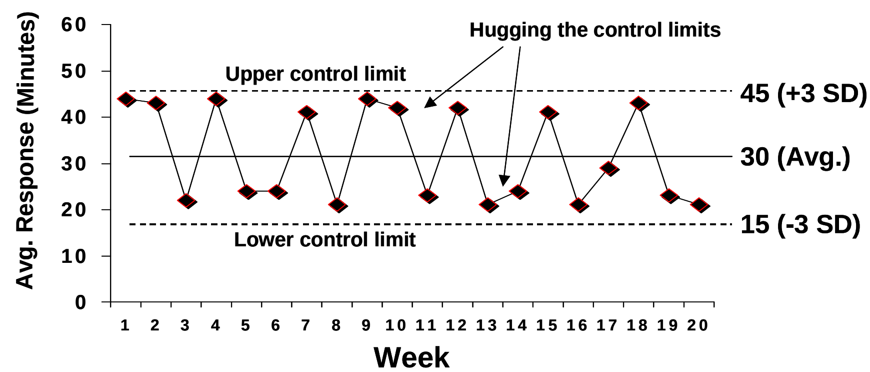
This process is <u>not</u> in control.

- All of a sudden, the normal variation is gone.
- This should be a signal to check data collection and analysis methods.



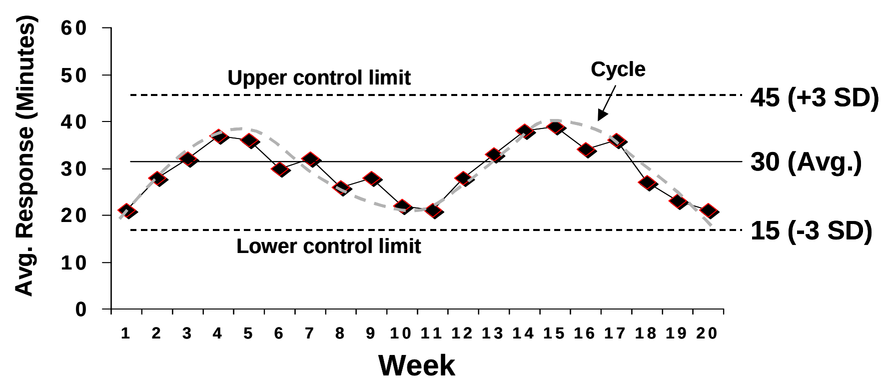
This process is <u>not</u> in control.

- Suddenly the points hug the control limits, which is not a random pattern.
- This pattern may show up when two special causes are working at the same time; one causing a high number and the second causing low numbers.



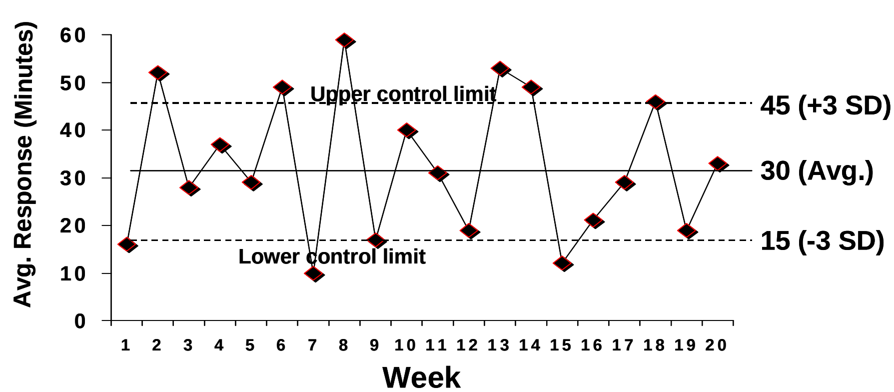
This process is <u>not</u> in control.

- A cyclic pattern shows that variation is not random.
- External factors are affecting the process at different times.
- This pattern is often associated with conditions that change seasonally.



This process is <u>not</u> in control.

- This process is completely unstable.
- Perhaps several factors are working on this process at once.
- It is absolutely necessary to find and eliminate all the special causes before trying to improve this process. <u>All processes must be stabilized before improvements are made.</u>



Once a process is in control, then there are two ways of improvement. First, moving the average closer to the ideal. For example, if our ideal target is processing a permit application in three days, then moving the process performance closer to three days.

The second type of improvement is reducing variation by narrowing the control limits. In order for this to happen we must improve the consistency of our service being closer to the ideal. The effect of greater consistency closer to the ideal is greater service quality.

Process Capability: Maximum and Optimum Capacity. As we move a process' performance close to the ideal, be sure to ask if the process is capable of performing anywhere close to the ideal. The ability of a process to meet service standards is called *process capability*.

For example, let's say that our target for the Fire Department EMT average response time is 3 minutes, with a maximum allowable time of 5 minutes. But let's say hypothetically that try as we may with simple process improvements, the average response time will not drop below 4 minutes. It may be that under the current conditions, the EMT process may not be capable of breaking that 4-minute barrier. Such things like the number of fire stations or road conditions might limit the EMT process capability. It may take considerable time and experience to understand what a process is capable of doing and when you have reached a performance barrier.

A process at any point and time is limited in its capacity to produce, that is, the number of customers served, and its capability to get close to the service ideal. Imagine, for example, that a work unit has improved its process until it is running at peak efficiency. This work unit can still only review so many permits, or process so many bill payments in a day.

In managing processes, it is important to understand that all processes possess what is called an "optimum" and a "maximum capacity." Maximum capacity means that everyone is working as fast as they can, as hard as they can on production, leaving no time for anything else. Maximum capacity is often discovered during a crisis time of peak demand.

Optimum capacity means that the process is providing as much service as possible at the desired level of quality, but can maintain that level of performance indefinitely. Optimum capacity also means that the cost of production is as low as possible. Enough time is spent on problem solving, maintenance and improvement that the organization stays

Maximum and Optimum Capacity

Consider an example from a manufacturing plant. In a factory, one could run the production machine at full throttle, 24 hours a day, not taking time to change the oil, tighten belts, and fine tune the equipment (maximum capacity). The lack of maintenance combined with the added stress of running full throttle will surely lead to costly breakdowns and delays.

Alternatively, the machine could be run at 85% maximum, and stop for scheduled maintenance (optimum capacity). In the long run, the latter strategy will yield more product at higher quality and lower cost.

Processes in service organizations are not different. Optimum capacity can be evaluated by measuring the effect of increasing workload on the frequency of service defects.

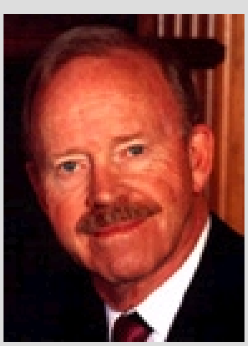
"Why is there never enough time to do it right . . . but always enough time to do it over?"

Anonymous

Philip B. Crosby (1926 – 2001)
Quality is Free

Philip Crosby was a quality manager for Martin-Marietta, and corporate vice president of quality at International Telephone and Telegraph (ITT). After leaving ITT, Crosby became an independent consultant working with GM, Chrysler, Motorola, Xerox, many hospitals, and hundreds of corporations worldwide.

Crosby demonstrated and taught that doing the job right the first time is always cheaper than fixing mistakes or product failures. In fact, he called for measuring and publicizing the costs currently spent to make up for poor quality. This way, management can really see opportunities for improvement and evaluate the relative success of improvements. Quality, doing it right the first time, is free. What costs money, are all the actions taken when the job wasn't done right the first time.



continually healthy and productive. Time spent in rework and dealing with complaints is at a minimum.

Attempts to force a process to perform at a higher level than it is capable of performing, or to operate beyond optimum capacity will cause more problems and may hurt performance dramatically. This frequently takes the form of employee burnout, increased mistakes, and a general feeling of continually operating in crisis mode. But there is a way to operate within process capability and optimum capacity. Measuring and studying variation with control charts over time will tell us both a process' capability and its optimum capacity. Again, control charts guide us to manage better. Managing a process without this information and understanding is flying blind.

Cost of Poor Quality. One last consideration in getting closer to the ideal, or in other words, managing variation, is the balancing act between controlling variation and cost. What happens if the control limits are too wide and we allow a high degree of variation in our service? For example, EMT response times range from 2 to 15 minutes. Customers will receive poor service too often and long-range problems will develop.

On the other hand, what happens if we set extremely narrow targets for our service and cannot allow the slightest variation? As in the last example, let's say that EMT target response times are set to range from 1.5 minutes to 2.5 minutes. Those targets could be achieved if we invest in more technology and resources. We might need a fire station for each square mile of city. Costs would go up.

Maintaining quality service that meets standards has a price. It takes overhead to write procedures, test or inspect the work, monitor performance data, and conduct team problem solving meetings. But the cost of poor quality also has a price. When defects reach the customer, or service was provided poorly, the organization pays the price of responding to complaints, doing the work over again, and making up for the problem. One rule of thumb states that every dollar spent on prevention will save approximately seven dollars in failure costs. It costs dramatically more dollars to fix a failure than it does to prevent it.

Many people initially question that spending time on process management is taking employees away from productive work time. But if employees are spending 100% of their time on production and 0% percent of their time on prevention, maintenance, and planning, then productivity will suffer in the long run. Responding to complaints, correcting customer problems, expediting, and burnout will keep production lower than it would be if 90% of their time were devoted to production and 10% devoted to prevention and maintenance. That is the difference between a process that is operating at maximum capacity and a process operating at optimum capacity. In fact, Dr. Joseph Juran challenges us to spend 4 hours out of a typical 40-hour workweek on improvement.

Mature management systems actively measure the time spent in, and costs associated with; production, prevention, appraisal, and dealing with services that fail to meet the customer's expectations. This information is then used to evaluate the actual return on investment of quality efforts, like process management. Further discussion is beyond the scope of these guidelines.

"Our most recent research suggests that customers who have bad experiences tell approximately 11 people about it; those with good experiences tell just 6."

Christopher Hart, James Heskett, & Earl Sasser

Harvard Business Review

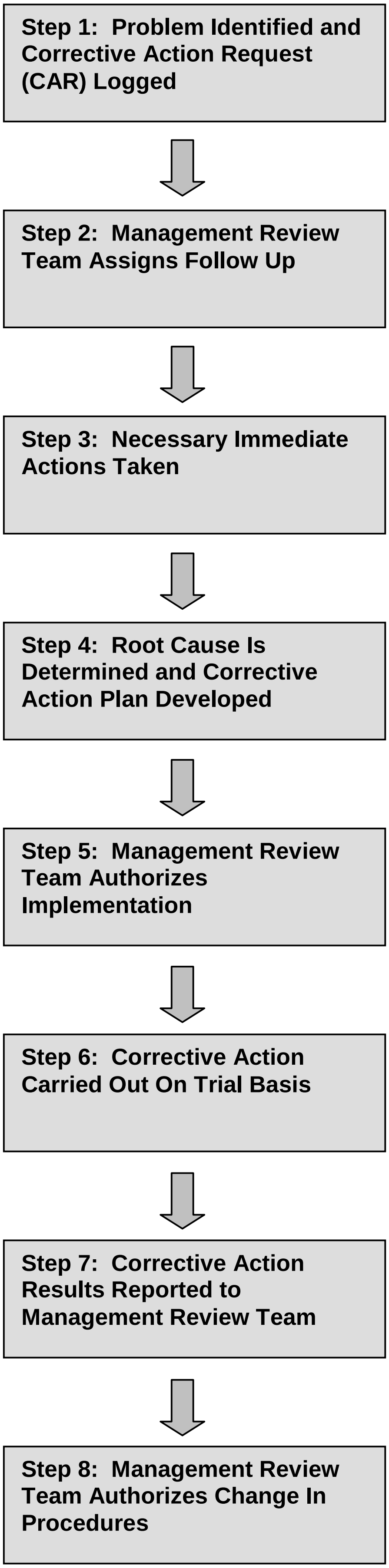
Corrective Action Procedures

What happens when a service is provided that is below standard or a customer complains? Do we try to correct the problem in the customer's eyes? And if we succeed making it right with the customer this time, then what will prevent it from happening again? Too many times organizations think that an instance of poor service was just a random accident, when in reality, the problem was likely caused by the process through which the service was provided. If something isn't changed within the process, then the same problem will keep happening over and over.

A corrective action is any action taken that will eliminate the cause of an unacceptable service delivery in order to prevent its reoccurrence. In other words, a corrective action is what we do when something goes wrong to prevent it from ever happening again. Whenever a customer complains, a serious service delivery failure occurs, or a run control chart shows that a process has suddenly become out of control, then a standard procedure is triggered to identify and implement a corrective action.

A corrective action procedure deals with an identified problem in four time periods: the past, the present, the near term, and the future. Let's say that a customer calls in to complain that a City employee did not show up at a scheduled time. Four time periods need to be investigated.

- *Past:* Have any other appointments been missed that we don't know about?
- *Present:* How can we immediately make up for the problem in the customer's eyes?
- *Near term:* Does this problem create an opportunity to miss any appointments tomorrow or in the



next few days? If so, how do we prevent that from occurring?

- *Future:* How could we change our scheduling process to ensure that we never miss an appointment again?

Following is a detailed example of the general steps that make up a corrective action procedure.

Step 1: Any employee receives a complaint, becomes aware of a below standard service incident, observes a procedure not being followed, or a control chart becomes out of control. The problem is recorded on a Corrective Action Request (CAR) form that is usually part of an electronic database. Of course, the employee may have already taken steps to recover from the service failure. The immediate actions taken for service recovery would also be recorded on the CAR.

Step 2: The CAR is routed to the appropriate Management Review Team to decide the suitable course of action. Management may decide:

- that recovery actions already taken are adequate
- that further steps must be taken to resolve the immediate problem
- to assign follow up to an individual
- to assign follow up to a process management team

Step 3: The person or team assigned the problem must investigate the problem and take any actions necessary to correct the immediate problem and prevent the problem in the near term.

Step 4: The person or team assigned to develop the corrective action:

- determines the root cause of the problem
- identifies and selects an appropriate corrective action
- develops an action plan to carry out the corrective action

Step 5: The Management Review Team reviews the proposed corrective actions and may decide to approve, modify, or deny the proposed corrective action. Anyone may initiate a CAR, but only the appropriate Management Review Team can authorize the implementation of a corrective action.

Step 6: The corrective action is carried out and any changes to work processes are instituted on a trial basis. A defined period of time is allowed to pass while the effectiveness of the corrective action is monitored.

Step 7: At the end of this monitoring period, the CAR is electronically updated to document the effectiveness of the implemented corrective action. The CAR is routed to the Management Review Team for final review.

Step 8: The Management Review Team reviews the status of all outstanding CARs on a standard, regular basis. If the corrective action was successful, then the Management Review Team closes out that specific CAR. Written procedures and/or work instructions are updated. However, if the corrective action did not succeed in eliminating or preventing the problem, then the CAR is routed back to start over at Step 4.

The purpose and value of a corrective action procedure is to keep process management alive. It assures that accountability and follow up will happen. It is a systematic way to make sure that problems are corrected and prevented. Corrective action procedures also help to keep written procedure manuals current.

Preventative Action Procedures

A corrective action is needed when something goes wrong. But is there anything that we can do to discover a potential problem developing before it gets to the point that a customer complains. Once a complaint happens, or a service is provided below standard, the damage is already done. Wouldn't it be better to look for trends or any signals that would give us an early warning before a service delivery failure has occurred? That is exactly the purpose of a preventative action procedure.

Sometimes larger problems may become obvious when individual incidents begin to show a pattern or a trend. A preventative action procedure defines the steps through which feedback sources are regularly examined for patterns, and then actions taken to prevent a problem before it can actually occur. For example, let's say that a review of last month's corrective actions shows that different types of problems came from one computer system. This discovery could then lead to an investigation about what might have changed in the computer system.

Following is a detailed example of the general steps that make up a preventative action procedure.

Step 1: Performance data from multiple sources are compiled and analyzed to look for trends and patterns that indicate a potential problem, service failure, or undesirable situation may be developing. Some of the possible sources of these performance data are:

"Like the frog that will sit in a pot of water and let itself be slowly boiled to death, we are very good at reacting to immediate danger to our survival, but we are very poor at recognizing gradual threats."

Peter Senge

Dr. Peter M. Senge (1947 -)
Learning Organization

Peter Senge is a senior lecturer at MIT, Chairman of the Society for Organizational Learning, and advisor to companies like AT&T, FedEx, Ford, Harley-Davidson, Hewlett-Packard, Intel, and many others. He defines a learning organization as one "where people continually exapand their capacity to create the results they truly desire…" This is accomplished by:

- Understanding the organization as a system
- Developing your personal capacity to learn and grow
- Being open to challenge all assumptions and beliefs
- Building a shared vision
- Becoming skilled in team learning

- process performance measures
- summary of all corrective and preventative action reports
- customer comments and feedback
- employee observations

Step 2: The Management Review Team meets at regularly scheduled times to review the performance information and identify any meaningful trends or patterns that raise concern. If a trend is identified, then the Management Review Team prepares a Preventative Action Request (PAR) form, usually via an electronic database. The PAR is assigned to an individual or a team for follow-up. Any employee may submit a PAR , but the Management Review Team must approve the PAR to process further.

Step 3: The person or team assigned to develop the preventative action:

- investigates the problem
- determines the root cause of the problem
- identifies and selects an appropriate corrective action
- develops an action plan to carry out the corrective action

Step 4: The Management Review Team reviews the proposed preventative actions and may decide to approve, modify, or deny the proposed preventative action. Anyone may initiate a PAR, but only the appropriate Management Review Team can authorize the implementation of a corrective action.

Step 5: The preventative action is carried out and any changes to work processes are instituted on a trial basis. A defined period of time is allowed to pass while the effectiveness of the preventative action is monitored.

Step 6: At the end of this monitoring period, the PAR is electronically updated to document the effectiveness of the implemented preventative action. The PAR is routed to the Management Review Team for final review.

Step 7: The Management Review Team reviews the status of all outstanding PARs on a standard, regular basis. If the corrective action was successful, then the Management Review Team closes out that specific PAR. Written procedures and/or work instructions are updated. However, if the preventative action did not succeed, then the PAR is routed back to start over at Step 3.

As you can see, the only real difference between the corrective and preventative action procedures is what triggers each. The greatest value in corrective and preventative actions is that everyone knows and immediately responds in a standard way whenever something goes wrong or a service delivery failure occurs.

System and Process Documentation

In an organization without procedures or other process documentation, if you asked six employees in the same work unit how they do a common job, you would most likely get six different answers. Employee would naturally do their work in a completely different way to suit their individual style. But is this a bad practice? After all, if each employee finds their own way to do a job, won't we get more done? Not necessarily.

The lack of standard procedures can cause several problems.

- Not every method will produce equal results in terms of productivity, quality, and cost.
- When an employee leaves the organization, all the knowledge of best methods leaves with that employee.
- Startup time for new employees is longer and prone to rediscover mistakes that have been made before.
- Changes are made to a process without communicating to other employees who depend on that work and without fully considering any negative side effects that the change may have.
- Making improvements is impossible. How can a process be improved that is not defined and always changing? If there are six versions of a process, then which version should we fix? And if the steps of a process are not documented, then can we be sure which step is causing the problem? A process must be defined and held constant before it can be improved.

Many organizations have turned to process documentation and procedures to improve productivity, act as a corporate memory of best practices, and serve as a major analysis tool to make process management work. Written procedures are an integral and essential part of corrective and preventative action procedures.

While it is critical to document processes as written procedures, this task is no small matter and carries the costs of personnel time and computer resources. So it isn't wise to document everything. Procedures should be written only for those processes where the lack of written procedures would bring about poor service being delivered to the customer.

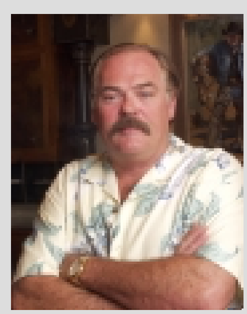
Dr. Mikel Harry (1951 -)
Six Sigma

In the mid-1980s Motorola engineers had to respond to increasing complaints from sales staff about product failures and warranty claims. Bill Smith, a senior engineer at Motorola, and a team of scientists, developed a methodology to reduce product defects to near perfection. These methods, called Six Sigma, build on traditional process management concepts.

Sigma is the Greek letter used in statistics to represent the standard deviation, the consistency of process performance. Six Sigma refers to reducing process variation to about 3.4 defects per **one million** opportunities! It is an intensive, aggressive, task force approach that depends on statistical analysis to improve processes. Six Sigma also demands immediate financial pay back. Since inception, Motorola documented over **$16 billion** in savings resulting from Six Sigma projects.

Mikel Harry worked closely with Bill Smith at Motorola to develop Six Sigma. He founded Six Sigma Academy in 1994, which is located in Scottsdale, Arizona. Through this training and consulting firm, Mikel Harry and partner Richard Schroeder, began advising top CEO's like Allied Signal's Larry Bossidy and GE's Jack Welch.

Since 1994, many Fortune 500 companies such as Sony, Dow, DuPont, J. P. Morgan, Honeywell, Ford Motor Company, Merrill Lynch and many others have adopted Six Sigma.



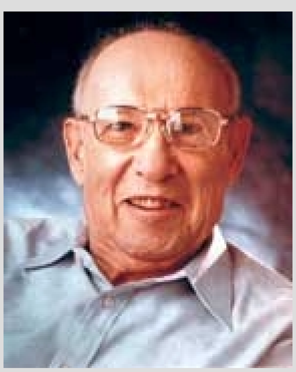
Dr. Peter F. Drucker (1909 -)
Knowledge Worker

Drucker was born in Vienna, Austria, educated in England, and received his doctorate in Public and International Law from Frankfurt University in Germany. Author of 31 books on management and economics, and many articles, he is still active in writing and speaking into his 90s.

In 1937, Drucker immigrated to the United States working as a freelance writer. By 1943, his writings earned him an invitation by General Motors to conduct a two-year study of the largest corporation in America. Over the years he advised many major corporations such as GE, Citicorp, Coca-Cola, IBM, and Intel. He is widely recognized as the father of modern management.

Drucker observed that in past decades most businesses involved producing physical products. Today, many corporations process information to produce knowledge. Drucker defined *'knowledge workers'* as those who use their knowledge to do their work. For example, an X-ray specialist doesn't just produce a picture, but uses personal experience and medical understanding to make a diagnosis.

Knowledge workers effectively carry the means of production within their minds. The need for teams in today's workplace is a natural outgrowth of society's change to knowledge work. An organization's success truly depends on the contributions of each member. Members of the workplace have become increasingly inter-dependent.

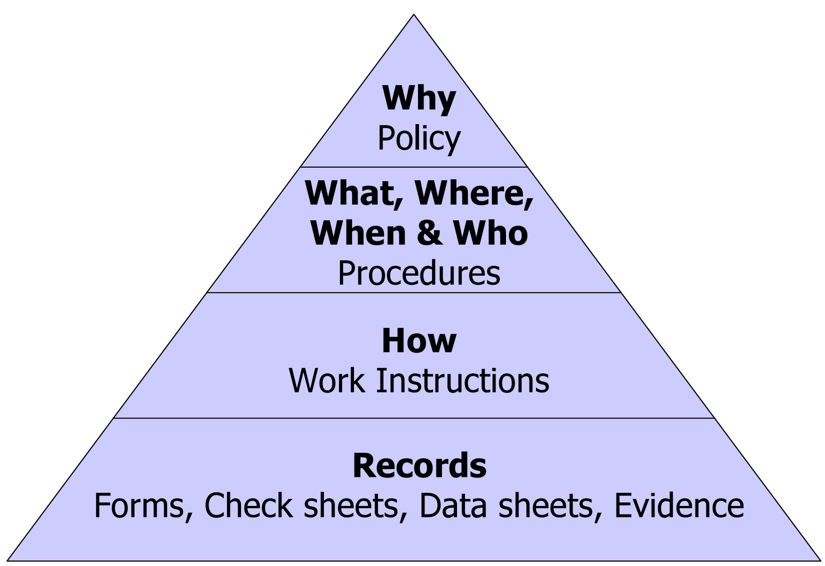


Consequently, a public permitting process would benefit from written procedures, whereas the process of making in-house photocopies would most likely not produce any meaningful benefits.

Some organizations have reached a point where the cost of maintaining written procedures far outweighed the benefits, and this risk of investing too much time and effort is real. The value of written procedures depends on how well they are incorporated into the daily work life and used on a daily basis through corrective and preventative action procedures.

A second concern about procedures is commonly raised. If everyone must follow procedures, won't they discourage creativity? Procedures can actually encourage creativity if they are part of a dynamic and living system that allows for their rapid and easy, but planned, change. And that living system is formed by the corrective and preventative action procedures. Any employee seeing an opportunity for improving a process may initiate a Preventative Action Request or a Corrective Action Request. This mechanism provides a structured forum for all employees and process teams to use their creativity and be heard.

Process documentation is divided into four categories based on function: policies, procedures, work instructions, and data. Policies define why a system or process exists. Policies describe the ultimate purpose of a system. Procedures describe a process at a higher level, and usually, take a cross-functional (interdepartmental) perspective. They define what is to be done by the process, when, where, and by whom. But procedures don't really get into the extreme detail that an employee may need to operate a machine or follow detailed steps. That is the purpose of work instructions, which as the name implies, are detailed, step-by-step instructions. The last component of



process documentation is the records and data that document performance.

The four documentation components are linked together and cascade down. Procedures, when executed properly are collectively intended to achieve the purpose of a certain policy. Work instructions more completely describe a procedure. Records and data demonstrate that the work being carried out does meet standard.

Document Control

We can now understand that written procedures are the core components on which corrective and preventative actions depend. They are the constant memory that keeps everyone focused on improving the work that we do. If employees happened to use the wrong or out of date procedures, then everyone would be confused about what actions are correct to take. Making sure that all employees use the most current and accurate procedures and forms is the purpose of a document control system.

Keeping procedures current can be a challenging task when multiple process management teams are continually changing and updating the procedures and work instructions for their processes. One effective approach to accomplish keeping procedures current is to maintain procedures and allow their access only on computer. Any procedure that is printed on paper becomes invalid at the close of business.

Additionally, changes to procedures and work instructions must be authorized only by the appropriate process owner or management review team. Essential documents that are required to be uniform and standard must be controlled to make sure that only the right document is being used by everyone at all times.

Teams Manage Processes

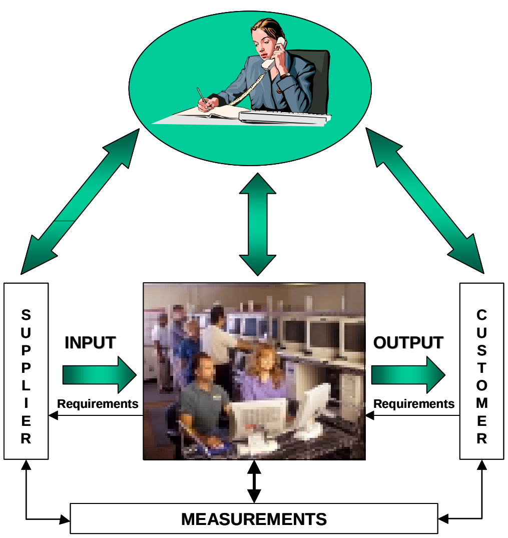
Because processes are often complex and cross several work units, it is impossible for any one person to understand all aspects of the process that would be needed to make improvement. Consequently, teams are essential to manage processes. Dr. Deming taught that those persons who are closest to the work are in the best position to make improvements. Only they know what problems they face on a daily basis and usually know how to overcome those problems.

"One has to assume, first, that the individual human being at work knows better than anyone else what makes him or her more productive . . . even in routine work the only one true expert is the person who does the job."

Peter F. Drucker

Process Owner

- Accountable for process performance.
- Has the authority to remove barriers to success.
- Coordinates work across functional work units.
- Provides resources.
- Holds process management teams accountable for timetables and results.
- Reviews and analyzes performance data.
- Determines process capability.
- Is the process "champion".



The use of process management teams can also provide an additional major benefit. Sometimes out of frustration, employees can begin pointing fingers at other teammates and blaming each other for workplace problems. But as we know in reality, most problems arise from process causes. When teams begin the focus on what's wrong with the process, suddenly the process becomes the "enemy" not other teammates. The team dynamic changes from one of conflict and blame to joint problem solving.

Process management is a team activity carried out by the members of a process. As we track the things moving through a process, like a report, the process takes the report from person to person. Each person that works on the report is a member of that process. A Process Management Team is then composed of all members of a process (or a subset if the number is large), the appropriate manager, and often customers and suppliers. This team meets on a regular basis to collectively carry out the 12 'process management steps on an ongoing and unending basis. In fact, process management team meetings usually replace traditional staff meetings. Instead of these staff meetings being dominated by receiving top-down, one-way messages, they now focus on reviewing run control charts and evaluating ongoing improvements.

Team Roles

Under process management, every person who participates in a process is responsible for the success of the entire process. That means that not only am I responsible for the work that I do, but I'm also responsible for the work of my teammates, and how the work is done to meet our customer's needs. Because collectively, team members know best how to get the job done, and are responsible for the team's success, all team members must be involved in the analysis and decision making about the process.

Experience has shown that teams are most effective when roles are clearly defined and the team uses structured approaches, called team tools, to work together. And becoming a high performance team requires practice in using those team tools. But before discussing the team tools further, let's take a look a look at the standard roles that make up a process management team.

Process Owner: The process owner is anyone who has the power and responsibility to change a process. He or she is responsible for monitoring the performance of the process (performance measures) and coordinating the efforts of all process members to improve performance (see sidebar). The process owner may be a manager or a team leader, depending on the process being addressed. A Manager would typically be a process owner for a high-level core process. A team leader would typically be the process owner for a very focused subprocess. However, the two roles may be combined.

The role of process owner is critical to the success of process management. Frequently, processes cross work unit, or even departmental boundaries. So a process owner will have the responsibility to coordinate the work as it passes through several different work units or Departments. This requires developing extensive skills in collaboration and influence. The split in authority between the process owner managing the work process, and work unit managers managing the people, makes cooperation unavoidable and absolutely necessary.

But if an employee reports to a supervisor within a work unit, then what is their reporting relationship to the process owner? The answer is that many employees will report to two "supervisors". This may seem confusing, but in reality, we already report to several "bosses" within the organization's hierarchy and also report to our customers. The roles of direct line supervisor and process owner are not in conflict.

The process owner manages the work carried out by the process management team, which might include more than one functional work unit. An employee's first line supervisor would be located in the functional work unit in which the employee works, for example, customer service. This person would ensure that immediate workplace needs, such as workspace, equipment, and supplies, are met for customer service employees. The first line supervisor also conducts employee evaluations. But the first line supervisor is also responsible to ensure that customer service does its part in the larger process. Collaboration between the process owner and all the process members' supervisors is essential.

Team Leader: The team leader is the person who manages the team: calling and perhaps facilitating meetings, handling or assigning administrative details, orchestrating all team activities, and overseeing preparations of reports and presentations. A team leader serves as the contact point for communication between the team and the rest of the organization. While this person may participate as a full-fledged member to offer suggestions and provide input, he or she must take extra precautions to avoid dominating the group. Selection of a team leader should be done carefully because he or she must possess a blend of technical skills in quality methods in addition to strong interpersonal skills and maintenance of team harmony. The team leader may or may not be the process owner.

Process Management Is Alive When . . .

- All key processes are identified, mapped, and documented with procedures.
- Process Owners are identified.
- Process Management Teams meet frequently to review performance data, develop corrective actions, and evaluate the results of previous trials.
- Service standards and control limits are continually calculated and reported to Team members.
- Run control charts are posted in a prominent location for all employees to see.
- All Team members actively participate in problem solving and managing the process.
- Corrective and preventative action procedures are used regularly.

Facilitator: A facilitator is a neutral person, who has no decision-making role or authority within the team, but guides the team through decision making or problem solving processes. The facilitator's role is to increase team effectiveness by improving how the group works together, its team processes. The facilitator typically selects structured team processes that she or he believes will help the team be most effective in dealing with the particular decision or problem at hand. It is important that the facilitator possesses complete knowledge of quality methods and practices because many rely heavily on the use of teams and team tools. Facilitators must also possess skills in monitoring team dynamics and knowing how to intervene when conflict or complications arise to maintain group cohesion and productivity.

Quality Coach: Team leaders who are tackling process management the first time can receive training and acquire the technical knowledge to take on the role, but they will still lack hands-on experience. The quality coach serves to coach the team leader through the process the first time and act as a mentor. Coaches attend team meetings, but are neither a leader nor a team member. They are outsiders to the team and must maintain a neutral position. The major focus of the quality coach is to teach quality tools and methods to the team leader and guide the team's progress when technical expertise is needed. The quality coach not only must possess a blend of technical and interpersonal skills, but also must possess skills as a teacher.

Process Management is How We Work

Let's return to the example of the factory machine running at maximum capacity, full throttle, 24 hours a day. The problems with such a practice are obvious. But instead, suppose that this company found that at the end of every 8-hour day they could get the greatest results by investing 30 minutes in maintenance of the machine. So, without fail, maintenance becomes part of every day's work. This "down time" is not only built into the production schedule, but is factored into the price of the product that the machine produces. Maintenance becomes part of the work required to produce the product.

Now consider one last example. Imagine a surgeon conducting open-heart surgery on a patient to repair a heart valve. Several monitors are attached to the patient to measure among other things, heart rate, blood oxygen, and blood pressure. The surgeon depends on these data to determine whether the patient might become unstable and require specific drugs immediately. Consider also that it takes trained medical staff time and equipment to take these measurements throughout the surgery. However, the surgeon could hypothetically conduct the surgery without any of these monitors connected by relying alone on her years of experience in the operating room to judge patient condition. Yet no one would even think of conducting such a surgery without taking the time to attach and operate these monitors. In fact, all doctors would consider the surgeon negligent if she had chosen to avoid using the monitors. The time and resources used to operate the monitors have simply become a standard part of the surgery.

Process management is just like these two examples. Yes it will take time, effort, and money to work through the 12 process management steps. *But if being responsive to customer needs and eliminating the problems in our daily lives are important, then process management must become part of what we do, not something in addition to our regular work.* Just like the surgeon would not think about conducting the surgery without using monitors, process owners would be negligent if they did not, for example, use run control charts in frequent process team meetings to formally resolve performance problems. There is no question. Process management requires work. But the gains in increased productivity, decreased people problems, and increased customer satisfaction can far outstrip the costs of process management.

These guidelines to process management provide a prescription for a better quality work life. While some of the methods are seemingly technical and procedural in nature, they are all about helping people work together better. They are about learning how to enjoy our work more, and feel that sense of pride and fulfillment that comes from doing an excellent job, and knowing it. Each one of us wants to know that we matter; that our time at work matters through our contributions to building Mesa's quality of life. As you reflect on what you have read here, please consider that process management is a way for each one of us to contribute more fully, to have a say in eliminating the problems we face, and to experience joy and rewards through our work.

Dr. Michael E. Porter (1948 -)
Value Chain

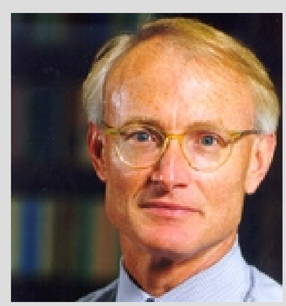
As professor at the Harvard Business School, Michael Porter is a leading authority on what makes businesses competitive. He has served as an advisor on competitive strategy to many companies including DuPont, Intel, Edward Jones, Procter & Gamble, Royal Dutch Shell and others.

In his 1985 book, *Competitive Strategy: Creating and Sustaining Superior Performance*, Porter developed an important concept, called the *'Value Chain'*, which advanced the understanding of process management.

An organization can be thought of as a chain of critical activities that ultimately creates value for its customers. For example, the customer receives value as materials pass through the following steps:

- Receiving (raw materials)
- Operations (products are made)
- Shipping (delivered to customer)
- Marketing & Sales
- Customer Service

Porter concluded that competitive advantage could be achieved by how well these activities, and the flow between them were coordinated.



Recommended Reading

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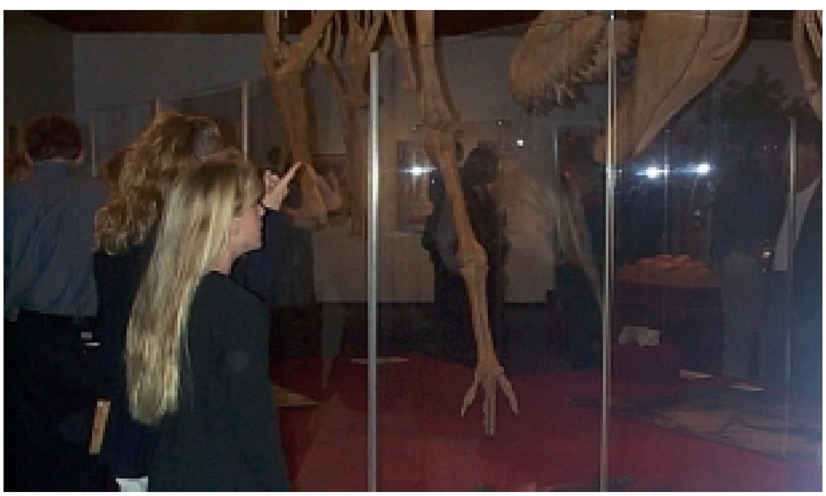
April 17, 2003



Quality Glossary

Activity-based costing (ABC): financial accounting method that organizes information about the work (referred to here as activity) that consumes and delivers value in an organization. ABC first traces costs to activities and then traces costs to the products and services that use them. Knowing the costs of activities supports efforts to improve processes.

Balanced scorecard: a framework of performance objectives, and performance measures and their metrics within four areas, 1) financial, 2) customer, 30 internal processes, and 4) innovation and learning. The term "balanced" refers to the organization being driven by a balance of financial and non-financial performance measures. The purpose of a balanced scorecard is to translate an organization's strategic objectives into a coherent set of performance measures.

Baseline: base level of previous or current performance that can be used to set improvement goals and providing a basis for assessing future progress.

Benchmarking: measuring your performance against that of best-in-class organizations, determining how the best-in-class achieve those performance levels, and using the information as a basis for your own organization's targets, strategies, and implementation. It is the study of the performance levels of the best organizations and how they get it done, and then emulating them.

Bottlenecks: a condition or situation that halts or retards free movement of workflow through a process.

Brainstorming: a creative idea generating tool that uses the following rules: 1.) each person takes a turn calling out an idea and no one is allowed to comment or critique the idea, 2.) a person may call out "pass" if they have no idea, 3.) the facilitator writes down all ideas on a flip chart until everyone passes, 4.) discuss the merits of each idea, and 5.) use consensus, multivoting or other methods to narrow the list to the most useful ideas.

Check sheet: a type of data collection form in which the results may be interpreted on the form directly without additional processing. Often used to tally the occurrence of a product defect or process workflow problem as they occur.

Common Cause/Special Cause: One goal of Total Quality is to minimize the variation in process productivity and variation in product or service quality. Common causes of variation are inherent in the process itself, and cannot be reduced without changing the fundamental process. It simply reflects the capability of the process. Special causes of variation are not part of the process all the time, and arise because of a specific circumstance. If you react to common cause variation as if it were result of special causes, you will only make matters worse (called tinkering) and increase variation, defects, cost, and mistakes. Only after tracking performance data for a period of time can managers know when and how to respond to changes in productivity or quality.

Control chart: a graphical presentation of performance data over time. Noted by graphing the mean of those data, and statistical upper and lower confidence intervals of the data. Those points falling outside the confidence intervals indicate the result of a special cause. Data points within the confidence interval, and demonstrating no pattern, are result of common causes.

Core process: the fundamental steps that drive creation of an organization's products or services.

Cost of Poor Quality: those costs generated as a result or providing defective services or producing defective work. Such costs include labor, rework, lost material, disposal, warranty, and recovery service provided to make up for ill will. Also included are any activities that exist only because of deficiencies that occur in its processes.

Critical process: a subprocess of a core process that is critical to the function of that core process.

Customer: anyone who wants, needs, or uses our products or services. May refer internally to the organization, and to the person to which you directly deliver your work products. May also refer to the ultimate customer of the organization.

Customer Focus: The customer is the true judge of quality. Customer focus drives the company to create products and services that contribute to perceived value to the customer and lead to customer satisfaction. The organization shows constant sensitivity to emerging customer and market requirements; and also measures the factors that drive customers satisfaction and loyalty. This sensitivity also applies to internal customers such that building and maintaining internal relationships is as important as external relationships.

Customer Requirements: Customer requirements are those needs and expectations that they hope to satisfy with your products or services. Typically, organizations simply ask their customers what they want (called the *voice of the customer*). Customers express their needs in their own words and terms, which may not be detailed enough to design a product or service. If you hear "I want a big house." Does that mean two bedrooms or four?

Cycle time: the time necessary for one unit to pass through a process.

Document control: A system for controlling the use of standard documents in a uniform and orderly fashion.

Downsizing: reduction in employees to cut costs, usually in an attempt to save a firm that is economically failing. Numerous private companies have turned to TQM and reengineering as a result of the first decision to cut employees. These tools allow a company to do more with fewer employees, but their decision to downsize came first. TQM and reengineering are standards of today's world to make productive organizations even more productive. They are not related directly to downsizing.

Efficiency measure: 1.) a measure of the relative amount of resources used to produce a certain amount of product or service, 2.) inputs / outputs, 3.) a type of measure that reflects the cost of providing a product or service. For example, assume that is costs an average of $70.00 in personnel time and resources to authorize each type B permit. An alternative process would be 50% more efficient if it could authorize an equal quality permit for an average of $35.00.

80/20 Rule: Developed initially by Italian economist, Vilfredo Pareto, it states that 80% of the trouble comes from 20% of the problems. It implies focusing on the vital few sources of poor performance and not get distracted.

Focus group: a panel of individuals (customers or non-customers) who answer questions about a company's products or services, as well as those of competitors, in reference to meeting customer needs and expectations.

Gap analysis: the difference between the present state and the desired future state.

Goals: 1.) the general end purposes toward which effort is directed, 2.) defines the management philosophies within which, each objective will be pursued.

Inputs: the resources necessary to produce a product or service, and may include labor, information, and materials.

ISO 9000: an international quality system that guides a company's performance of specified requirements in the areas of product design, product development, production, installation, and service. These standards only require that the supplier have a verifiable process in place to ensure that it consistently produces what it says it will produce. It does not ensure quality itself, only that the true level of quality is documented.

Leadership: 1.) involves envisioning the future, coordinating the development of a coherent mission, overseeing the development and control of products and services that have exemplary quality and features, and providing a motivational climate for people, 2.) the ability to decide what needs to be done, and then get others to want to do it, 3.) creation of a compelling vision that has intense meaning to others through effective communication, teaching, mentorship, commitment, concern, and constancy.

Line of business: a collection of similar products and services that are produced by essentially the same process.

Malcolm Baldrige National Quality Award: recognizes companies that excel in quality management and quality achievement. Its principal focus is on the management of practices that lead to customer satisfaction and business results. The award criteria include 1.) customer-driven quality, 2.) leadership, 3.) continuous improvement and learning, 4.) fast response, 5.) design quality and prevention, 6.) long-range view of the future, 7.) management by fact, 8.) partnership development, 9.) corporate responsibility and citizenship, 10.) results orientation.

Measure: a basis or standard of comparison; e.g. wealth is not a measure of happiness, length and weight are measures of size.

Metric: a standard of measurement; e.g. inches is a metric of length, ounces is a metric of weight.

Mission: a short comprehensive statement of purpose. The mission identifies what an organization does (or should do) and for whom it does it.

Moments of truth: any time that a customer comes into contact with an employee or the organization (e.g. invoice, letter, customer service, building) such that the customer forms an opinion about the service quality received.

Objective: specific and measurable targets for the accomplishment of a goal. Objectives are SMART. That is, they will be *S*pecific, *M*easurable, *A*ggressive yet *A*ttainable, *R*esult-oriented, and *T*ime-bound.

Operational planning: 1.) the process whereby objectives are converted to management actions by the allocation of money and human resources, 2.) the operational plan describes how an objective will be implemented. Operational planning "gives life" to the strategic plan by stating specifically who does what, with which resources, and when. The time frame of an operational plan is typically one year.

Outcome: end results, or impacts, of the products or services provided. If the process succeeded at achieving its ultimate purpose, then what would be the desired outcome?

Pareto chart: a series of graphically presented bars whose heights reflect the frequency or impact of problems. Each bar represents the number of a specific type of problem in producing a product or providing a service. Pareto charts are useful throughout the project: early on to identify which problem should be studied, later to narrow down which causes of poor performance to address first.

Performance measures: a management tool that measures the work performed and the results achieved by a process.

Policy: 1.) directives issued by management for guidance and direction where uniformity of action is essential. Directives pertain to the approach, techniques, authorities and responsibilities to carry out the management function. 2.) the definitive position of an organization on a specific issue. A policy provides a basis for consistent and appropriate decision-making and defines authority and accountability within an organization. 3.) a high level plan defining the general goals and acceptable procedures. 4.) a course of action or inaction chosen by public authorities to address a given problem or an interrelated set of problems,

Procedure: 1.) a prescribed method for performing specific work. A procedure defines what is to be done, when, where, and by whom. 2.) a written document that describes how a system functions, demonstrating the linkages and interactions between departments or work units, and used to define responsibilities and authorities.

Process: 1.) a sequence of tasks, activities, or functions that is intended to achieve some result, typically to create added value for the customer, 2.) a process is defined not by the things people do, but instead by the sequence of things done to, or tasks performed to produce the output, 3.) the steps taken in producing a product or service. Processes begin with inputs and change them, add to them, or combine them in order to create new products or services (outputs).

Process owner: an employee responsible for defining process outcomes, determining actions, committing resources, and meeting customer targets. Process owners are responsible for: 1.) identifying internal/external customers and suppliers, 2.) identifying the products and services provided, 3.) identifying what those customers and suppliers consider important, 4.) define the process for doing the work, 5.) mistake-proof the process and eliminate wasted effort, and 6.) ensure continuous improvement by measuring, analyzing, and controlling the improved process toward meeting customer expectations.

Product: a tangible entity that is usually used or consumed in a different place and time from where it was created. Examples include cars, books, movies, and documents.

Quality: 1.) meeting or exceeding customer expectations, 2.) the totality of features and characteristics of a product or service that bears on its ability to satisfy customer needs.

Quality circles: a small group of employees from the same work area who meet regularly and voluntarily to identify, solve, and implement solutions to work-related problems. Important for solving problems within the work unit, but lack the ability to generate quantum improvements in organizational productivity.

Quality policy: the overall quality intentions and direction of an organization with regards to quality, as formally expressed by top management.

Reengineering: the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in cost, quality, service, and speed. It starts with a blank sheet of paper, making an assumption that the old process does not exist, and attempts to design the best process conceivable. The goal is to achieve quantum leaps in performance. Contrast this tool with continuous improvement, which seeks to make incremental improvements to an existing process over time. Please note that reengineering does not imply downsizing (see downsizing).

Rewards: something that gives other people reasons to care about your objectives. Types of rewards typically include money, prestige, and job content. An effective reward system is one designed so that employees are directed to gratify their needs by behaving in ways that lead to organizational objectives. Organizations often do not get the employee behavior their leaders claim to want, but they invariably get the behaviors that subordinates believe are rewarded. Thus it is important to align the reward system with the principles of total quality.

Root Cause: the ultimate cause of a problem, which when changed, can result in a permanent solution. Root causes can be determined by 1.) asking why 5 times, 2.) utilizing star burst method, and 3.) utilizing Ishikawa or fishbone diagrams.

Service: a service is both produced and consumed at the same time and place. Services are intangible. Examples include an examination by a physician, hotels, fast food restaurants, and a drive through car wash.

Six sigma quality: shrinking process variation to half the permissible variation in the product or service quality characteristic of concern. Statistically, this degree of control means allowing only 3.4 defects per million products or services provided.

Specifications: Once the most important few requirements have been identified in the voice of the customer, the next task is to translate them into the technical description of the product or service. These specifications must be measurable and quantifiable. For example, suppose a survey found that a “big house” means three bedrooms to our target customers. The customer requirement is a “big house”; the specification is three bedrooms.

Stakeholder: any person who believes that she or he has an interest in the performance or outcomes of your organization. Stakeholders do not necessarily use the products or receive the service.

Star Burst: a method by which the causes of a problem are identified (root cause analysis). The problem is placed in the center of a flip chart, and potential causes are written in a circle around the problem. Once everyone has passed on offering new ideas, each cause is itself subjected to a brainstorm of potential causes. At each level, each cause is prioritized by ranking it for severity, immediacy, and trend (SIT). The result is a series of concentric rings that trace causes of causes until the root cause is found.

Strategic planning: a future oriented process of diagnosis, objective setting, and strategy building that is an essential part of quality management. It relies on careful consideration of an organization’s capacities and environment, and ultimately leads to significant resource allocation decisions. Strategic planning is the process by which guiding members of an organization envision its future and develop the necessary procedures and operations to achieve the future. The standard strategic planning model asks the following questions with respect to a 3-5 year time frame.

1.) Where are we now? Environmental scanning (SWOTT)
2.) Where do we want to be? Goals, objectives, and strategies
3.) How do we get there? Operational plan (priorities and budgets)
4.) How do we measure our progress? Performance measures and evaluation

Strategy: a set of hypotheses about cause and effect. That is, a strategy predicts outcomes resulting from specific actions to be taken. For example, if we invest in training, then customer service should improve. If customer service improves, then customer satisfaction should improve. Therefore, if we invest in training, then customer satisfaction should improve. Investment in training is a strategy to improve customer satisfaction.

Supplier: the upstream person or process that provides you, or your process, with the resources necessary to produce the end product or service. Total Quality focuses on building close relationships with suppliers such that quality and timely inputs are provided without fail. In this context, meeting suppliers' needs and expectations is equally important as meeting customer needs.

SWOT analysis: a systematic assessment of an organizations internal Strength and Weaknesses, as well as external Opportunities and Threats.

T/C/V: Time/Cost/Value. Criteria for evaluating each step in a process for process redesign. How much time does each step take? What does each step cost? Is there any value to each step? Value addresses three more specifice questions. Does the object of the work flowing through the process physically change? Is it done right the first time? Is the customer willing to pay for it?

Team: 1.) a small number of people with complementary skills who are committed to a common purpose, set of performance goals, and approach for which they hold themselves mutually accountable, 2.) a group of individuals who need one another to take action.

Total Quality Management: a people-focused management system that aims at continual increase in customer satisfaction and continually lower real cost. It is a total system approach (not a separate area or program) and an integral part of high-level strategy; it works horizontally across functions departments, involves all employees, top to bottom, and extend backward and forward to include the supply chain and the customer chain. It stresses learning and adaption to continual change as keys to organizational success. The foundation of total quality is philosophical: the scientific method. The core principles of TQM are 1.) focusing on achieving customer satisfaction, 2.) measurement driven continuous improvement, 3.) everyone involved, 4.)management systems aligned. It is both a comprehensive managerial philosophy and a collection of tools. TQM represents an ongoing process that is unique to each organization, and is never completed. TQM is common sense, rigorously applied.

Value: What the customer got / What it cost. What the customer got is a function of the actual product or service they received, and their satisfaction with it. What it cost the customer is a function of the monetary price of the product or service, and what is called the customer burden (i.e. hardships and frustrations). Only the customer judges value, and value is judged by what the customer perceived she got in comparison to what she perceived it cost. Thus value is affected by quality in fact, and quality perceived.

Value added step: a step in a process is said to be value added if 1.) it physically changes the work passing through the process, 2.) it is done right the first time, 3.) the customer is willing to pay for it, 4.) it is a legitimate legal requirement, or 5.) it is necessary to allow for the survival of the organization.

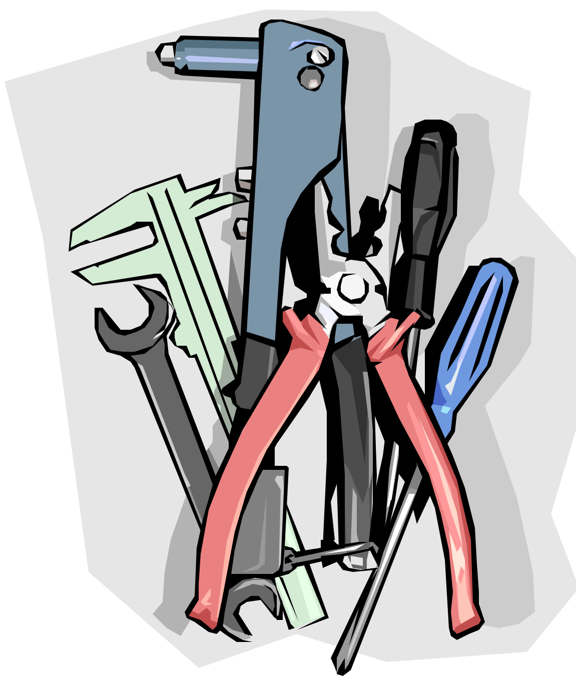
Vision: a compelling conceptual image of the desired future. A vision focuses and ennobles an idea about a future state of being in such a way as to excite and compel an organization toward its attainment. It crystallizes what management wants the organization to be in the future.

Work flow: physical movement of people, materials, documents, or information through a process as raw materials are transformed into products or services.

Work instructions: detailed step-by-step information on how to perform a particular task; for example, operating instructions for a piece of equipment.

Appendix

Quality Tool Sheets



Quality Tool Sheets

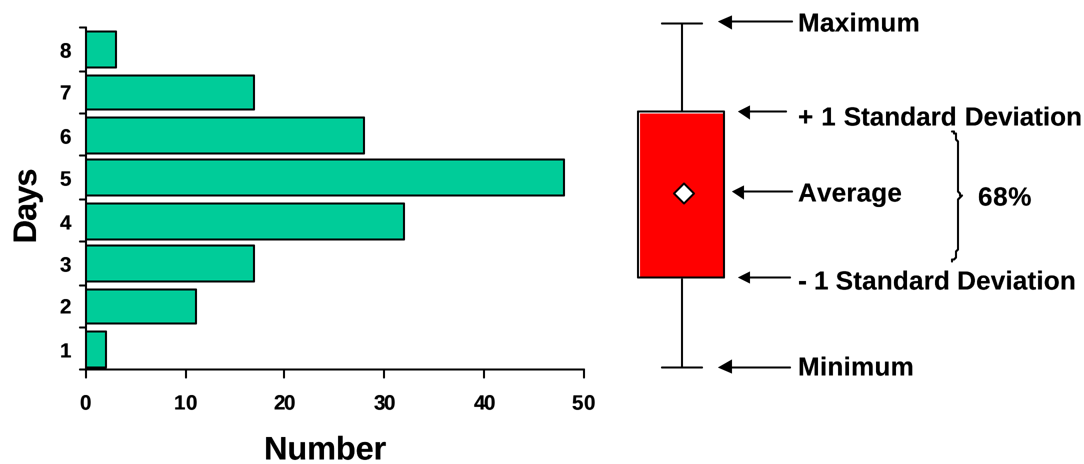
Quality Tool Sheet: Box-Whisker Plot

Box-Whisker Plot

A graphic representation of sample variation. The calculated sample average is represented by a dot. A box surrounds the dot indicating plus or minus one standard deviation from the mean. The "whiskers" extending from the box indicates the minimum and maximum values of the sample. The graphic representation amounts to turning the traditional bell curve (normal distribution) on its side to indicate the variation about the mean.

Best Uses

Box-whisker plots work well to display process performance measures over regular time periods, such as months for example. The performance measure must, obviously, be an average calculated from a sample of measurements. Over time, an average may not change substantially, however, the variation of performance about that mean could increase dramatically. The box-whisker plot then, allows the process owner to evaluate with one glance both average performance and the consistency at which performance remains close to the average.

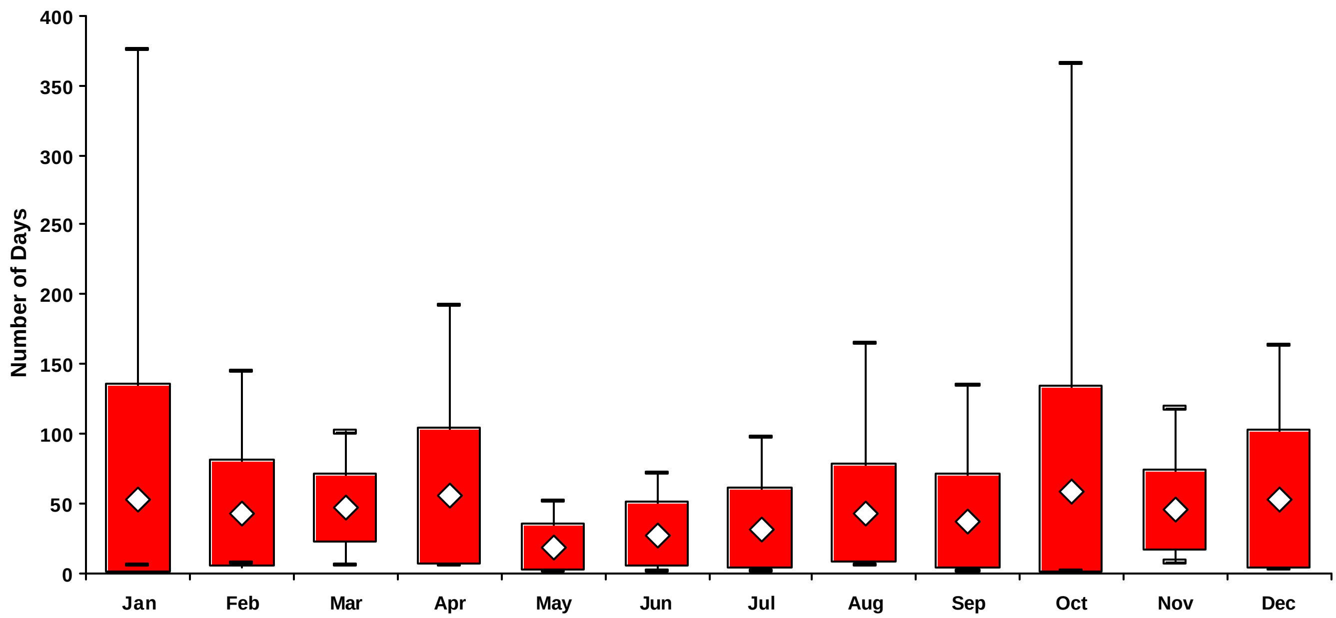


Steps

1. Calculate and determine the sample average, standard deviation, maximum and minimum.
2. Several statistical software packages produce box-whisker plots. Following is a description of how to build one using Excel.
3. In Excel, label and enter data in the following rows with data for each time period in each column.
    a. 1 standard deviation up
    b. average value
    c. minimum value
    d. maximum value
    e. 1 standard deviation down

4. Create a line chart. Format the "average" series, and under "Options" choose Hi-Low Line and Hi-Low Bar. Also select a white marker. Now return to the chart to format the remaining series. Select "None" for line and marker. This will make only the box and whiskers visible. Only one last step remains. To place an end cap T on the whiskers, select the series for minimum and maximum values, and then set the marker to a dash symbol. This completes construction of a box-whisker plot in Excel.

5. The chart below is an example of a box-whisker plot for a performance measure evaluated monthly. It shows the average length of time required to process applications. Notice that while the average does not vary greatly from month to month, that the variation of times increased greatly in January, April, and October. This information would trigger a process owner and team to investigate special causes that hurt performance. The goal of process management would be to make each month's performance look like May.



Quality Tool Sheet: Check Sheet

Check Sheet

Check sheets are often used by process improvement teams to tally the occurrence of a product defect or process workflow problem as they occur. This allows the team to decide on which problem to focus first. They are a type of data collection form in which the results may be interpreted on the form directly without additional processing.

Best Uses:

Check sheets are used to determine which problem a process is experiencing most frequently. They can also be used to monitor performance over a period of time to make sure that problems are being eliminated.

Steps:

1. Brainstorm a list of the major process performance problems that you believe are happening. Try to think of the most common mistakes, delays, defects, complaints, or problems that seriously hamper process performance.
2. Determine the time periods for collecting the data, and for how long.
3. Develop a data collection sheet that lists the problems as rows and time periods as columns (or vice versa).
4. Distribute the check sheets to any employee who may see, discover, or encounter the problems on the list. Keep the check sheets out in the open where you can immediately mark the occurrence of a particular type of problems.
5. Team members must commit to consistently and honestly mark down the occurrence of any problem on the list immediately as they discover it.
6. Summarize the results after a predetermined time has passed, and discuss the findings at a regular process improvement team. One effective way to present check sheet information to construct a Pareto Chart (see Quality Tool Sheet).

	Week						
Type of Problem	1	2	3	4	5	6	Total
Illegible signature		𝍷𝍷	𝍷𝍷𝍷		𝍷𝍷𝍷𝍷	𝍷𝍷𝍷	12
Incorrect account number	𝍷𝍷𝍷𝍷		𝍷		𝍷𝍷	𝍷𝍷	9
Incomplete application	𝍷𝍷𝍷𝍷	𝍸 𝍷𝍷𝍷	𝍷𝍷𝍷𝍷	𝍷𝍷	𝍸 𝍷𝍷	𝍷𝍷𝍷𝍷	29
Delivered to the wrong Department	𝍸	𝍷𝍷𝍷		𝍸	𝍷𝍷𝍷	𝍷𝍷	18
Delayed waiting for signature	𝍸 𝍸	𝍸 𝍷𝍷	𝍸 𝍷𝍷𝍷	𝍷𝍷𝍷𝍷	𝍸 𝍷𝍷	𝍸 𝍸	46
Total	23	20	16	11	23	21	114

Quality Tool Sheet: Fishbone Diagram

Fishbone Diagram

Initially developed by Kaoru Ishikawa, the fishbone diagram is an effective tool to help teams analyze the root causes of a complex problem. The fishbone diagram is also known as the "Cause and Effect Diagram" or the "Ishikawa Diagram". The diagram provides a graphic structure to guide brainstorming, then to prioritize the root causes that are believed to most likely resolve the problem. The underlying principle is that if only a symptom of a problem is addressed then the problem will keep reoccurring. But if the root cause of a problem is eliminated, then the problem will be corrected permanently. In real world problems, however, many issues may possibly cause a problem and work together to make the problem worse. The fishbone diagram can bring clarity and focus to a seemingly complicated problem.

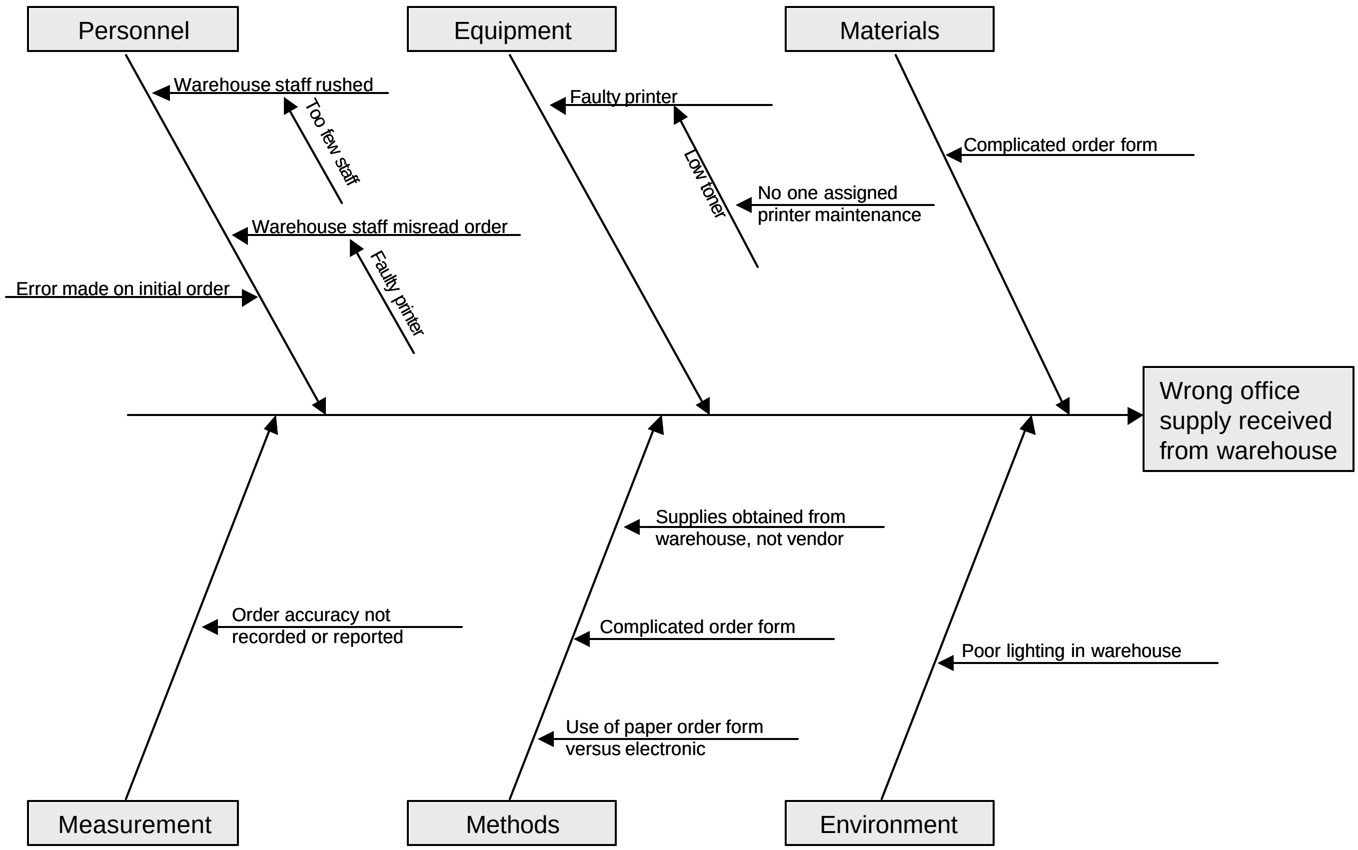
Best Uses:

Used to develop a list of possible root causes of problem, and then prioritize those causes that likely contribute most to the problem.

Steps:

1. Write the problem statement in a box on the right hand side of a large piece of paper. Flip chart or butcher paper is useful for a team work session.
2. Draw a horizontal arrow leading into the left side of this box. Connect six additional arrows leading into this centerline and label each line with the following categories; Machine, Material, Measurement, Method, Manpower, and Environment. These are the most common categories of problem causes, but they may not fit every situation. Feel free to substitute or add categories. The name "fishbone" comes from this diagram resembling the bones of a fish, with the problem statement being the head of the fish.
3. Brainstorm the possible causes for each category. Write each possible cause as arrows leading into each category (see example).
4. With each cause ask "Why?" 2 to 5 times until its believed that the root cause of each has been identified.
5. Select and circle the causes that most likely produce the problem. Additional research or obtaining preliminary data may help formulate these initial predictions. Look for words or phrases that appear repeatedly throughout the diagram. These words may give a clue to an underlying root cause.
6. Rank the circled causes in order of their likely contribution to the problem.
7. Once the causes of the problem have been verified, the team is ready to begin identifying potential solutions (hypotheses).

Example Fishbone Diagram



In this example, a secretary received an office supply that was not what was ordered. A team of employees including the secretary, procurement staff, and warehouse staff brainstormed possible causes, which are presented in the fishbone diagram above. After some further investigation, the team found that the warehouse staff misread the order. In turn, they could not read the order because the printer wasn't working correctly. The printer wasn't printing clearly because the toner cartridge was getting low. Finally, the toner cartridge had not been changed because no one was assigned the responsibility of maintaining the printer.

Variation

One variation of using the fishbone diagram is to begin the diagram on a large piece of butcher paper, and post the diagram on a wall that everyone can see. As people walk by the diagram over a few days, they can pause and add to the diagram any new ideas that come to mind. In this way employees can think about the possible causes for awhile, discuss it with each other, and have time to get to the bottom (root cause) of the problem.

Quality Tool Sheet: Pareto Chart

Pareto Chart

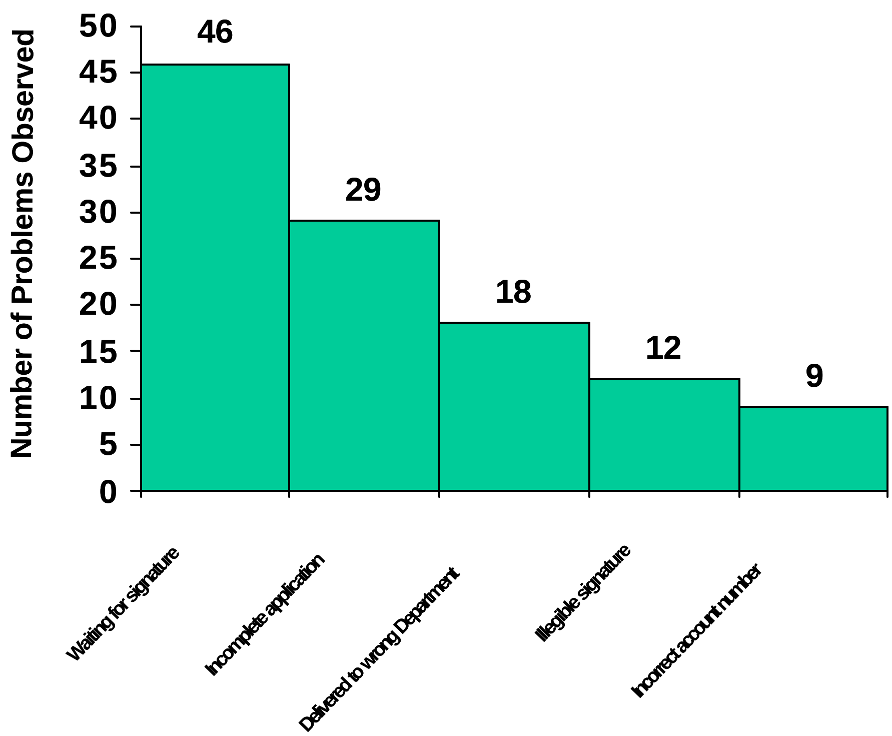
Vilfredo Pareto (1848-1923) was an economist who first stated the principle that 80% of the wealth is generally held by 20% of the population. Dr. Joseph Juran, one of the early pioneers in quality, many years later developed the Pareto Principle that 20% of process problems will provide 80% of the opportunity for improvement. In other words, correcting only a vital few causes of lower performance will provide most of the improvement possible. A Pareto chart is a specialized bar chart that simply places the data values in declining order.

Best Uses:

Used to visually prioritize problems so that the most frequently occurring problem can be addressed first.

Steps:

1. Sort the frequency of occurrence of all process problems (errors, defects, mistakes, delays, etc.) in descending order.
2. Plot a vertical bar chart of the frequency of these problems. An example of a Pareto chart is provided below. Data shown in the Pareto chart were take from the example used in the Quality Tools Sheet for check sheets. In this example, the process improvement team would likely obtain most of the improvement possible if they attacked the problem of waiting for signatures.



Quality Tool Sheet: Process Map / Flow Chart

Process Map / Flow Chart

A process map is a graphic representation of workflow. It traces the steps taken in producing a product or providing a service.

Best Uses

A process map has two primary uses. The first is to understand and analyze the process through which work is accomplished. It is used to discover steps in the process that ultimately reduce performance and productivity. Second, a process map is an effective way to communicate the standard operating procedure to employees. In fact, a process map is often the central focus of written procedures. Such procedures can be used not only to standardize and align current operations, but also can greatly reduce the startup time when training new employees.

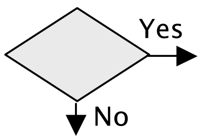
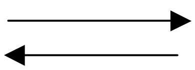
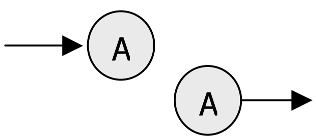
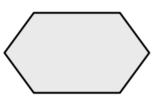
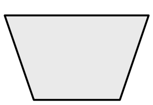
A process map is most commonly used to identify process problems and redesign the process to improve performance. Redesigning a process involves building three process maps.

- First, construct the process map of the process "as is". That is, map the way we currently do the work.
- Next, imagine that anything is possible, assuming that you have unlimited resources and technology. Construct the "ideal" process, perhaps beginning with a black sheet of paper or just modifying the existing process.
- Finally, identify what can be done immediately and what could be phase in as funds become available. Develop a plan for making further process improvement. Construct the new process map of the steps that you actually intend to implement now.

Steps

1. A process may only have one beginning and one end point. This defines the scope or boundaries of the process. It is all too easy to stray into other processes when developing a process map. The result may be burnout and fatigue as a team tries to map the entire world. Begin by defining clearly what signals initiation and completion of the process. Identify the beginning and ending points of the process.
2. Identify the "thing" passing through the process as it is transformed from beginning to end, and imagine that you are that "thing". Follow it through each step of the way as it is transformed from the original input into the final product or service.
3. Use sub-processes to reduce complexity. A high-level task or activity may, within itself, contain several detailed tasks or steps. These high-level activities may be thought of as sub-processes, and mapped with their own beginning and ending points.
4. Only one line may go into or out of a symbol, except for decision points.
5. Avoid crossing lines that connect from one symbol to another. If they must cross, use a half circle to indicate that the line crosses but does not intersect.
6. Use the following symbols to indicate the process flow.

Process Mapping / Flow charting Symbols

Symbol	Represents	Example
	Boundaries	• Shows the beginning and end of a process • Normally starts with supplier & ends with the customer
	Task or Activity	• Fill out a form • Write a letter • Deliver package
	Decision	• Yes or No • Approve or Disapprove • Accept or Reject • True or False
	Direction Of Flow	• Direction of flow of the item or information passing through the process
	Connector	• Show the flow of the process to/from the next line or page
	Multiple Decision	• Three types of forms to process • Determine which insurance plan of the following four
	Choice	• Option A, B, or C • Ford, Chevy, or Chrysler