CONTINUOUSLY IMPROVING ACHIEVES EXCELLENCE

INCLUDES CONTINUOUS IMPROVEMENT TOOLS
CONTINUOUSLY IMPROVING
ACHIEVES EXCELLENCE

A VICTORY GUIDE

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This book is the result of over 30 years of continuous improvement of continuous improvement. Over the years, the pursuit of a simple, easy-to-use, proven, inexpensive continuous improvement system for any organization has been my focus. MANAGING FOR VICTORY is this system. This book is the foundation of the system. Continuous improvement begins many organizations journey to VICTORY. Continuously improving will help you in many ways. If you are a small to medium organization, this book provides an easy to implement, simple, proven continuous improvement system. For larger organizations, this book provides a foundation to build a more complex continuous improvement system.

MANAGING FOR VICTORY system includes:

V  Visioning creates a common focus

I  Involving everyone establishes a superior organization

C  Continuously improving achieves excellence

T  Training, educating, coaching, facilitating, mentoring develops a learning culture

O  Owning the work fosters empowerment

R  Recognizing and rewarding builds high performance

Y  Yearning ensures success

Customers drive VICTORY

Progressive Leaders guiding the organization to VICTORY

This book is the result of a TEAM effort. Special thanks to Meloney Sallie-Dosunmu for her inspiration for this specific book.

Value stream mapping was modified from the works of Mike Rother, John Shook, Dan Jones and Jim Womack.
CONTINUOUSLY IMPROVING ACHIEVES EXCELLENCE

Power of Process

Continuous improvement (invention, innovation illumination, illustration, imitation, inspiration, ideas, and imagination) are essential for achieving organizational excellence. The organization must establish and maintain a disciplined continuous improvement system for VICTORY. The improvement system must be used continuously and consistently throughout the organization. The focus of a disciplined continuous improvement system must be perfection.

The continuous improvement system applies the fundamental aspects of a managing for victory philosophy. First, people are not the problem. People are the solution. Almost all "root" causes of problems in an organization or variation in a process can be traced to the system or process itself. Therefore, the continuous improvement system uses people to focus on the system, process, issue, and problem; it does not look for fault in the people. People provide the solution. Second, quantitative methods are the principal means to make decisions. Measurement is basic to all activities in the entire organization. Third, the continuous improvement system, with an appropriate improvement methodology, is used to improve all material services supplied to an organization, all the processes within the organization, and the degree to which the needs of the customer are met -- now and in the future.

Achieving excellence through the use of a continuous improvement system requires the organization to first establish a policy of excellence. Next, the organization must expect continuous improvement of people, product and processes. This involves creating a process orientation throughout the entire organization. In addition, an improvement methodology must be established for achieving excellence. Finally, the organization needs to learn how to develop and use improvement tools. The continuously improving considerations include:

Establish an excellence policy
Expect continuous improvement
Create process orientation
Establish improvement methodology
Learn improvement tools
Excel - Establish an Excellence Policy

Pursue perfection; achieve excellence.

While the vision, mission and values provide the common focus, the Excellence Policy provides the standard for organizational actions. It targets the organization to achieve excellence. The Excellence Policy launches continuous improvement and inspires the organization to excellence. It provides the vehicle that internalizes the excellence standard throughout the organization. Finally, the Excellence Policy yields excellence.

Establish an Excellence Policy Considerations

P - Provides the standard for excellence
O - Orients the organization to target excellence
L - Launches continuous improvement
I - Inspires excellence in the organization
C - Creates policy deployment throughout the organization
Y - Yields excellence

Policy - Provides the Standard for Excellence

The standard for excellence is described in the organization’s Excellence Policy statement. The Excellence Policy statement should contain as a minimum the following elements:

- Organization’s meaning of excellence
- Organization’s code of excellence

The organization’s meaning of excellence must be clarified in the Excellence Policy. What does “excellence” mean in the organization? Does it mean: perfection, six-sigma, quality, total customer satisfaction, and so-on? The following is an example of the meaning of excellence:

Excellence is meeting our customers’ view of perfection.
The code of excellence equals the principles that apply to excellence. For example, the principles in chapter one could be a code of excellence. The following is another example of code of excellence:

**Code of Excellence**

- Commit to excellence first
- Do the right thing right the first time
- Provide superior performance, service, and quality
- Take pride in your work
- Achieve total customer satisfaction
- People are not the problem, they are the solution
- Use quantitative methods to make decisions
- Be a team player
- Freely acknowledge problems and mistakes
- Communicate and share information

When establishing an Excellence Policy, the organization should use a similar process as when creating vision, mission and values. The Excellence Policy needs to be established by a team representing all areas of the organization. It should be led by a top-manager in the organization and an outside expert should facilitate the process.

**Policy - Orients the Organization to Target Excellence**

In addition to the Excellence Policy statement, the organization needs to determine “why excellence” in their specific organization. This is the organization’s reason for pursuing a strategy of excellence. The purpose of “why excellence” is to get personal commitment from everyone in the organization. Therefore, it must not only provide organizational reason, but it must address “what is in it for people in the organization.”

**Policy - Launches Continuous Improvement**

With excellence as a target, the organization must continuously pursue improvement. Therefore, the establishment of an Excellence Policy is usually one of the first steps in launching continuous improvement in the organization.
Policy - Inspires Excellence in the Organization

In addition to providing the standard for action in the organization, the Excellence Policy must inspire the organization to perspire to make excellence a reality. Therefore, the Excellence Policy must be more than a meaningless slogan. It must relate to everyone’s work in the organization.

Policy - Creates Policy Deployment throughout the Organization

The Excellence Policy creates the deployment of policy throughout the organization. This is accomplished through standards. The Excellence Policy forms the basis for standards at every level in the organization. Figure 1 shows the flow of policy to standards to measures. Standards are the view of excellence at each level of the organization. Figure 2 shows an example of operational standards.

Figure 1  Policy deployment.
Basic Operational Standards

2 HOURS NOT DAYS
The total order process cycle time starting with receipt of the order from a customer to order ready for the customer be no more than 2 hours.

SAME DAY SHIPPING
Orders received before 4PM will ship the same day.

JUST-IN-TIME DELIVERY
Delivery to customers the next day.

AVAILABILITY OF PRODUCT
Inventory on-hand whenever the customer needs it.

Figure 2 Operational standards example.

Policy - Yields Excellence

The policy deployed throughout the organization provides the intended results. It is commonly known that what gets measured gets done. The Excellence Policy forms the basis for measurements in the organization. Figure 3 shows an example of measures focused on perfection.

Measures

RESPONSIVE, ACCURATE, COMPLETE ORDERS

100% of all orders are accurate at order entry.
100% of all orders are picked and shipped correctly.
100% of incoming customer calls are handled within 2 minutes.
100% of customer orders filled immediately from stock on-hand.
100% of customers notified of out-of-stock item within 30 minutes of placing order.
100% of customers called back on inquiries within 30 minutes.
100% of customers receive proof of delivery within 30 minutes of shipment.
100% of orders ready for pick-up within 2 hours of placing order.
100% of orders shipped the same day as ordered.

**Figure 3** Perfection measures example.

**Excel - Xpect Continuous Improvement**

Good, better, best, never let it rest, until the good becomes better and the better best.

Continuous improvement is the cornerstone of an excellent organization. The organization needs to expect improvement in every process, every day by everyone. Figure 4 shows the continuous improvement process. Xpect continuous improvement considerations include:

- **I**nstitute a systems view
- **M**ake perfection a passion
- **P**ursue continuous improvement of people, product and processes
- **R**equire metrics of critical areas of success
- **O**perate using continuous improvement cycle
- **V**erify results
- **E**stablish and maintain documentation

**Figure 4.** Continuous improvement process.
**Improve - Institute a Systems View**

A successful organization needs a holistic systems view to achieve success. The organization must be viewed as a complete system. Within the organizational system are subsystems. These subsystems are made up of processes. In any organization, systems, subsystems, and processes are all interrelated to influence the output of the organizational system. The organization must constantly think of how all the components of the system interact to achieve total customer satisfaction.

One part of the system cannot be looked at in isolation from other parts of the system. For instance, the VICTORY model is a system. The reward system and involvement system are subsystems of the VICTORY system. A change in the reward subsystem will affect the behaviors of the involvement subsystem, which influences the VICTORY system that impacts the complete organizational system.

A systems view requires an understanding of the complete organization. A comprehensive study of the organization, its interrelationships, and interactions provides the systems view. This information needs to be shared with everyone in the organization, so they can see the “big picture.” This helps people stop viewing the organization only in regards to their department or function, with blinders on to other parts of the organization. Once the organization understands its systems, it can deal with improvement opportunities from a system standpoint. This will impact the organization’s ability to be a winner. Institute systems view considerations include:

- **State** the complete organizational system
- **Y**earn to know interrelationships of organizational subsystems
- **S**hare systems view throughout the organization
- **T**reat each organizational development opportunity as a system
- **E**mphasize the impact of people in the system
- **M**ake the most use of information systems and technology

**Improve - Make Perfection a Passion**

The pursuit of perfection has to be the passion of everyone in the organization. Everyone has seen the charts of what you get with 99.9%. Nobody wants to be the .1% of mistakes in our health care system or .1% of aircraft failures. It is just
unacceptable. There are many other cases where less than perfect is unacceptable. These include cases of lost documents, incorrect financial postings, errors in routing, wrong deliveries, and so on. Even a six-sigma pursuit is still 3.4 parts per million defective. A successful organization needs to see the importance of perfection in all pursuits.

Perfection means 100% correct, accurate, complete, pure, satisfied, conformance, defect-free, and so-on. This may sound clear. However, perfection sometimes gets diluted in different parts of the organization. One organization’s view of perfection is stated as “perfection is doing the right thing, right the first time, doing it on time, all the time, always striving for improvement, always satisfying the customer.” Every organization needs to agree on a view of perfection.

Perfection should be the target of metrics and measures in the organization. The measures should be expressed in relation to perfection. For example, instead of 3% of deliveries late, it should be expressed as 97% of deliveries are on time.

Standards need to indicate perfection. For example, the standards indicate:

100% of customers satisfied with transaction
100% complete orders
100% accurate orders
100% on-time delivery
100% defect-free
100% conformance to requirements
100% safe
100% attendance

Perfection should be instituted in the organization. This means perfection is accepted as the standard for everything and everyone in the organization. Perfection is included in philosophy, principles, practices and procedures. In addition to words, perfection needs to be expressed in every action of the organization.

Perfection needs to be a passion throughout the organization. Perfection is a mind-set. Perfection is doing your best. Perfection is being a champion.
Make Perfection a Passion Considerations

Pursue perfection
Agree on a view of perfection
Set perfection targets
Specify perfection in standards
Institute perfection
Observe indicators for perfection
Nurture passion for perfection

Improve - Pursue Continuous Improvement of People, Product, and Processes

Continuous improvement of product, processes, and people in an organization is a never-ending pursuit. Customer expectations drive product deliverables. This drives the people in the organization to improve their processes. Improved processes drive better product deliverables exceeding customer expectations. This leads to the need for continuous improvement of product, people, and processes. All three of these elements are important to an excellent organization. Although this chapter emphasizes continuous process improvement, continuous development of people and some product improvement tools are just as important. The continuous improvement system can also be used for continuous improvement of product. However, there are many sophisticated techniques for product design, development and improvement. For instance, concurrent engineering, quality function deployment, robust design, statistical quality control, cost of poor quality, total product maintenance, just-in-time, computer-aided design and manufacturing, TRIZ and many more.

Improve - Require Metrics of Critical Areas of Success

Metrics are measurements made over time that communicate vital information about the quality of a process, activity, or resource. Metrics reflect meaningful measures that target continuous improvement actions. Metrics are differentiated from plain measurement by the specific focus on total customer satisfaction. Metrics must be customer oriented and communicate a state of health. Metrics must show where we are now in relation to where we want to go over time.
Metrics are essential to assess all critical processes and activities leading to success.

Customer oriented metrics foster understanding and helps develop a trusting relationship. The customer agrees that it is an accurate indication of customer satisfaction. Good metrics always focuses results toward an improvement action. Metrics must distinguish between acceptable and unacceptable actions. Metrics must target long-term improvement. Metrics indicate a trend over time while being timely. Metrics must be unambiguously defined with a specific link to the organization's objectives. The metrics data must be easy and economical to gather.

Metrics are not charts, schedules, goals, or counts of activity. Charts may graphically display the results of metrics, but the chart itself is not metrics. Some forms of schedules can lead to good metrics, but usually schedules do not provide information that by itself will lead to improvement. Goals, objectives, strategies, plans, missions, or guiding principles can be measured, but metrics are not by itself the end. It is a means to an end. Also, counts of activity can result in metrics. However, a measure does not necessarily drive appropriate action. Require metrics of critical areas of success considerations include:

- **M**eaningful to the customer (internal/external)
- **E**stablishes appropriate action
- **T**ells how well the organization is performing
- **R**epeatable over a period of time
- **I**ndicates a trend
- **C**lear operational definition
- **S**imple to collect

**Improve - Operate Using Continuous Improvement Cycle**

The continuous improvement system cycle involves five stages: clarifying the focus, yearning to discover improvement opportunities, choosing improvement opportunity, launching improvements using an improvement methodology, and evaluating the results. A sixth stage can be added as a reminder -- do it again and again and again. This cycle is never-ending. Figure 5 shows the continuous improvement cycle.
Stage 1: Clarify the focus

During this phase, the focus and priorities are determined. First the overall focus must be established, understood, and supported. Top leadership must determine the focus with input from all stakeholders during strategic planning. Once there is a focus, the specific mission is defined by the people responsible for the accomplishment.

Stage 2: Yearn to discover improvement opportunities

The next phase involves listing all improvement opportunities. It is important to obtain an understanding of the process at this stage. Customers, both internal and external customers, must be identified and their needs and expectations understood. Suppliers must also be matched with requirements. Any potential problems should be identified at this time.

Stage 3: Choose improvement opportunity

Specific improvement opportunities are selected in this phase. Remember to focus on critical processes that have the greatest impact on customer satisfaction.

Stage 4: Launch improvement using improvement methodology

This phase uses a disciplined methodology to improve the process. This methodology is used to complete the continuous improvement mission, improve a process, and/or solve problems. There are many improvement methodologies. The next section of this book provides an improvement methodology.

Stage 5: Evaluate the results

During this phase the improvements are evaluated against the impact on achieving the overall mission/vision of the organization.

Stage 6: Do it again and again and again

This is a never-ending process. Everyone must continuously repeat the improvement cycle.
Figure 5  Continuous improvement cycle.

Operate Using Continuous Improvement Cycle Considerations

Clarify the focus
Yearn to discover all improvement opportunities
Choose improvement opportunities
Launch improvements
Evaluate results
Improve - Verify Results

As a minimum, the organization needs to measure the areas critical for business success, key internal business processes, and customer satisfaction. The critical areas for business success are the three to ten most significant indicators of the organization's performance.

The results areas mentioned in the Malcolm Baldrige National Quality Award provide an excellent starting point to verify results. Each organization determines specific measurements based on the following:

- Customer-focused results
- Product and Service results
- Financial and Market results
- Human Resources results
- Organizational Effectiveness results
- Governance and Social Responsibility results

Besides the key areas for business success, each process within the organization needs a process performance indicator. These indicators need to be developed by the process owners. The process performance indicators should aim toward continuous improvement. They should not be used to drive or control the people in the organization. In this regard the process performance indicator is not aimed at any particular person. It is focused on the process. Some typical process performance indicators of internal processes include: cycle time, cost, schedule, number of items, amount of rework, number of errors, number of failures, delivery time, and so on.

Customer satisfaction is an essential measurement area. The development of measurements in this area requires communication with the customer to determine the exact measure for total customer satisfaction. Usually the customer wants the deliverable to satisfy their specific need, at the time it is needed, whenever it is needed, for as long as it is needed, and at a cost they can afford. Customer satisfaction indicators aim at: performance, response time, cost, availability, reliability, value, service, use, appearance, and so on. Verify results considerations include:

**Make measures meaningful**

**Emphasize business results**

**Adopt objective measures**

**Specify subjective measures**

**Understand consequences of measures**
Reinforce positives of measures
Eliminate unnecessary measures

Improve - Establish and Maintain Documentation

Documentation is necessary in a continuous improvement system. Documentation helps standardize excellence.

The system must be documented to ensure understanding, conformance, and consistency. However, documentation should be the minimum essential for the success of the organization.

Documentation includes all internal documentation to support the organization. The quality system documentation, as outlined in ISO9000 provides guidelines for management system documentation. Again, the management system documentation should be tailored to the requirements of each specific organization. Management system documentation could include the following:

- Manual gives the overall policy and guidance for the management system.
- Operation Procedures outlines the general procedures for performing operations.
- Work Instructions provide the detailed step-by-step methods for performing tasks.
- Records show the evidence of system performance.

When establishing management system documentation, first define the management system. This includes the vision, mission, values, philosophy, principles, plans, policies and practices. Second, describe the organizational structure including structure, roles, responsibilities, and authority. Third, delineate specific goals of the system. Fourth, understand key processes. Fifth, make a documentation plan to detail the required documentation at each level of the organization. Sixth, ensure enough records to verify progress. Seventh, temper the amount of documentation to essential information for success. Eight, continually review documentation for improvement. Establish and maintain documentation considerations include:

Define the system
Outline the organization
Clarify the goals of the system
Understand key processes
Make a documentation plan
Establish documents
Need records
Temper documentation

Excel - Create Process Orientation

Process equals work.

The process is a fundamental element of any organization. Processes are how work gets done. Therefore, processes form one of the major focuses of continuous improvement.

The organization creates a process orientation by first providing a process overview. In addition, process plans should be required of all major processes. Next, process performance is observed for obvious improvements. Then, process diagrams provide a view of the process. Benchmarks give an indication for making progress. Finally, the systemizing of process analysis and data analysis give the foundation for long-term improvement. Create process orientation considerations include:

Provide process overview
Require process plans
Observe process performance
Create process diagrams
Establish benchmarks
Systemize process analysis
Stress data analysis

Process - Provide Process Overview

Creating a process orientation starts with a process overview. The process overview provides an understanding of basic process definitions, the nature of a process, the states of a process, and process variation.

The following are some basic definitions required to understand a process:
• A process is a series of activities that takes an input, modifies the input (work takes place and/or value is added), and produces an output. Thus, a process is the job itself. Figure 6 presents a graphic representation of a process.
• An input is what you need to do the job.
• An output is the product or service given to someone else.
• A supplier is the provider of the people, material, equipment, method, and/or environment for the input to the process.
• A customer (internal or external) is anyone affected by the product or service.
• The process owner is the person who can change the process.
• Continuous process improvement is the never-ending pursuit of excellence in a process performance.
• A measurement of a process is the difference between the inputs and the outputs of the process as determined by the customer.
• Variation of a process is any deviation from its ultimate best target value.

![Figure 6 Graphic representation of a process.](image)

**The nature of a process**

A process has a horizontal flow and hierarchical nature. A total process flows across the organization. It can run through many departments and functions. For instance, as shown in the order process Figure 7, the order flows from customer service, through the warehouse functions, to the customer by delivery, and finally to accounts receivable for billing.
Figure 7  Order flow process.

An understanding of the hierarchical nature of a process as displayed in Figure 8 is important to understanding a process. There are many levels of a process. At the top level are the major processes. These top-level processes can be broken down into subprocesses. Each subprocess consists of many tasks.

Figure 9 shows an example of the nature of a process. At the top level in the figure, there are the three major processes in producing a part. A part is engineered, it is manufactured, and it is tested. The manufacturing process breaks down into its subprocesses. This is another level of processes. When manufacturing a part, a shop order is prepared. Material kits are provided. The part is fabricated. The part is inspected. The kitting subprocess consists of several tasks. Building a material kit subprocess requires pulling parts, preparing the kit, and releasing the kit to the shop.

Figure 8  Hierarchical nature of a process.
Because of the various levels of a process, determining the boundaries of a specific part or parts of a process is a necessity. This means the start and finish must be defined. Further, processes impact other processes on the same level or on different levels above or below the process. Therefore, know the impact of any improvement effort on other processes before the improvement is implemented. For instance, if an improvement recommends making a square hole, a further process may have to be changed to include a square peg.

**Process states**

A process can be in one of several states depending upon variation and capability.

State 1 is the unknown state. In this state, the process performance has not been measured. There is no target. State 2 shows the process out of control. There is a target, but the performance cannot be predicted. In this state, the process performance is an element of chance. State 3 displays a process in control, but the process is not capable. The process performance can be predicted but it will not always hit the target. In this state, the process is not within limits. State 4 is a process in control and capable. The process performance can be predicted within the target. State 5 is process improvement. In this state, the process is improved to reduce variability to the target value. The aim is to consistently hit the bull’s-eye or center of the target. State 6 is continuous improvement. In this state, the process is constantly improved to its best possible
performance. The target keeps getting smaller and smaller while still continuously hitting the bull’s-eye.

The continuous improvement system moves the process from one state to another with the ultimate aim to consistently perform all processes at its ultimate best.

Process variation

There is variation in every process. The causes of variation are from common and special/assignable causes. Common causes are the normal variation in the established process. They are always part of the process. Special/assignable causes are abnormal variation in the process. They arise from some particular circumstance. It is important to understand the impact of both causes of variation. A variation from a special assignable cause should be solved as a specific problem attributed to something outside the normal process. A variation from a common cause can only be improved by a fundamental change in the process itself. If a common cause is mistaken for a special cause, the adjustment of a common cause could result in increased variation and it will frequently make the process worse. For example, a test failure is encountered when performing a final test of an assembly. The test failure is attributed to the "A" board. If the failure’s root cause is further blamed on the special cause of operator error in the fabrication of the board, when in fact the procedures in the process were incorrect which would be a common cause, the test failure will be repeated in the future.

Process - Require Process Plans

Process planning constitutes the every-day planning activities for getting the work done in the organization. The purpose of process planning is to record the important elements of a process to explain how the process is currently performed within the organization.

The process plan action process contains the following:

1. Process Description. This means stating the overall process in terms of the customer (internal/external) and internal operations. First, this involves stating the process as an action and a descriptor. For instance, the customer service process might be stated as “serve customers.” Second, state the general operation performed in the process.
Example of Process Description

Serve the customer by providing quotes, processing orders, and keeping customers happy.

2. Process Start. This is the action that begins the process.
3. Process End. This is the action that ends the process.
4. Process Operations. These are all operations necessary to perform the process.
5. Supplier Requirements. This is the input to the process and who supplies the input. Requirements should be as detailed as necessary.
6. Customer Expectations. This is the planned output of the process. These outputs are expressed as products or services to customers (internal/external). Here state as specific as possible the customer’s needs and expectations from the process.
7. Process Measure(s). State the process measurement or metrics. This is how to know if the process is performing up to the organization’s standards while meeting customer expectations.
8. Responsibilities. List the general responsibilities needed to perform the process.
9. Resources. List the major resources (people, equipment, material, etc.) needed to perform the process.
10. Education and Training Requirements. List the specific education and training qualification to perform the process.

Process - Observe Process Performance

All process performance can be measured through process indicators. The major process indicators focus on: quality, cost, quantity, time, accuracy, reliability, flexibility, effectiveness, efficiency, and customer satisfaction. Usually, these process performance indicators are either the difference between the input and the output of the process, or the output of the process from a customer's viewpoint. In manufacturing processes, the process performance indicators are called quality characteristics. These quality characteristics are items such as: weight, height, thickness, strength, color, temperature, and density. Besides these quality characteristics, there are process performance indicators in every aspect of the organization. The possibilities of performance indicators are only limited by the view of the organization. Each organization and process owner
must determine its own process performance indicators. Some other examples of process performance indicators are: errors, time to deliver to the customer, orders filled, number of repairs, number of skilled personnel, response times, number of changes, customer complaints, spares used, mean-time-between-failures, time available for operational use.

Observe Process Performance Considerations

I - Items defective
N - Number of changes, orders, transactions, errors, customers, and so-on
D - Delivery times
I - Items available
C - Characteristics of quality
A - Accuracy
T - Time to process, order, respond, test, inspect, assemble, design, and so-on
O - Orders complete
R - Reliability
S - Satisfied customers

Process - Create Process Diagrams

A process diagram is a tool for defining the process that is a major focus for continuous improvement activity. An initial step in any continuous improvement activity should be to define and understand the project process and the processes to accomplish the project. Each organization, function, and person should define their specific process(es) and understand how the process satisfies customers' needs and expectations (both internal and external customers). Each process is a customer of the preceding process, and each process has a customer for their process. Everyone must constantly strive to improve his or her process both as a customer and for a customer.

A process diagram uses symbols and words to describe the process. It provides an indication of improvement opportunities, non-value-added tasks, and where simplification of a process is possible. A process diagram identifies graphically the interrelationships of the process to show the roles and relationships between processes. It shows which elements impact process
performance. Finally, it indicates where the process should be measured. Process diagram considerations include:

**D**isplays the details of a process

**I**dentifies process interrelationships

**A**llows an analysis of the results of a process

**G**ives a graphic display of a process

**R**eexamines roles, responsibilities, and interrelationships

**A**ssesses the elements that impact process performance

**M**easures process performance

**Process - Establish Benchmarks**

Benchmarking is a method of measuring your organization against those of the recognized best performers in a certain industry, organization, function, system, or process. The purpose of benchmarking is to provide a target for improving the performance of the organization. The benchmark targets improvement of the process outputs or the performing of the actual process. Benchmarking brings a focus on customer-driven project management improvement efforts by emphasizing desired outcomes. It also nurtures wholesome competition by creating the desire to be the best. Benchmarking provides a common focus to hold the organization together by measuring critical areas and analyzing these critical areas against the best. Targeting the best reinforces continuous improvement by keeping everyone aiming at a long-term objective. Establish benchmarks considerations include:

**B**uilds a target for improvement efforts

**E**mphasizes desired outcomes

**N**urtures competitiveness

**C**reates a desire to be the best

**H**olds the organization together while striving for excellence

**M**easures critical areas

**A**nalyzes critical areas against the best
Reinforces continuous improvement

Keeps everyone moving toward excellence

**Process - Systemize Process Analysis**

Process Analysis is a tool used to improve a process by eliminating non-value added activities, waits, and/or simplifying the process. The focus of process analysis is on specific defined outcomes. These desired results usually aim at time and/or cost reduction. Process analysis is extremely useful for getting the output of the process to the customer as quickly as possible at the lowest possible cost. The major goals of process analysis are elimination or reduction of high costs, non-value-added processes, activities, and tasks and the waits between processes.

High cost areas are usually a primary area of focus. This is accomplished by adding cost figures to the process diagram to determine processes of excessive cost. Then the team does a complete process analysis on each of the high cost areas.

In addition to high cost areas, many organizations lose money performing non-value added processes. These non-value added processes are another target for process analysis. The value and non-value of a particular process, activity, or task is a judgment based on facts within a specific environment. Each process, activity, and task deserves a thorough analysis to determine its value. The customer-driven team conducts the process analysis with inputs from all people affected by the process under review. As part of the process analysis, the customer-driven team conducts a risk assessment to reduce the probability of eliminating an essential task. Processes, activities, and tasks are not eliminated without the concurrence of the process owner and consensus of everyone affected by the process improvement.

Once non-value added tasks are evaluated for possible savings, the team can focus on reducing or eliminating waits. Many hours are wasted between the performances of processes. This down time affects the organization's ability to rapidly respond to customers. Rapid response time is a major differentiator in today's economic times. By concentrating on improving the waits between processes, the team can make a considerable impact on its cycle time.

During process analysis, the first challenges are the following:

- Excessive costs
- Inordinate waits
- Bureaucratic procedures
- Duplicate efforts
- Inspection or oversight operations
- Layers of approval
Once the above is examined, process simplification becomes the next step. This step involves probing the high cost and high time processes for simple, innovative, and creative improvements for accomplishing the process. Can the process be combined with another activity? Can the process be done less frequently? Can the process be automated? Can the process be done another way? These initial actions achieve quick results at little or no cost. This level of process analysis aims at process improvement to achieve increased financial performance, improved operating procedures, and greater customer satisfaction.

During this step, the team challenges the following:

- Complexity
- Unnecessary loops
- Frequency
- Methodology

**Process Analysis Considerations**

**Simplify**

**Modify**

**Accelerate**

**Remove**

**Trade-off**

**Eliminate**

**Reengineer, redesign, or reorganize**

**Process - Stress Data Analysis**

Data statistical analysis is an essential element of any continuous improvement endeavor. Managing for Victory uses quantitative methods to continuously improve all the processes in the organization aimed at total customer satisfaction. This involves the monitoring, analyzing, correcting, and improving processes using rational decision-making based on facts. Statistics are one method to establish factual data. Statistics are used for many purposes in a continuous improvement environment including problem solving, process measurement, and pass/fail decisions. Statistics are useful in step one of the improvement methodology to define quality issues. Statistics help quantify total customer satisfaction. In understanding and defining the process, statistics provide factual data on process performance. In analyzing the improvement opportunity, statistics aid in the verification of underlying or root causes,
determining the vital few, evaluating variation, and establishing correlation. In taking action, statistics provide data for robust design and capable processes. In step checking and monitoring results, statistics furnish a yardstick for decision-making.

In problem solving, statistics help in understanding the problem, determining actual performance, focusing on the vital few problems, and verifying the root or underlying causes. In process measurement, statistics assist in determining the performance and the causes of variation in a process. Once the process performance is known, process improvement goals can be determined. In addition, variations in the process can be analyzed to determine the cause -- common or special. Next, the corrective can be aimed at doing nothing, either eliminating or reducing as much as possible the variation in the process, or improving the process. The first option should always be considered when discovering a chance variation of a process. This option is often overlooked resulting in the correction of a chance variation in a process, which only increases the variation. Second, eliminate special causes. Third, reduce common causes. Finally, you target continuous process improvement. In pass/fail decisions, statistics can provide the criteria for the decision.

Data statistical analysis includes tools for collecting, sorting, charting, and analyzing data to make decisions. A chart can make the process easier to understand by arranging the data so that comparisons can be made to focus on the right problems. Sorting and resorting the data can help the team focus on the most important problems and causes. Targeting smaller and smaller samples or categories funnels the data to the underlying causes. Even small improvements on the right problems can yield significant benefits. Stress data analysis considerations include:

Seek factual data
Treat statistics as factual
Allow use of statistics everywhere in the organization
Temper conclusions with common sense
Identify tools for collecting, sorting, charting, and analyzing data
Sort and resort data to focus
Target smaller and smaller samples to funnel data
Interpret data to find root causes
Chart data when appropriate
Seek alternatives and solutions using data
Excel - Establish Improvement Methodology

Improvement methodology provides the “how.”

Continuous improvement requires a disciplined approach using a proven improvement methodology. The discipline to use an improvement methodology is absolutely necessary for any high performance organization.

The improvement methodology system must accomplish three objectives. First, the system must bring processes under control. Second, the system must keep processes under control and make them capable. And lastly, the system must continuously improve the processes aimed toward the best target value. This involves continuously eliminating waste, simplifying processes, and solving process problems. It is a never-ending cycle.

The same improvement methodology must be used organization-wide. Therefore, it is important to establish a basic improvement methodology. Everyone can then be trained on the use of the basic improvement methodology. It is simpler to use the same improvement methodology consistently throughout the organization. The methodology can be modified as needed for each specific application. In addition with experience, certain steps can be omitted when appropriate. Finally, it is critical to document the process and results. Establish improvement methodology considerations include:

- **M**ake improvement methodology organization-wide
- **E**stablish a basic improvement methodology
- **T**rain everyone on use of improvement methodology
- **H**ave the same methodology for process improvement and problem-solving
- **O**mit steps only when appropriate
- **D**ocument the process

**Method - Make Improvement Methodology Organization-Wide**

Continuous improvement starts at the top organizational level using the continuous improvement cycle as shown in this chapter. This is the overall cycle for continuous improvement. This cycle is used mainly for strategic improvement...
activities. Within the continuous improvement cycle, an organization-wide improvement methodology must be used for tactical improvement activities such as process improvement and problem solving. This fosters preventive action and corrective action in every part of the organization. In addition, an organization-wide improvement methodology assists in the creation and maintenance of a systematic, integrated, consistent, organization-wide perspective.

**Method - Establish a Basic Improvement Methodology**

There are many different improvement methodologies being used by various organizations. Some organizations use statistical process control, others use quality function deployment, and still others focus entirely on process analysis. Again, the organization-wide improvement methodology must be geared to the specific organization. The improvement methodology used in this book was selected because it is commonly understood by a wide variety of people, it is simple to use for any organization, and it is proven to work.

The basic improvement methodology is outlined below. Steps 1 through 7 are basic methodology and they can be continuously repeated. This basic improvement methodology includes the following steps:

1. **I**dentify the opportunity
2. **M**easure an opportunity for improvement
3. **P**robe the selected opportunity
4. **R**equire improvement
5. **O**perate the new way
6. **V**erify results
7. **E**ncourage continuous improvement

**Method - Train Everyone on Use of Improvement Methodology**

Everyone needs to be trained on the improvement methodology. The training should start with the top-level and progress throughout the organization using a cascading approach. Each level in the organization should understand and use the improvement methodology effectively before training the next level. Each level in turn trains the next level.
Method - Have Same Methodology for Process Improvement and Problem Solving

It is simpler to use the same improvement methodology for process improvement and problem solving. People do not have to learn two different methodologies for preventive action and corrective action. The basic improvement methodology has minor modification for each specific application.

The basic improvement methodology modified for process improvement and problem solving is shown in table below.

<table>
<thead>
<tr>
<th>Process Improvement</th>
<th>Problem Solving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the process</td>
<td>Identify the problem</td>
</tr>
<tr>
<td>Measure critical process</td>
<td>Measure the underlying cause of the problem</td>
</tr>
<tr>
<td>Probe critical process</td>
<td>Probe the problem</td>
</tr>
<tr>
<td>Require improvement</td>
<td>Require solution</td>
</tr>
<tr>
<td>Operate new process</td>
<td>Operate new way</td>
</tr>
<tr>
<td>Verify results</td>
<td>Verify results</td>
</tr>
<tr>
<td>Encourage continuous improvement</td>
<td>Encourage continuous improvement</td>
</tr>
</tbody>
</table>

The basic improvement methodology for process improvement is shown in Figure 11.

The following is a step-by-step detailed outline for using the improvement methodology for process improvement.

**Step 1 – Identify the process.** During this first step, focus all efforts on understanding the process's specific contributions to total customer satisfaction. Specifically, to fully understand the process you should do the following:

- Define the overall process.
- Diagram the top-level and top-down process.
- List the customer needs and expectations from the process.
- Determine if the process is meeting the customer's expectations.
- Discover who owns and influences the process.
- Determine all the inputs and outputs to the process.
- Understand the relationship between inputs and outputs.
- List the suppliers of the inputs.
- Determine if the suppliers are meeting the requirements.
- Specify the customer(s) of the process.
Figure 11  Basic improvement methodology.
Step 2 – Measure a critical process for improvement. Measure a critical process for improvement based on the information collected in the identification stage. A critical process usually is a process that is not meeting the expectations of the customer. To measure the process for improvement, do the following:

- Determine how to measure or use metrics for the process.
- Measure the process to determine how it is performing.
- Understand the value of the process to the product or service.
- Benchmark the process.

Step 3 - Probe the selected critical process. This requires a thorough use of analytical tools to focus on process variation or underlying causes of process problems. When analyzing the selected process part, do the following:

- List the problems with the process as it exists.
- Determine if the whole process can be eliminated.
- List the detailed steps in the process.
- Diagram the process.
- Look for ways to eliminate non-value-added steps or simplify the process.
- Eliminate or reduce wait times.
- Remove any unnecessary loops.
- Decrease any complexity.
- Analyze frequency changes.
- Eliminate or reduce any waste.
- Look for other ways it can be done.
- Find any problem areas.
- Determine underlying cause.
- Ask five whys.
- Define measurements.
- Find or collect data.
- Complete data gathering.
- Organize data.
- Define the expected outcomes (goals).
- Determine if the process is meeting the outcomes (goals).
- Analyze the forces at work in the situation.
- Determine restraining forces.
- Specify driving forces.

Step 4 – Require improvement. During this step the use of creativity, innovation, and imagination is encouraged to explore as many alternatives as possible. This could include: improving the current process, reengineering the process, or inventing a new process. When generating improvement alternatives, do the following:

- Define alternatives that can be used to reach the goal.
- Determine all the forces at play with each alternative.
• Select an improvement most likely to attain your desired outcome. Specifically, do the following:
  • Specify selection criteria.
  • Define the selection method.
  • Determine how the decision will be made.
  • Make the decision.
  • Complete a test or pilot, if feasible.

Plan the implementation using an implementation plan. Further, a presentation may be needed to gain approval for implementation of the improvement. During this step, do the following:

• Determine how the improvement will be implemented.
• Prepare an implementation plan.
• Gain support.
• Stress benefits.
• Determine if a presentation is required.
• Prepare the presentation.
• Request action in the presentation.
• Overcome objections during the presentation.
• Follow up on actions after the presentation.

**Step 5 – Operate new process.** This involves institutionalizing the improvement by installing a feedback system, developing procedures, and/or providing training. Specifically, do the following:

• Install a continuous feedback system.
• Develop, document, and implement procedures.
• Provide training.

**Step 6 – Verify the results for the desired outcome.** At this step, a continuous check of results is needed to ensure that the process stays under control. If the process is not meeting desired outcomes, return to the understand, analysis or select alternatives steps. Repeat all of the steps, 1 through 6, as many times as necessary to achieve the overall goals. During this step, do the following:

• Measure the performance against the expected outcomes (goals).
• Determine if you're meeting those outcomes (goals).
• Continue to keep the process under control.

**Step 7 – Encourage continuous improvement**

During this step, the organization pursues the never-ending focus on perfection. During this step, improve continuously using steps 1 to 7.

**Method - Omit steps only when appropriate**

The improvement methodology is designed to provide systematic improvement. Therefore, steps should not be omitted. However, there may be cases where an improvement would have a significant impact on an organization, it might be
appropriate to implement the improvement on a test or pilot basis. In these cases, the organization may add a plan, do, check and act cycle to test or pilot an alternative to determine if the alternative will provide desired outcomes without going through all the steps to institutionalize the improvement. Steps are as follows:

- Plan the improvement on a test or pilot basis
- Do the improvement on a test or pilot basis
- Check the results of the test or pilot to desired outcome
- Act to make the improvement permanent

**Method - Document the Improvement Process and Results**

The improvement process must be documented for communication with team members and others in the organization. The documentation of each stage in the process provides future reference. The team should maintain a master copy of all documentation. It can save others time and it can be used as lessons learned. In addition, results of the improvement process are documented for success stories.

The process plan provides documentation of process for everyday operations. In addition, a process improvement report gives details of a specific process improvement activity. The process improvement report contains the following:

- Background Information
- Current Performance
- Focus of Improvement
- Team Leader
- Team Members
- Owner
- Facilitator
- Process Improvement Methodology with outline of specific activities
- Process Improvement Action(s)
- Improved Performance
- Future Opportunities for Improvement

In addition to the above documentation of process improvement activities, the organization needs to maintain a record of all process improvement projects. As a minimum, the record contains the following:

- Process Improvement Number
- Date Started
- Process
- Owner
- Description of Goal, Issue or Problem
- Action
- Result
Improvement tools help all people in the organization contribute to continuous improvement efforts. Besides selecting an improvement methodology, the selection of improvement tools is critical to making significant long-term improvements.

There are hundreds of tool and techniques for innovation and improvement. Some of the major tools and techniques are shown in figure 12. From the list of tools, the organization needs to select both general tools for the entire organization and specialized tools for specific areas.

There are some guidelines for selecting tools. For general tools to be used throughout the organization, it is advisable to keep it simple at first. You can add complex tools as the organization achieves success. In addition, select tools that are familiar to the organization. For instance, statistical process control (SPC) tools may be familiar in the manufacturing area or quality function deployment (QFD) in design engineering. It is popular to move these tools throughout the organization. However, the organization needs to consider the total organization. For some organizations, this may be appropriate. For other organizations, it may be too complex, overwhelming or difficult to transfer to the other parts of the organization.

It is especially vital in the early stages of continuous improvement to get real results. Almost any tool will provide some results. The organization can pick the low hanging fruit. It is essential to select tools that can sustain continuous improvement. The tools need to build confidence, stimulate participation, encourage involvement, and foster commitment.

When considering improvement tools for learning, the organization must decide the basic improvement tools for everyone. They must understand how the tools are used within the improvement methodology. Also, a support system must be operational. Once the organization has confidence in use of basic improvement methodology and tools, the organization can launch new tools for general use and specify specialized tools. Learn improvement tools considerations include:
Train everyone on basic improvement tools
Outline use of basic tools in improvement methodology
Organize support system
Launch new tools as appropriate
Specify specialized tools

Figure 12 Tools.
Tools - Train Everyone on Basic Process Improvement Tools

Everyone in the organization requires a basic working knowledge of the overall VICTORY system, working in teams, and the improvement process. The table below outlines 20 basic tools for continuous improvement. Ten tools focus on general improvement and ten tools target process improvement.

<table>
<thead>
<tr>
<th>Ten Basic Tools</th>
<th>Ten Basic Process Improvement Tools</th>
</tr>
</thead>
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<td>Managing for Victory System</td>
<td>Benchmarking</td>
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<tr>
<td>Dealing with Change</td>
<td>Process Diagrams</td>
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<td>Focus Setting</td>
<td>Input/Output Analysis</td>
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<td>Teamwork</td>
<td>Customer/Supplier Analysis</td>
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<tr>
<td>Effective Meetings</td>
<td>Brainstorming</td>
</tr>
<tr>
<td>Communicating for Results</td>
<td>Selection Techniques</td>
</tr>
<tr>
<td>Improvement Methodology</td>
<td>Process Analysis</td>
</tr>
<tr>
<td>Decision Making</td>
<td>Cause and Effect Analysis</td>
</tr>
<tr>
<td>Metrics and Measures</td>
<td>Data Statistical Analysis</td>
</tr>
<tr>
<td>Presentation</td>
<td>Force Field Analysis</td>
</tr>
</tbody>
</table>

Ten basic process improvement tools

Ten tools for process improvement are outlined below:

**Benchmarking** is a method of measuring your organization against those of recognized leaders. There are four methods of benchmarking: internal, competitive, functional, and generic. In each case, the type of benchmarking selected depends on the measures needed and the methods used to collect the data. The four types of benchmarking are described below:

1. *Internal benchmarking* looks inside the organization for similar processes and units that seem to do it better.

2. *Competitive benchmarking* looks at competitors and examines their processes. This type of benchmarking seeks other institutions that are performing better than the customer-driven project management organization. When these processes are found, the competitors’
performance is compared to the customer-driven project management organization.

3. *Functional benchmarking* looks at any outside or inside activity that is functionally exact to the process under review.

4. *Generic benchmarking* looks at any outside or inside activity that is generically the same as the one under review.

**Process Diagrams** are tools for defining the process. There are three types of process diagrams:

1. Top-level process diagram provides a picture of the entire process.
2. Top-down process diagram is a chart of the major steps and sub-steps in the process. By examining the major steps, the opportunities for improvement are focused on the essential steps in the process.
3. Detailed process diagram is a flowchart consisting of symbols and words that completely describe a process. This type of diagram provides information indicating improvement opportunities, identifying areas for data analysis, determining which elements impact process performance, and documenting and standardizing the process. It is helpful in identifying non-value-added tasks and areas for simplification. Further, complex activities and unnecessary loops are visualized. This type of process diagram is useful for training, documentation, and explaining the process to others.

**Metrics** are meaningful measures that target continuous improvement focusing on customer satisfaction. They are measurements made over time that communicate vital information about the quality of a process, activity, or resource. Metrics reflect meaningful measures that target continuous improvement actions. Metrics are differentiated from plain measurement by its specific focus on total customer satisfaction while supporting the organization.

**Input/Output Analysis** is a technique for identifying interdependency problems. This identification is accomplished first defining the process and second listing inputs and outputs. Once the inputs and outputs are determined, the relationship of inputs to outputs is analyzed along with the roles of the organization.

1. The input analysis lists all the inputs of the process. These inputs are based on the requirements of the process. Once the inputs are known, the prime owner and support responsibilities for each of the inputs are defined. This thorough analysis of all the inputs is used to match with outputs.
2. The output analysis lists all the outputs of the process. Again, the prime owner and support responsibilities are understood. This is accomplished by communicating with supplier(s), owner, and customer(s). The team needs to especially listen to the customer.

Supplier/Customer Analysis is a technique that involves your suppliers in the development of your requirements and their conformance to them. In addition, it provides insight into your customer's needs and expectations and meeting those expectations. Use surveys and interviews to ensure a mutual agreement on supplier requirements and customer expectations. The Supplier/Customer Analysis worksheet can be used to document results. It is important to communicate, listen, and thoroughly analyze supplier and customer perceptions to continuously improve supplier performance, the process, and customer satisfaction.

The supplier analysis consists of answering the following questions:

- Did you survey the supplier(s) to ensure requirements are known?
- Is there a mutual understanding of requirements?
- Have you established a partnership with key suppliers?
- What are the suppliers' perceptions of your requirements?
- Did you listen to the supplier's concerns?
- Did the supplier listen to your concerns?
- Were interviews conducted to determine supplier perceptions?
- Were customer expectations translated into supplier requirements?
- Is your supplier satisfying your requirements?

Customer analysis seeks to answer the following questions:

- Are you communicating to ensure that you are satisfying your customer(s)?
- Do you understand your customer's needs and expectations?
- Have you conducted a survey to determine if you are satisfying your customer(s)?
- Has a thorough analysis been completed to ensure the entire process is focused on customer's needs and expectations?
- Does the owner understand process impacts on the customer(s)?
- Are process outputs measured in relation to customer expectations?
- Are you satisfying mutually agreed upon customer expectations?
- Have you developed a relationship with key customer(s)?

Brainstorming is a technique used by a group of people that encourages their collective thinking power to create ideas. The purpose of brainstorming is to stimulate the generation of ideas. It adds to the creative power of the team. The value of brainstorming lies in the fact that there may be more than one way to look at a problem or handle it. Through brainstorming, not only are individual
ideas or thoughts brought out, but they may also spark new ideas or thoughts from others, or improve on an idea already under consideration. The more ideas a team has, the greater the probability of finding an opportunity and/or solution. There are three primary brainstorming methods:

1. Round robin is where each group member in turn contributes an idea as it relates to the purpose of the discussion. Every idea is recorded on a flip chart or board. When a group member has nothing to contribute, he or she simply can say "pass." The next time around, this person may offer an idea if they wish or pass again. Ideas are solicited until no one has anything to add.

2. Freewheeling is where each team member calls out ideas freely and in a random order. Every idea is recorded on a flip chart or board. The process continues until no one has anything else to add.

3. Slip is where each team member writes all his or her ideas on an issue, a problem, or an alternative on a piece of paper. He/she writes as many ideas as possible. Then the slips are collected and all the ideas are written on the board. A variation to this method is the Crawford Slip method where each idea is written on a separate slip of paper. The slips are then put on a board and arranged in categories.

*Selection tools and techniques* are used several times during the improvement methodology to help clarify assumptions and focus on consensus when selecting an improvement opportunity or improvement. The selection tools and techniques are voting, selection matrix, and selection grid. The following is a brief description of each tool:

1. Voting is a technique to determine majority opinion.

2. A selection matrix is a tool for rating problems, opportunities, or alternatives based on specific criteria.

3. A selection grid is a tool for comparing each problem, opportunity, or alternative against all others.

*Process Analysis* is a tool used to improve a process by eliminating non-value-added activities, waits, and/or simplifying the process. The focus of process analysis is on specific defined outcomes. These desired results usually aim at time and/or cost reduction. Process analysis is extremely useful for getting the output of the process to the customer as quick as possible at the lowest possible cost. The major goals of process analysis are elimination or reduction of high costs, non-value-added processes, activities, and tasks and the waits between processes. During process analysis, the team first challenges the following:

- Excessive costs
- Inordinate waits
• Bureaucratic procedures
• Duplicate efforts
• Inspection or overseer operations
• Layers of approval

Once the above is examined, process simplification becomes the next step. This step involves probing the high cost and high time processes for simple, innovative, and creative improvements for accomplishing the process. Can the process be combined with another activity? Can the process be done less frequently? Can the process be automated to be accomplished quicker? Can the process be done another way? These initial actions achieve quick results at little or no cost. This level of process analysis aims at process improvement to achieve increased financial performance, improved operating procedures, and greater customer satisfaction.

During this step, the team challenges the following:

• Complexity
• Unnecessary loops
• Frequency
• Methodology

Other forms of process analysis include work-flow analysis and five whys.

1. A work-flow analysis looks at a picture of how the work actually flows through an organization or facility. Like process analysis focusing on eliminating and simplifying the process, the workflow analysis targets inefficiencies in the work motion. The workflow analysis aims for the identification and elimination of unnecessary steps and the reduction of burdensome activities.

2. The five ways is a powerful tool to find the “root” cause quickly. It consists of repeating the question “why” until the underlying cause or causes are discovered. There is no magic with five whys. In reality, it could take less or more “whys.” This helps focus on the process instead of the person by asking “why” instead of “who.” In the majority of cases, the cause is the process. The cause is a person only a small percentage of time.

*Cause and effect analysis* is a technique for helping a group examine underlying causes. The cause and effect diagram is a graphic representation of the relationships among a list of issues, problems, and opportunities. It is a useful tool in association with brainstorming because it takes brainstorming to find the core issues or root causes. Application of this technique usually results in a more specific definition of the problem to the underlying cause. It has the added benefit of being very graphic. This helps members see patterns and relationships among potential causes. It lets individual members express their interpretation of the nature of the problem. Frequently, it stimulates further brainstorming and
clarification of the problem leading to establishing priorities and taking corrective action.

**Data statistical analysis** includes all the tools for collecting, sorting, charting, and analyzing data. Data statistical analysis is an essential element of any continuous improvement endeavor. Quantitative methods are necessary to continuously improve all the processes in the organization aimed at total customer satisfaction. This involves the monitoring, analyzing, correcting, and improving processes using rational decision-making based on facts. Statistics are one method to establish factual data. Statistics are used for many purposes in a continuous improvement environment including problem solving, process measurement, and pass/fail decisions. Statistics are useful in step 1 of the improvement methodology to define quality issues. Statistics help quantify total customer satisfaction. In understanding and defining the process, statistics provide factual data on process performance. In analyzing the improvement opportunity, statistics aid in the verification of underlying or root causes, determining the vital few, evaluating variation, and establishing correlation. In taking action, statistics provide data for robust design and capable processes. In step checking and monitoring results, statistics furnish a yardstick for decision-making. Data Analysis includes:

1. Data Collecting
2. Data Sorting
3. Data Charting
4. Data Analysis

**Data collection**

Data collection is the first step in data statistical analysis. It starts with determining what data is needed. Sometimes the data required is already available. In these cases, all that is required to do is sort, chart, and analyze it. However, in many cases, the specific data required for data statistical analysis is not available. If this is the case, the team needs to determine what data to collect, where to collect the data, and how to collect it.
Data collection plan

Data collection requires a plan. The data collection plan establishes the purpose, strategy, and tactics to get the data for data statistical analysis. The data collection plan answers the following questions:

- Why does the team need to collect the data?
- What data is needed?
- What process provides the data?
- Where in the process the data is available?
- Is the data already being collected?
- If the data is not already collected, how will the data be collected?
- Who will collect the data?
- How long will the data be collected?
- What data collection method will be used?
- What sampling method is needed?
- Who will chart the data?
- How will the data be reported/presented?
- Is a pilot or test necessary?
- How will the pilot or test be conducted?
- Who will participate in the pilot or test?
- Is the data timely, accurate, and consistent?

Data collection methods

Data must be collected to measure and analyze a process. There are many methods for data collection. The data collection method must accomplish the purpose of as stated by the customer-driven team in the data collection plan. Data collection methods include the following:

- Observation
- Questionnaire
- Interview
- Tests
- Work samples
- Checksheets

Observation is looking at actual performance or data. This could include reviewing documentation. This type of data collection is useful when wanting to distinguish between perceived and actual outcomes or behaviors.
A questionnaire or survey requests in writing some particular information. A questionnaire is most useful when needing to get information from a large number of people in a short time, or when the people with the information are geographically distant. Questionnaires have some disadvantages as respondents may misinterpret the questions, the returns could be low, and there is no opportunity to probe deeper into responses.

An interview involves personally communicating with the people who have the information. Interviewing is used to collect information needed to improve processes, solve problems, and to involve those outside the group in generating and implementing potential solutions. Interviewing is also useful when evaluating implemented solutions. Interviewing is essential for supplier and customer analysis. The disadvantage to an interview is that many times the outcomes depend on the skill of the interviewer. In addition, respondents may be hesitant to discuss personal, sensitive, or confidential information. In these cases, provisions must be made for guaranteed anonymity and confidentiality.

Tests measure outcomes. A test is useful when you need to measure specific results. Tests can be of people or items. A test can measure a person's knowledge on a subject. A test can also be used to determine if an assembly operates properly.

Work samples involve checking or inspecting specific work outputs or work-in-process. Work samples are most useful analyzing actual work performance.

Checksheets verify accomplishment of procedures. Checksheets are useful for qualifying or certifying performance exactly as specified. A checksheet simplifies data collection.

**Data collection sampling**

When collecting data for analysis, it is often impractical to check 100% of the items. This would be the entire population of the data. A sample of the whole population may be all that is required. By taking a sample, reliable information can still be collected. A sampling table can help you determine an appropriate sample size. These tables are usually available from the industrial engineering, quality, or management services personnel in an organization. To reduce the chance for biased results, use a random or systematic method to select samples. A random sample allows each item an equal chance of being selected. A systematic
sample selects every fifth, tenth, or twentieth item. This reduces the chance for biased results.

The central limit theorem

The central limit theorem states: the mean (average) of the sampling distribution will equal the population mean (average), regardless of sample size and as the sample size increases the sampling distribution of the mean will approach normal, regardless of the shape of the population. The central limit theorem allows the use of sample statistics to make judgments about the population of the statistic.

The central limit theorem is an important concept in statistics since it is often impractical or impossible to check the entire population.

Types of data

The two types of data are variable data and attribute data. Variable data is data that can be measured. Variable data measures characteristics having a range of values, i.e., quality characteristics like thickness, width, and temperature, force, wear, strength, sensitivity. Variable data is characterized as: nominal best, smaller best, and larger best. Attribute data is data that can be counted or classified. Attribute data is associated with characteristics as pass/fail, have/have not, go/no go, grade (A/B/C), and accept/reject.

Data Shorting

Once the data is collected from the population or sample, it needs to be arranged in a meaningful way. The arrangement allows observation of such things as the highest and lowest values (range), trends, central tendencies, patterns, the values appearing most often, special causes, common causes, etc. The arrangement of data helps to determine the measures of central tendency and the frequency distribution.

Data charting

Once sorted, data must be put on a chart. Charts are pictures of the data that highlight important trends and significant relationships. Charts present the data in a form that can be quickly and easily understood. Charts serve as a powerful communication tool and they should be employed liberally to describe
performance, support analysis, gain approval and support, and document the improvement process.

There are many different types of charts or graphs available and useful in the improvement process. Some of the most common are the bar chart, pie chart, simple line chart (time plots or trend chart), histogram and scatter chart. In addition, Pareto charts, control charts, and process capability charts are helpful for many specific improvement activities. Some of these types of charts are shown in Figure 13.

Analyzing The Data

Once the data has been collected, sorted, and put on charts, the data is analyzed to identify significant findings.

- Ask specific problem identification questions with "what," "when," "where," "who," "how much," "what are the causes," and "what's the impact?"
- Identify underlying causes
- Clarify expected outcome

Pareto analysis is another specific type of process analysis. In the late 1800s, Vilfredo Pareto, an Italian economist, found that typically 80 percent of the wealth of a region was concentrated in less than 20 of the population. In recent times, Joseph Juran formulated what he called the Pareto principle of problems: only a vital few elements (20 percent) account for the major of problems. The Pareto principle states that a large percentage of the results are caused by a small percentage of the causes. This is sometimes referred to as the 80/20 rule.

Force field analysis is a technique that helps a group describe the forces at work in a given situation. The underlying assumption is that every situation results from a balance of forces; restraining forces and driving forces. Restraining forces are those things that keep the situation from improving. Driving forces are those things that are pushing toward the achievement of the goal. Force field analysis forces the team to examine strengths, as well as problems. Sometimes by building on a driving force or strength, a team can bring about the needed improvement.
Figure 13. Charts.
Tools - Outline Use of Basic Tools in Improvement Methodology

Equally important to learning improvement tools is using the proven tools and techniques within the selected improvement methodology for process improvement and problem-solving. This section provides some areas where specific tools and techniques may be effective within the improvement methodology for process improvement. Each organization and individual is encouraged to use the tools and techniques in any way appropriate to their specific applications. Further, the tools and techniques can be tailored to your specific application. If it works, use it.

The following is a proven recommendation for use of tools and techniques during specific steps in the process improvement methodology.

The following tools and techniques are useful when understanding the process:

- Focus (mission) setting
- Process diagrams
- Input/output analysis
- Supplier/customer analysis
- Benchmarking
- Metrics
- Brainstorming

The following selection tools and techniques help clarify assumptions and focus on consensus when selecting a part of the process for improvement:

- Voting
- Selection matrix
- Selection grid
- Consensus decision making

The following tools and techniques are useful when analyzing the selected process part:

- Process diagrams
- Process analysis
- Cause and effect analysis
- Five whys
- Force field analysis
- Focus (goal) setting
- Data statistical analysis

Use one of the following tools and techniques when generating alternatives:

- Brainstorming
- Force field analysis
The following selection of tools and techniques help clarify assumptions and focus on consensus when selecting an alternative:

- Voting
- Selection matrix
- Selection grid
- Consensus decision-making

The following tools and techniques assist with planning and gaining approval for the selected improvement:

- Force field analysis
- Presentation

When instituting the selected improvement, install a continuous feedback system, develop document and implement procedures, and provide training to implement the selected improvement. Project management tools are useful at this step.

The following tools and techniques help check the results for the desired outcome:

- Data/statistical analysis
- Supplier/customer analysis
- Metrics

### Tools - Organize Support System for Use of Tools

Just like a support system is required for teams, a support system is required for use of tools. These support systems must be integrated together and within the organization for effectiveness and efficiency. A support system can have many elements as necessary. As a minimum, the support system for tools and techniques needs to consist of facilitators and trainers. This is one area where outside assistance will help. The training for the inside champions, facilitators and trainers can be provided by an outside expert. They can also provide guidance on selection and timing the launch of tools within the organization for optimum impact. The outside assistance is usually best during the early stages, while over the long-term developing internal competence is the optimum goal for the organization.

### Tools - Launch New Tools as Appropriate

The organization gains success with the use of basic improvement tools. Then the organization can launch new tools as appropriate to achieve organizational objectives. Some of the more advanced tools for consideration are shown in the table below. The first seven are usually referred to as the seven management and planning tools. Variability analysis and process capability analysis are more
advanced process analysis tools. Project management focuses on implementation of improvements in the organization.

<table>
<thead>
<tr>
<th>Ten Advanced Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interrelationship Diagram</td>
</tr>
<tr>
<td>Affinity Diagram</td>
</tr>
<tr>
<td>Tree Diagram</td>
</tr>
<tr>
<td>Matrix Diagram</td>
</tr>
<tr>
<td>Process Decision Program Chart</td>
</tr>
<tr>
<td>Prioritization Matrices</td>
</tr>
<tr>
<td>Activity Network Diagram</td>
</tr>
<tr>
<td>Variability Analysis</td>
</tr>
<tr>
<td>Process Capability Analysis</td>
</tr>
<tr>
<td>Project Management</td>
</tr>
</tbody>
</table>

*Interrelationship Diagram* takes a central idea, issue or problem, and maps out the logical or sequential links among related items.

*Affinity Diagram* is a tool that gathers large amounts of information organizes it into groupings based on natural relationships between each item, and defines groups of items.

*Tree Diagram* systematically maps out in increasing detail the full range of paths and tasks that need to be accomplished in order to achieve a primary goal and every related subgoal.

*Matrix Diagram* organizes large numbers of pieces of information such as characteristics, functions, and tasks into sets of items to be compared.

*Process Decision Program Chart* is a method that maps out conceivable events and contingencies that can occur in any implementation plan.

*Prioritization Matrices* prioritize tasks, issues, characteristics, etc. based on known weighted criteria.
**Activity Network Diagram** plans the most appropriate schedule of any project, task, or subtask.

**Variability Analysis** examines deviations from target values using statistical process control. Through variability analysis processes can be monitored, controlled, and improved.

**Process Capability Analysis** provides an indication of the performance of a process. It involves measuring process performance in relation to being able to produce the process output within engineering specifications. This is accomplished using process capability indexes.

**Project Management** is the process of planning and controlling a project within defined cost, time and quality goals.

**Tools - Specify Additional Tools for Specific Improvements**

There are an unlimited number of specialized tools to invent, innovate and improve within specific areas of an organization. In recent years, many improvements are aided by technology. Tools can help run the business, manage customers, design products, manufacture products and create innovation and so on. In addition to the tools for specific improvement, there are also many systems for improvement such as: Total Quality Management, Six-Sigma, Kaizen, etc. These systems include their own selection of improvement tools. The following are some of the most common specialized tools with the focus on process and product improvement.

<table>
<thead>
<tr>
<th>Ten Specialized Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical Process Control</td>
</tr>
<tr>
<td>Quality Function Deployment (QFD)</td>
</tr>
<tr>
<td>Concurrent Engineering</td>
</tr>
<tr>
<td>Lean Production</td>
</tr>
<tr>
<td>Cost of Quality</td>
</tr>
<tr>
<td>Robust Design</td>
</tr>
<tr>
<td>Total Productive Maintenance</td>
</tr>
</tbody>
</table>
Statistical Process Control (SPC) is a statistical tool for monitoring and controlling a process. SPC monitors the variation in a process with the aim to produce the product at its best target values.

Quality Function Deployment (QFD) is a disciplined approach for transforming customer requirements, the voice of the customer, into product development requirements. QFD is a tool for making plans visible and then determining the impact of the plans. QFD involves all activities of everyone at all stages from development through production with a customer focus.

Concurrent Engineering (CE) is a philosophy and set of guiding principles where product design and process design are developed concurrently; i.e., with some product design and process development overlapping. This includes production and support planning. With sequential engineering, the engineering phases are accomplished one after the other. Concurrent engineering overlaps the engineering phases.

Lean Production is the systematic elimination of waste in an organization. Lean manufacturing is different than traditional manufacturing. Lean manufacturing advocates pull scheduling, production based on customer orders, short lead times, small continuous batch processing, total inspection at source by workers, layout by product flow, high ownership of work processes, and many inventory turns.

Cost of Quality is a system providing managers with cost details often hidden from them. Cost of quality includes both the cost of conformance and the cost of nonconformance to quality requirements. Cost of conformance consists of all the costs associated with maintaining acceptable quality. The cost of nonconformance or the "cost of poor quality" is the total cost incurred as a result of failure to achieve quality. Historically, organizations looked at all costs of quality. Today, many excellent organizations are concentrating strictly on the nonconformance costs. This highlights the waste, or losses, due to deviation from best target values. Once these costs are determined, they can be reduced or eliminated through application of the continuous improvement philosophy. Typically, the
cost of nonconformance includes items like:  inspection, warranty, litigation, scrap and rejects, rework, testing, re-testing, change orders, errors, lengthy cycle times, inventory, and customer complaints.

**Robust Design** means designing a product having minimal quality losses. There are several methodologies associated with robust design. The major ones are traditional design of experiments (DOE) and the Taguchi approach. Traditional design of experiments is an experimental tool used to establish both parametric relationships and a product/process model in the early (applied research) stages of the design process. The Taguchi approach focuses on quality optimization. The loss function is a key element of the Taguchi approach. The loss function examines the costs associated with any variation from the target value of a quality characteristic. Any variation from the target is a loss. At the target value, there is little or no less contribution to cost. The costs are higher the further away from the target. Costs get higher as values of the quality characteristic move from "best" to "better" to "poor" levels.

**Total Productive Maintenance** (TPM) is a system for involving the total organization in maintenance activities. TPM involves focusing specifically on equipment maintenance. TPM emphasizes involvement of everyone and everything, continuous improvement, training, optimum life cycle cost, prevention of defects, and quality design. This methodology is effective for improving all production maintenance activities.

**Just-In-Time** (JIT) is a philosophy and methodology for having the right material just in time to be used in an operation. JIT reduces inventory and allows immediate correction of defects. This methodology is used for reducing waste, decreasing costs, and preventing errors.

**Technology-Aided Enterprise, Customer-Management, Design, Manufacturing, etc.** allows technology to assist in many areas of the organization. For instance, there are Computer-Aided Design, Computer-Aided Engineering, and Computer-Aided Manufacturing (CAD/CAE/CAM) for assisting in the design, engineering, and manufacturing processes. CAD/CAE/CAM is used to improve systems and processes, enhance product and process design, reduce time, and eliminate losses. There are enterprise management systems that help run every aspect of a business. Customer Relationship Management (CRM) systems assist with the many facets of dealing with customers. There are many more too numerous to mention.
Theory of Inventive Problem Solving (TRIZ) is inventive problem-solving approach that there are universal principles of invention that are the basis for advances in technology, and that if these principles could be identified and codified, they could be taught to people to make the process of invention more predictable. For the last 50 years, patents have been examined, classified by level of inventiveness, and analysis to look for principles of innovation. The results have been applied to create and to improve products, services, and systems.
This book focuses on continuous improvement. This is the main cornerstone of an excellent organization. A disciplined, organization-wide system is critical for success. The continuous improvement cycle can be summarized as follows:

**C**larify the focus

**Y**earn to discover all improvement opportunities

**C**hoose improvement opportunity

**L**aunch improvements

**E**valuate results

**Process 1 Clarify the focus**

**Major Area for Improvement**

1. If you had a magic wand and you could change anything in your work or process, what would that be?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________
2. List the reasons you picked this opportunity. What caused you to realize there might be a problem, issue or opportunity for improvement?

________________________________________________________________________
________________________________________________________________________

3. From the reasons listed above, state in one sentence the “real” issue. This statement answers the question “What is happening that I know there is a problem?” It is important to stick to the facts of the situation without pointing to any particular person or solution. FOCUS ON THE PROBLEM; NOT A PERSON and DO NOT describe the problem as a specific solution. This limits your alternatives and it may not solve the “real” problem.

The process improvement statements should:

- Provide why the situation is undesirable from company or customers viewpoint
- Give specific facts
- Identify the gap between what should be and what is
- Not blame a person
- State the effect if not corrected on company operations or customer satisfaction

Improvement Statement
Process 2 **Y**earn to discover all improvement opportunities

4. List the possible issues, problems and improvement opportunities that impact the improvement statement.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Process 3 **C**hoose an improvement opportunity

5. Select the critical issue, problem or process from the above list. You should define the criteria for selection. As a minimum, the item selected must be something you can improve by yourself.

**Selection of Specific Improvement Item**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Process 4 Launch improvements

6. Identify the process by listing the possible processes that affect the specific improvement item.

________________________________________________________________________
________________________________________________________________________

7. Select the critical process from the list above.

Selection

________________________________________________________________________

8. Measure process. Process performance measure is

________________________________________________________________________

9. Probe the process. Perform some type of analysis to confirm current state of process.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
10. **Require improvement. Generate some alternatives to improve the process.** List the possible alternatives to improve the process.

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

11. **Select One Improvement Idea from the list.** Based on the following criteria and other criteria you determine, you select one idea for implementation that you can do or recommend to your manager/supervisor to do.

**CRITERIA**

1. Impact areas for improvement to help reach the goal (step 1 above)
2. Action has to be something you can do or recommend manager/supervisor can do.
3. Must have recommendation for solution within 30 days.

Improvement idea: _______________________________________________________

12. **What is the plan to implement your solution?** Determine what, who and when.

<table>
<thead>
<tr>
<th>What needs to be done</th>
<th>Who will do it</th>
<th>When to do it</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
13. Operate the new way by institutionalizing the improvement. You can install a feedback system, developing procedures, and/or providing training. Specifically, does my solution need any of the following actions?

- Install a continuous feedback system.
- Develop, document, and implement procedures.
- Provide training.

In order to ensure my solution is used in the organization, I need to perform the following actions:

**Institutionalize Actions**

14. Verify the results against the desired outcome. During this step, do the following:

- Measure the performance against the expected outcomes (goals).
- Determine if you're meeting those goals.
- Continue to keep the process under control.

14. Encourage continuous improvement of the process.

**Process 5 Evaluate results**

15. Review results of the improvement action impact on the improvement statement.
Continuous Improvement Tools

The following section contains a description, steps, example and template for the most popular tools for continuous improvement. Below is a table of recommendations for use of tools within the improvement methodology.

<table>
<thead>
<tr>
<th>Continuous Improvement Steps</th>
<th>Useful Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify Opportunity</td>
<td>Goal Setting</td>
</tr>
<tr>
<td></td>
<td>Benchmarking</td>
</tr>
<tr>
<td></td>
<td>Brainstorming</td>
</tr>
<tr>
<td></td>
<td>Input/Output Analysis</td>
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<tr>
<td></td>
<td>Customer/Supplier Analysis</td>
</tr>
<tr>
<td></td>
<td>Value Stream Mapping</td>
</tr>
<tr>
<td></td>
<td>Process Diagrams</td>
</tr>
<tr>
<td></td>
<td>Selection Techniques</td>
</tr>
<tr>
<td></td>
<td>Decision Making</td>
</tr>
<tr>
<td>2. Measure</td>
<td>Metrics</td>
</tr>
<tr>
<td></td>
<td>Measures</td>
</tr>
<tr>
<td>3. Probe</td>
<td>Brainstorming</td>
</tr>
<tr>
<td></td>
<td>Five Whys</td>
</tr>
<tr>
<td></td>
<td>Cause and Effect Analysis</td>
</tr>
<tr>
<td></td>
<td>Value Stream Mapping</td>
</tr>
<tr>
<td></td>
<td>Process Analysis</td>
</tr>
<tr>
<td></td>
<td>Data Analysis</td>
</tr>
<tr>
<td>4. Require Improvement</td>
<td>Brainstorming</td>
</tr>
<tr>
<td></td>
<td>Selection Techniques</td>
</tr>
<tr>
<td></td>
<td>Force Field Analysis</td>
</tr>
<tr>
<td></td>
<td>Decision Making</td>
</tr>
<tr>
<td>5. Operate</td>
<td>Data Analysis</td>
</tr>
<tr>
<td>6. Verify Results</td>
<td>Metrics</td>
</tr>
<tr>
<td></td>
<td>Measures</td>
</tr>
<tr>
<td></td>
<td>Goal Setting</td>
</tr>
<tr>
<td></td>
<td>Benchmarking</td>
</tr>
<tr>
<td>7. Encourage Continuous Improvement</td>
<td>ALL</td>
</tr>
</tbody>
</table>
Description: A goal is the specific desired outcome(s) of some activity. Goals are important to know exactly where you are going. Goals provide clear direction and focus. Where vision and mission define the long-term view—“where you want to go in the future”, goals establish the short-term look—“each step along the way.”

Goals also tell how you are doing. This is critical to staying on-track and making necessary adjustments. Goals help you monitor progress, evaluate situations, and make improvements.

- **G**ear to specific results—defined within parameters
- **O**bserve by measurement—be able to check outcome
- **A**ttain success—challenging, but realistic
- **L**imit to specific time—including time boundaries
- **S**et by process owner(s)—let people closest to the process set the goal

Steps:

1. Understand the purpose of the goal.
2. Brainstorm expected outcome(s).
3. Clarify ideas.
4. Agree on items to consider for goals.
5. Write an initial effective goal statement for each goal item.
6. Review each goal statement with additional background information.
7. Evaluate the goal statement(s).
8. Clarify the goal statement(s).
9. Get personal commitment to the goal(s).
10. Monitor the progress.
Examples of effective goals

Reduce manufacturing cycle time for assembly A from 6 hours to 2 hours within 1 month.

Decrease errors in quantity required block on order processing sheet from 10 per month to 0 per month in 3 months.

By the end of the year, the ABC Company will respond to all customer complaints with a solution satisfactory to the company and customer within 24 hours.
GOAL SETTING TEMPLATE

Gear to specific results—defined within parameters as:
_______________________________________________________________________

Observe by measurement—be able to check outcome by:
_______________________________________________________________________

Attain success—challenging, but realistic because:
_______________________________________________________________________

Limit to specific time—include time boundaries as complete by:
_______________________________________________________________________

Goal Statement: _______________________________________________________
_______________________________________________________________________

Is the goal geared to a specific result?

➢ Can you observe the attainment of the goal by measurement?

➢ Is the goal a challenge while within reach?

➢ Is the goal specified to be completed within a certain time period?

➢ Was the goal set by the person or people who can make it happen?
**BENCHMARKING**

**Description:** Benchmarking is a method of measuring your organization against those of recognized leaders.

There are four methods of benchmarking as follows.

**Internal benchmarking.** Internal benchmarking looks inside the organization for similar processes and units that seem to do it better.

**Competitive benchmarking.** Competitive benchmarking looks at competitors and examines their processes. This type of benchmarking seeks other institutions that are performing better than the organization. When these processes are found, the competitors’ performance is compared to the organization.

**Functional benchmarking.** Functional benchmarking looks at any outside or inside activity that is functionally exact to the process under review.

**Generic benchmarking.** Generic benchmarking looks at any outside or inside activity that is generically the same as the one under review.

**Steps**

1. Understand your organization
2. Select critical areas for benchmarking
3. Determine where to get benchmark information
4. Collect and analyze data
5. Select target benchmarks
6. Determine your performance
7. Set desired outcomes
8. Use improvement methodology to achieve desired performance
The following example is benchmark for an organizational development and training (OD&T) organization. The OD&T organization decides to benchmark all of the areas critical to customer satisfaction at this stage.

The OD&T critical areas of customer satisfaction include the following:

- **Personal** - Ability to adapt the deliverable to specific customer needs and expectations.
  *Measure*: Percentage of special request met.

- **Responsive** - Capability to meet the needs and expectations of customers.
  *Measure*: Percentage of total customer requests met.

- **Obtainable** - Ability to provide deliverable within customer's affordability.
  *Measure*: Percentage of customer's loss due to cost

- **Deliverable** - Provide deliverable when customer needs it.
  *Measure*: Percentage on time delivery

- **Useful** - Deliverable provides business results.
  *Measure*: Percentage of customers reporting business results within 30 days

- **Convenient** - Provide deliverable where the customer wants it.
  *Measure*: Percentage of requests for specific location met

- **Timely** - Ability to provide OD&T solution at the time needed by the customer.
  *Measure*: Percentage of times deliverable is just in time for customer's results

- **Satisfaction** - Ability to totally satisfy the customer.
  *Measure*: Number of customer complaints

OD&T evaluation rating on 5-point scale
Number of customers requesting refunds from money back guarantee
The following is a benchmarking chart sample with (top) major processes; (middle) critical areas; and (bottom) goals.

<table>
<thead>
<tr>
<th>Major Processes</th>
<th>Critical Areas for Success</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Requirement</td>
<td>Deliverables</td>
<td>Processes</td>
</tr>
<tr>
<td>- Personal</td>
<td>- OD</td>
<td>- Training</td>
</tr>
<tr>
<td>- Responsive</td>
<td>- Training</td>
<td>- OD</td>
</tr>
<tr>
<td>- Obtainable</td>
<td>- Interventions</td>
<td>- Administration</td>
</tr>
<tr>
<td>- Deliverable</td>
<td>- Consulting</td>
<td>- Finance</td>
</tr>
<tr>
<td>- Useful</td>
<td>- Coaching</td>
<td>- Scheduling</td>
</tr>
<tr>
<td>- Convenient</td>
<td>- Facilitating</td>
<td>- Information systems</td>
</tr>
<tr>
<td>- Timely</td>
<td>- Assessing</td>
<td>- Support</td>
</tr>
<tr>
<td>- Satisfaction</td>
<td>- Support services</td>
<td></td>
</tr>
</tbody>
</table>

### Critical Areas for Success

<table>
<thead>
<tr>
<th>Measures of Success</th>
<th>Current Performance</th>
<th>Benchmark Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal</td>
<td>% of special requests met</td>
<td>72%</td>
</tr>
<tr>
<td>Responsive</td>
<td>% of total customer requests met</td>
<td>76%</td>
</tr>
<tr>
<td>Obtainable</td>
<td>% of customers lost due to cost</td>
<td>25%</td>
</tr>
<tr>
<td>Deliverable</td>
<td>% on time delivery</td>
<td>85%</td>
</tr>
<tr>
<td>Useful</td>
<td>% of customers reporting business results</td>
<td>83%</td>
</tr>
<tr>
<td>Convenient</td>
<td>% of requests for special location met</td>
<td>82%</td>
</tr>
<tr>
<td>Timely</td>
<td>% of just in time deliveries</td>
<td>89%</td>
</tr>
<tr>
<td>Satisfaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of complaints</td>
<td></td>
<td>5 per month</td>
</tr>
<tr>
<td>Evaluation rating on 5 point scale</td>
<td></td>
<td>4.2</td>
</tr>
<tr>
<td>Number of customer refunds</td>
<td></td>
<td>10 per year</td>
</tr>
</tbody>
</table>

### Goals

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Personal</td>
<td>80%</td>
<td>90%</td>
<td>96%</td>
</tr>
<tr>
<td>Responsive</td>
<td>80%</td>
<td>90%</td>
<td>100%</td>
</tr>
<tr>
<td>Obtainable</td>
<td>20%</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Deliverable</td>
<td>90%</td>
<td>96%</td>
<td>100%</td>
</tr>
<tr>
<td>Useful</td>
<td>95%</td>
<td>95%</td>
<td>100%</td>
</tr>
<tr>
<td>Convenient</td>
<td>95%</td>
<td>98%</td>
<td>100%</td>
</tr>
<tr>
<td>Timely</td>
<td>95%</td>
<td>98%</td>
<td>100%</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>1 per month</td>
<td>8 per year</td>
<td>5 per year</td>
</tr>
<tr>
<td></td>
<td>4.6</td>
<td>4.9</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5 per year</td>
<td>1 per year</td>
<td>0</td>
</tr>
</tbody>
</table>
### MAJOR PROCESSES

<table>
<thead>
<tr>
<th>Process</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### CRITICAL AREAS OF SUCCESS

<table>
<thead>
<tr>
<th>Measures of Success</th>
<th>Current Performance</th>
<th>Benchmark Target</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### GOALS

<table>
<thead>
<tr>
<th>Area</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
BRAINSTORMING

Description: Brainstorming is a technique used by a group of people that encourages their collective thinking power to create ideas. Brainstorming stimulates the generation of ideas and it adds creative power. Brainstorming’s power lies in the fact that there may be more than one way to look at a problem or handle it. Through brainstorming, not only are individual ideas or thoughts brought out, but they also may spark new ideas or thoughts from others, or improve on an idea already under consideration. The more ideas available, the greater the probability of finding an opportunity and/or solution.

Steps:

1. Generate ideas using rules
2. Evaluate ideas
3. Decide using consensus

Methods: There are three primary brainstorming methods:

1. Round robin. Each group member in turn contributes an idea as it relates to the purpose of the discussion. Every idea is recorded on a flip chart or board. When a group member has nothing to contribute, he or she simply can say "pass." The next time around, this person may offer an idea if they wish, or pass again. Ideas are solicited until no one has anything to add.

2. Freewheeling. Each team member calls out ideas freely and in a random order. Every idea is recorded on a flip chart or board. The process continues until no one has anything else to add.

3. Slip. Each team member writes all his or her ideas on an issue, a problem, or an alternative on a piece of paper. He/she writes as many ideas as possible. Then the slips are collected and all the ideas are written on the board. A variation to this method is the Crawford Slip method where each idea is written on a separate slip of paper. The slips are then put on a board and arranged in categories.
The following is an example of ideas generated during a brainstorming session on “barriers to teamwork.”

BARRIERS TO TEAMWORK

1. Personality conflicts
2. Egos
3. Management styles
4. Language
5. Communication
6. Not listening
7. Shy person
8. Lack of motivation
9. Dominate person
10. Lack of interest
11. Lack of technical knowledge
12. Participation
13. Caste system
14. Not respecting other’s individuality
15. Closed mind
16. Location
17. No focus
BRAINSTORMING TEMPLATE

Decide on brainstorming method:

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Round Robin</th>
<th>Freewheeling</th>
<th>Slip</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difficult for one person to dominate the discussion.</td>
<td>Spontaneous and no restrictions.</td>
<td>All ideas are recorded and all</td>
</tr>
<tr>
<td></td>
<td>Everyone is given an opportunity to participate fully.</td>
<td>Many ideas in a short period of time.</td>
<td>contributions are anonymous.</td>
</tr>
<tr>
<td>Disadvantage</td>
<td>People feel frustration while waiting their turn.</td>
<td>Some individuals may dominate.</td>
<td>Some creativity may be lost due to</td>
</tr>
<tr>
<td></td>
<td>Ideas are not spontaneous.</td>
<td>Quiet team member may be reluctant to</td>
<td>the inability of the other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>speak.</td>
<td>team members to react to the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>contribution of others.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chaotic if too many people talk at</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>same time.</td>
</tr>
</tbody>
</table>

Generate Ideas: (Remember to follow brainstorming rules)

R e c o r d  a l l  i d e a s
U s e  f r e e w h e e l i n g  i d e a s
L i m i t  j u d g e m e n t  u n t i l  l a t e r
E n c o u r a g e  p a r t i c i p a t i o n  b y  e v e r y o n e
S o l i c i t  q u a n t i t y

Evaluate Ideas: (Examine each idea for value)

D e c i d e:
The selection is: ____________________________________________
NOMINAL GROUP TECHNIQUE

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

- Generate and prioritize a list of ideas.
- Make decisions using inputs from all participants.

Steps:

1. Generate ideas. Give an appropriate amount of time for silent brainstorming. Clarify and consolidate ideas.

2. Assign a letter to each idea. For example, for eight ideas, you would assign the letters A through H.

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

4. Prioritize the lists. Have each person prioritize their list by writing a number beside each letter. If there are eight ideas, then “8” is written beside the letter corresponding to the most important idea. This is repeated for each number until “1” is written beside the letter corresponding to the least important idea. Each number (1 through 8) is used only once by each group member.

5. Compute the group total for each letter. The letter with the highest score is the idea with the highest priority, and the letter with the lowest score has the lowest priority.
The following office problems were identified in a brainstorming session:

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

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

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>G</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>7</td>
<td>21</td>
<td>3</td>
</tr>
</tbody>
</table>

Item E is highest priority.
Item C is lowest priority.
NOMINAL GROUP TECHNIQUE TEMPLATE

1. Generate ideas. Give an appropriate amount of time for silent brainstorming. Clarify and consolidate ideas.

2. Assign a letter to each idea. For example, for eight ideas, you would assign the letters A through F.

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

4. Prioritize the lists. Have each person prioritize their list by writing a number beside each letter. If there are eight ideas, then “8” is written beside the letter corresponding to the most important idea. This is repeated for each number until “1” is written beside the letter corresponding to the least important idea. Each number (1 through 8) is used only once by each group member.

<table>
<thead>
<tr>
<th>IDEA</th>
<th>LETTER</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Highest Priority Is _____________________
Lowest Priority is _____________________
Description: Multivoting is a technique used to reduce a large list of issues, problems, opportunities, or alternatives to a smaller number of items. Multivoting is a quick and easy way for a group to find the items of the highest priority in a list. Multivoting is best suited for large groups and long lists. Its simplicity makes it very quick and easy to use. This technique helps you:

- Prioritize a large list without creating a “win-lose” situation in the group that generated the list.
- Separate the “vital few” items from the “trivial many” on a large list.

Steps:

1. Generate a list of items requiring a decision.
2. Combine similar items.
3. Number items.
4. Have each member select a number of items from the list. This is accomplished by each person writing the number of the items on separate paper. For instance, if the total number of items on the list is 50, they are numbered 1 to 50. Each person may then be asked to select the top 20 items from the list of 50.
5. Total the number of votes for each item.
6. Create a new list of items of the top twenty vote getters. Number the items 1 through 20.
7. Have each member select a lower number of items from the list. For instance, from the list of 20 items, each member may be asked to select the top 5 items.
8. Reach consensus on the top priority.
A team was looking into the issues related to methods in the organization. The team listed 10 items that were brainstormed. The team next decided on selection criteria. Each team member voted. This list was pared down to the top four items. Finally, the team reached consensus on "too many signatures and approvals" as the issue on which to focus their improvement efforts.

Issues Relating to Methods in the Organization Include:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>VOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Unclear administrative procedures</td>
<td>1 1 1 1 1</td>
</tr>
<tr>
<td>2. Too much paperwork</td>
<td>1 1</td>
</tr>
<tr>
<td>3. Lack of configuration management</td>
<td>1 1</td>
</tr>
<tr>
<td>4. Too many signatures and approvals</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>5. Numerous engineering changes</td>
<td>1</td>
</tr>
<tr>
<td>6. Outdated methods</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>7. Policies and procedures overkill</td>
<td>1 1</td>
</tr>
<tr>
<td>8. Lack of understanding customer requirements</td>
<td>1 1 1 1 1</td>
</tr>
<tr>
<td>9. Delayed work authorizations</td>
<td>1</td>
</tr>
<tr>
<td>10. No scheduling</td>
<td>1 1 1</td>
</tr>
</tbody>
</table>

The team was asked to vote considering the following criteria: (1) would require no resources to solve. (2) The team can solve the issue. (3) The issue could be solved in 30 days.

As a result of the vote the team decided to focus on issues 1, 4, 6, and 8.

The team voted again to select the most significant issue. The result of this vote, “too many signatures and approvals,” was selected for further analysis.
MUTIVOTING TEMPLATE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>VOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
</tr>
</tbody>
</table>

The vote will consider the following criteria:

___________________________________________________________________________

___________________________________________________________________________

Top-four issues are:

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

Vote again on top four issues.
Selection is: __________________________________________________________
SELECTION TECHNIQUE – RANK ORDER VOTING

Description: Rank order voting is a quick method for ranking a list of issues, problems, opportunities, and alternatives to determine the top priorities.

Steps:

1. Generate a list of items requiring a decision.
2. Combine similar items.
3. Number items.
4. Have each member rate each item on a scale of one to five with five being the high number.
5. Total the points for each item.
6. Rank the items from highest to lowest based on total points.
7. Reach consensus on the top priority.
RANK ORDER VOTING EXAMPLE

The following is an example of rank order method of selection. First, a list of items for selection as opportunities was generated using a brainstorming session on the people issues at a specific organization. Second, similar items were combined. Third, items were numbered. Fourth, each member rated each item. Fifth, the total points were listed.

<table>
<thead>
<tr>
<th></th>
<th>Training</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>No accountability</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>Not interested in someone else's responsibility</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>Staffing problems</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>Too many leaders no enough workers</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Poor workmanship</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Lack of indirect resources</td>
<td>21</td>
</tr>
<tr>
<td>8</td>
<td>Lack of team spirit</td>
<td>20</td>
</tr>
<tr>
<td>9</td>
<td>No ownership</td>
<td>23</td>
</tr>
<tr>
<td>10</td>
<td>Understaffed</td>
<td>22</td>
</tr>
</tbody>
</table>

Sixth, the list was rearranged highest to lowest.

<table>
<thead>
<tr>
<th></th>
<th>Too many leaders not enough workers</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Training</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>Staffing problems</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>No ownership</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>Understaffed</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>Lack of indirect resources</td>
<td>21</td>
</tr>
<tr>
<td>7</td>
<td>No accountability</td>
<td>21</td>
</tr>
<tr>
<td>8</td>
<td>Not interested in someone else's responsibility</td>
<td>21</td>
</tr>
<tr>
<td>9</td>
<td>Poor workmanship</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>Lack of team spirit</td>
<td>20</td>
</tr>
</tbody>
</table>

Seventh, the team reached a consensus on the selection. In this particular example the highest number of points was "too many leaders not enough workers." However, the team decided through consensus to select "training." This was the issue the team could impact.
1. Generate a list of items requiring a decision.
2. Combine similar items.
3. Number items.
4. Have each member rate each item on a scale of one to five with five being the high number.
5. Total the points for each item.
6. Rank the items from highest to lowest based on total points.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>#</th>
<th>Votes</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Reach consensus on the top priority.
Description: A selection matrix is a technique for rating issues, problems, opportunities, or alternatives based on specific criteria. The issues, problems, opportunities, or alternatives are listed on the left side of the matrix. The team selects the criteria to be considered in evaluating the alternatives. This criterion is placed along the top of the matrix. Then, the members individually rate the issues, problems, opportunities, or alternatives. The selection matrix should always be completed individually first. Next, the group ratings are determined. The results of the selection matrix do not set the actual decision. Its purpose is to lead to a more focused discussion of each item. This process helps to clarify assumptions and focus consensus.

Steps:

1. The issues, problems, opportunities, or alternatives are listed on the left side of the matrix.
2. The team selects the criteria to be considered in evaluating the problems, opportunities, or alternatives.
3. The criteria are listed at the top of the matrix.
4. The members individually rate the problems, opportunities, or alternatives.
5. Each team member's highest total point item is tabulated.
6. Discussion of the issues, problems, opportunities, or alternatives ensues.
7. The group tries to reach a consensus.
In this example, the organization needs to select a method of training ensuring test technicians can perform a certain test. The opportunities are listed down the left side of the example. The opportunities are formal classroom, on-the-job, combination of both, or none. The criteria are listed across the top. For this example, the following criteria were selected: Cost, Resources, Importance, Time to implement, Effect, Risk, Integration, and Authority. Each opportunity is rated against the criteria individually by each team member. The team member that completed the selection matrix rated the combination of both formal and on-the-job training as the highest solution. The issue, problem, opportunity or solution is then rated by the total number of team members giving it the highest number of total points.

<table>
<thead>
<tr>
<th>Item</th>
<th>C</th>
<th>R</th>
<th>I</th>
<th>T</th>
<th>E</th>
<th>R</th>
<th>I</th>
<th>A</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>OJT</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>Combo</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### SELECTION MATRIX EXAMPLE

**Rating Scale**

<table>
<thead>
<tr>
<th>Item</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost to make improvement</td>
<td>Modest</td>
<td>Moderate</td>
<td>High amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resources needed</td>
<td>Few</td>
<td>Moderate</td>
<td>Many</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importance to organization</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to implement</td>
<td>Less than month</td>
<td>3 months</td>
<td>More than 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect on mission/goal</td>
<td>Measurable</td>
<td>Moderate</td>
<td>Intangible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Simple</td>
<td>Moderate</td>
<td>Complex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authority</td>
<td>Team</td>
<td>Owner</td>
<td>Executive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This next chart shows the total of team rating. Once all team members' highest rating is known, the group focuses on consensus. The final selection is based on the understanding and discussion of the items on the selection matrix.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>HIGHEST ITEM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal classroom</td>
<td>1 1 1</td>
<td>3</td>
</tr>
<tr>
<td>On-the-job training</td>
<td>1 1 1</td>
<td>3</td>
</tr>
<tr>
<td>Combination of both</td>
<td>1 1 1 1 1</td>
<td>5</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
# SECTION MATRIX TEMPLATE

## Rating Scale

<table>
<thead>
<tr>
<th></th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

## Selection Matrix

<table>
<thead>
<tr>
<th>Selection Item</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Team Total

<table>
<thead>
<tr>
<th>ITEM</th>
<th>HIGHEST ITEM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
SELECTION TECHNIQUES – SELECTION GRID

Description: A selection grid compares each issue, problem, opportunity, or alternative against others using the criteria.

Steps

1. List problems, opportunities, or alternatives.
2. Determine criteria.
3. Compare each pair of issues, problems, opportunities, or alternatives against others using criteria.
4. Try to reach a consensus as a group.
In this example, we will continue the example of a team looking into the issues related to methods in the organization. The top four issues are:

### SELECTION ITEMS

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Unclear administrative procedures</td>
</tr>
<tr>
<td>2.</td>
<td>Too many signatures and approvals</td>
</tr>
<tr>
<td>3.</td>
<td>Outdated methods</td>
</tr>
<tr>
<td>4.</td>
<td>Lack of understanding of customer requirements</td>
</tr>
</tbody>
</table>

### SELECTION CRITERIA

<table>
<thead>
<tr>
<th>Our selection must:</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low cost</td>
<td></td>
</tr>
<tr>
<td>Effect on objectives</td>
<td></td>
</tr>
<tr>
<td>Implemented within 30 days</td>
<td></td>
</tr>
</tbody>
</table>

The selection grid is shown on the next page. First, the selection grid should be completed individually. Each choice is given a number as shown above. Then each choice is compared against the other choices using defined criteria. The selection is made by circling the preferred choice (BOLD). For instance; in block 1 item 1 "unclear administrative procedures" is compared to item 2 "too many signatures and approvals." This team member selected item 2 "too many signatures and approvals" by circling item 2 on the selection grid. This procedure is repeated in each of the blocks.

### SELECTION GRID

```
ITEM 1 ITEM 1 ITEM 1
ITEM 2 ITEM 2 ITEM 4
    ITEM 2 ITEM 2
    ITEM 3 ITEM 4
    ITEM 3 ITEM 4
```
Once the selection grid is completed, the choices are totaled. Shown below is a data collection chart for totaling the individual selections. The individual data collection chart shows item 4 "lack of understanding customer requirements" as the highest selection. This highest number is the initial choice of the team member if completed individually, or the entire team if completed as a team.

### INDIVIDUAL TOTAL

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CHOICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1 1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1 1 1</td>
<td>3</td>
</tr>
</tbody>
</table>

If the selection grid is completed individually, the team's selections must be totaled like the selection matrix. Below shows the team data collection chart. The team's selection was also item 4. Again from this process, assumptions are clarified and a consensus can be reached. Remember, the ultimate selection may differ from the selection grid result.

### TEAM TOTAL

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CHOICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1 1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1 1 1 1</td>
<td>5</td>
</tr>
</tbody>
</table>
1. List problems, opportunities, or alternatives.

   **Selection Items**

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

2. Determine criteria.

   **Selection Criteria**

<table>
<thead>
<tr>
<th>Our selection must:</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
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<td></td>
</tr>
</tbody>
</table>

3. Compare each pair of issues, problems, opportunities, or alternatives against others using criteria.

   **SELECTION GRID**

<table>
<thead>
<tr>
<th>ITEM 1</th>
<th>ITEM 1</th>
<th>ITEM 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITEM 2</td>
<td>ITEM 2</td>
<td>ITEM 4</td>
</tr>
<tr>
<td>ITEM 2</td>
<td>ITEM 2</td>
<td></td>
</tr>
<tr>
<td>ITEM 3</td>
<td>ITEM 3</td>
<td>ITEM 4</td>
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<tr>
<td>ITEM 3</td>
<td>ITEM 4</td>
<td></td>
</tr>
<tr>
<td>ITEM 4</td>
<td>ITEM 4</td>
<td></td>
</tr>
</tbody>
</table>
4. Try to reach a consensus as a group.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CHOICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
**Decision Making**

**Description:** The decision-making process is the process of making a selection. In making a decision, the impact and support of the outcome should be considered. A group will be more committed to success if the decision is reached by consensus. Therefore, consensus should be used when selecting an issue, problem, or opportunity to work as a team. It is also necessary when deciding on a solution to implement. Consensus decision making targets a win/win outcome. Decisions reached by any method other than consensus results in a win/lose situation. A win/lose decision results in not having total commitment and support for the selection.

Although consensus is the recommended method for team decision-making, other methods of decision making also exist. These types of decision making may be appropriate at times, other than those mentioned above, as essential consensus decision making times. In many instances, time constraints, insignificance, or other considerations make consensus decision making unrealistic. In certain situations, the team determines an alternate method of decision making from the methods below:

* Decision by majority. This is a decision by more than half of the representatives. Decision by majority is accomplished by voting.
* Decision by leader. In some cases, the leader makes the decision.
* Decision by management. Management sometimes must make the decision.

**Steps:**

1. Decide on method for decision.
2. Choose selection method.
3. Make decision.
4. Try to reach a consensus as a team. Decision by consensus requires a detailed process.
CONSENSUS DECISION MAKING

Description: Consensus decision making means everyone on the team accepts and supports the decision. This does not mean everyone wants the same decision, but everyone on the team agrees to go along with the decision. Consensus equals commitment to the decision. Consensus can only be reached by open and fair communication among all team members. Consensus is critical when developing a code of conduct, vision, mission, charter, and values; or, selecting a process to improve, problem to solve, mission to accomplish, opportunity to pursue, the recommendation and a solution. Consensus requires understanding and discussion among all stakeholders. Once understanding and discussion takes place, the group or team can proceed with the process of arriving at a consensus decision.

Steps:

1. Present the decision to be made.
2. Write the decision statement along the top of a flipchart.
3. Review background information.
4. Decide how the decision should be made.
5. Brainstorm selection criteria.
6. Clarify ideas.
7. Agree on selection criteria for the decision.
8. Brainstorm alternatives.
9. Evaluate each alternative against selection criteria.
10. Agree on a decision.
11. Get each team member's personal commitment to the decision.
12. Implement the decision.
Description: Metrics are measurements made over time that communicate vital information about the quality of a process, activity, or resource. Metrics reflect meaningful measures that target improvement actions. Metrics are differentiated from plain measurement by its specific focus on total customer satisfaction while supporting the organization. Metrics must be customer oriented and communicate a state of health. Metrics must show where we are now in relation to where we want to go over time. Metrics are not

- **Charts.** Charts may graphically display the results of metrics, but the chart itself is not metrics.
- **Schedules.** Some forms of schedules can lead to good metrics, but usually schedules do not provide information that by itself will lead to improvement.
- **Goals, objectives, strategies, plans, missions, or guiding principles.** Most of these can be measured, but metrics are not by itself the end. They are a means to an end.
- **Counts of activity.** Counts of activity can result in metrics, but just because you have a measure does not necessarily drive appropriate action.
- **Snapshots or one-time status measures.** These show little trend information. A comparison of status over time can be metrics but tend to be very top level and does not provide a "real" understanding for specific action.

Steps:

1. Define the purpose of the metrics.
2. Develop operational definition.
3. Determine if measurements are already available.
4. Generate new measurements if required.
5. Evaluate the validity of the metrics.
6. Institute and baseline the metrics.
7. Measure progress against the baseline.
8. Prepare the metric presentation.
The metrics package consists of the following three basic elements: the **operational definition**, the **actual measurement**, and **metric presentation**. The operational definition is the precise explanation of the process being measured. The measurement involves the collection, sorting, and translation of the data from the process into understandable and useful information. The metric presentation provides the communication link to the customer (internal/external).
The following is a step-by-step example of metrics development for team leader effectiveness. The metrics package example provides the visual information. The figures show examples of the three parts of the metrics package: the operational definition, measurement, and metric presentation.

**Step 1.** Define the purpose of the metrics.

Improve customer-driven team's (CDT) effectiveness.

**Step 2.** Develop operational definition.

**Operational Definition Example**

<table>
<thead>
<tr>
<th>METRICS TITLE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPROVE CDT's EFFECTIVENESS</td>
</tr>
</tbody>
</table>

**Operational Definition:**

The customer-driven project team will perform a monthly project performance review at the second team meeting of each month using the results of the approved customer satisfaction critique.

**Measurement Method:**

The measurement consists of a customer satisfaction index compiled as an average from the approved customer satisfaction critique. The customer satisfaction index indicates the defined key customers satisfaction with deliverable satisfaction, project execution, customer relationships, relationships with other key interfaces, and team leader performance. The customer satisfaction index uses a closed scale from 1 (very dissatisfied) to 5 (very satisfied).

**Desired Outcome:**

Improve customer satisfaction rating in all five areas.

**Linkage to Organizational Objective:**

Meets total customer satisfaction strategy.

**Process Owner:**

Customer-driven project team
Step 3. Determine if measurements are already available.

There are no current measurements of team effectiveness that meet the criteria of metrics.

Step 4. Generate new measurements if required.

The measurement consists of a customer satisfaction index compiled as an average from the approved customer satisfaction critique. The customer satisfaction index indicates defined key customer satisfiers.

The measurements include surveying the key customer satisfaction indicators as determined by the team and the customers. The critique includes:

➤ Deliverable satisfaction
➤ Project execution
➤ Customer relationships
➤ Relationships with other key interfaces
➤ Team leader performance

Step 5. Evaluate the validity of the metrics.

The metrics is valid against the metrics considerations criteria.

Step 6. Institute and baseline the metrics.

The customer satisfaction critique is used to collect the initial baseline data.

Step 7. Measure progress against the baseline.

The critique is conducted monthly and charted to examine trends over time.

Step 8. Prepare the metric presentation.

Each month the metric presentation is conducted. The metric presentation consists of metric description and metric graphic.
Step 9. Use the metric for continuous improvement actions.

The metric is used by the team leader and the team to take action to continuously improve their effectiveness.

<table>
<thead>
<tr>
<th>Customer Satisfaction Critique</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instructions</strong></td>
</tr>
<tr>
<td><strong>1. Deliverable satisfaction</strong></td>
</tr>
<tr>
<td>Very dissatisfied</td>
</tr>
<tr>
<td><strong>2. Relationships</strong></td>
</tr>
<tr>
<td>Very dissatisfied</td>
</tr>
<tr>
<td>Is the customer satisfied with the team's relationships with suppliers, other teams, other leaders?</td>
</tr>
<tr>
<td>Very dissatisfied</td>
</tr>
<tr>
<td><strong>3. Project execution</strong></td>
</tr>
<tr>
<td>Very dissatisfied</td>
</tr>
<tr>
<td><strong>4. Team leader performance</strong></td>
</tr>
<tr>
<td>Very dissatisfied</td>
</tr>
</tbody>
</table>
PRESENTATION EXAMPLE

**DELIVERABLE SATISFACTION**

Baseline: 3.2

**PROJECT EXECUTION**

Baseline: 2.8

**CUSTOMER RELATIONSHIP**

Baseline: 3.5

**OTHER RELATIONSHIPS**

Baseline: 2.0

**TEAM LEADER PERFORMANCE**

Baseline: 3.0

---

**DELIVERABLE SATISFACTION**

**ASSESSMENT**

GREEN

Good ↑

**Graph:**

- Y-axis: Very Satisfied, Baseline, Very Dissatisfied
- X-axis: Jan, Feb, Mar, Apr, May, Jun
- Line shows an upward trend from Jan to Jun, indicating improvement.
METRIC TEMPLATE

METRIC TITLE: _____________________________________________________

Operational Definition:
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Measurement Method:
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Desired Outcome:
___________________________________________________________________________

Linkage to Organization Objective:
___________________________________________________________________________

Metric Owner: _________________________________________________________

Presentation:
**MEASURES**

**Description:** Measures are quantitative indicators of performance. Measures are a vital component of metrics. However, measures are not always metrics. Measures compare results to requirements. There is a common saying about measures. What gets measured gets attention and what gets attention gets done. Therefore, it is important to determine the right measures. These are the measures that drive action.

**Steps:**

1. Define the purpose of the measure.
2. Develop operational definition for measure.
3. Determine if measurements are already available.
4. Generate new measure if required.
5. Evaluate the validity of the measure.
7. Measure progress against the baseline.
8. Use the measure for continuous improvement.
## MEASURES EXAMPLES

<table>
<thead>
<tr>
<th>Customer</th>
<th>Employee</th>
<th>Costs</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales volume</td>
<td>Turnover</td>
<td>Labor</td>
<td>Performance</td>
</tr>
<tr>
<td>Retention</td>
<td>Absenteeism</td>
<td>Overhead</td>
<td>Features</td>
</tr>
<tr>
<td>Marker share</td>
<td>Complaints</td>
<td>Expenses</td>
<td>Conformance</td>
</tr>
<tr>
<td>Market position</td>
<td>Safety issues</td>
<td>Equipment</td>
<td>Reliability</td>
</tr>
<tr>
<td># new customers</td>
<td>Development activities</td>
<td>Supplies</td>
<td>Durability</td>
</tr>
<tr>
<td>Volume of sales per customer</td>
<td>Housekeeping</td>
<td>Interest</td>
<td>Serviceability</td>
</tr>
<tr>
<td>Margins</td>
<td>Rewards</td>
<td>Inventory</td>
<td>Aesthetics</td>
</tr>
<tr>
<td>Returns</td>
<td>Suggestions</td>
<td>Scrap</td>
<td>Inspection</td>
</tr>
<tr>
<td>Complaints</td>
<td>Improvements</td>
<td>Rework</td>
<td>Prevention</td>
</tr>
<tr>
<td>Order accuracy</td>
<td>Productivity</td>
<td>Space</td>
<td>Process capability</td>
</tr>
<tr>
<td>Order response</td>
<td>Efficiency</td>
<td>Damage</td>
<td>Product quality-in</td>
</tr>
<tr>
<td>Order complete</td>
<td>Effectiveness</td>
<td>Exchange rates</td>
<td>Product quality-out</td>
</tr>
<tr>
<td>Relationship</td>
<td></td>
<td>Response to emergency requirements</td>
<td>Consistency</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Satisfaction</td>
<td>Optimize</td>
<td>Perfection</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td><strong>Number of</strong></td>
<td><strong>Performance</strong></td>
<td><strong>Lean</strong></td>
</tr>
<tr>
<td>Cycle time</td>
<td>Transactions</td>
<td>Total customer satisfaction</td>
<td>Value/Non-value added</td>
</tr>
<tr>
<td>Response</td>
<td>Interactions</td>
<td>Product availability</td>
<td>Cycle time</td>
</tr>
<tr>
<td>Transport</td>
<td>Errors</td>
<td>On-time delivery</td>
<td>Waste</td>
</tr>
<tr>
<td>Test</td>
<td>Defects</td>
<td>Return on investment</td>
<td>Takt time</td>
</tr>
<tr>
<td>Produce</td>
<td>Complaints</td>
<td>High performance organization</td>
<td>Total lead time</td>
</tr>
<tr>
<td>Process</td>
<td>Returns</td>
<td>Profitability</td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>Changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pack</td>
<td>Orders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ship</td>
<td>Inventory turns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receive</td>
<td>Deliveries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Find</td>
<td>Product produced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wait</td>
<td>Stock-outs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approval</td>
<td>Failures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspections</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hours/days/weeks</td>
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<td></td>
</tr>
</tbody>
</table>

- **Lean**: Value creating time, Changeover time, Uptime, Scrap/rework, Inventory, Every item made every, Throughput, Perfection, Queuing and Waits, Pull, Activity based costing, Perfection.
Measure: _________________________________

Operational Definition:
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Measurement Method:
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Desired Outcome:
___________________________________________________________________________

Linkage to Organization Objective:
___________________________________________________________________________

Measure Owner: _________________________________
Description: Process planning constitutes the every-day planning activities for getting the work done in the organization. The purpose of process planning is to record the important elements of a process to explain how the process is currently performed within the organization. The process plan contains the following:

Process Description. This means stating the overall process in terms of the customer (internal/external) and internal operations. First, this involves stating the process as an action and a descriptor. For instance, the customer service process might be stated as “serve customers.” Second, state the general operation performed in the process.

Process Operations. These are all operations necessary to perform the process.

Supplier-Inputs. This is the input to the process and who supplies the input. Requirements should be as detailed as necessary.

Customer-Outputs. This is the planned output of the process. These outputs are expressed as products or services to customers (internal/external).

Process Measure(s). State the process measurement. This is how to know if the process is performing up to the organization’s standards while meeting customer expectations.

In addition, process plan can include: list of the general responsibilities, list the major resources (people, equipment, material, etc.) and list of the specific development areas needed to perform the process.

Steps:

1. Identify process name
2. Determine process owner
3. Establish process start and process end
4. State the process description
5. List suppliers, inputs, process steps, outputs and customers
6. Determine metric/measure
7. List other requirements to needed to perform the process
PROCESS PLAN EXAMPLE

Process Name: Receive Order from customer
Process Owner: Customer Service
Process Start: Order received
Process End: Order entered into computer system

Process Description/Objective: Provide customer with the right product at the right time in the right quantity when it is needed with a hassle free experience.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Inputs</th>
<th>Process</th>
<th>Outputs</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>XYZ</td>
<td>Order item</td>
<td>Answer phone</td>
<td>Product</td>
<td>XYZ</td>
</tr>
<tr>
<td></td>
<td>Customer number</td>
<td>Write order information</td>
<td>On-time delivery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer location</td>
<td>Confirm order</td>
<td>Bill</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Order quantity</td>
<td>Enter order in computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delivery address</td>
<td>Verify order information</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Billing address</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Process Metrics/Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Purpose</th>
<th>Current</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>Customer gets right product</td>
<td>98%</td>
<td>100%</td>
</tr>
<tr>
<td>Compleness</td>
<td>Customer gets all product</td>
<td>99%</td>
<td>100%</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>Customer WOW‘ed by experience</td>
<td>99%</td>
<td>100%</td>
</tr>
</tbody>
</table>
PROCESS PLAN TEMPLATE

PROCESS PLAN

Process Name: ___________________________________________

Process Owner: ___________________________________________

Process Start: ___________________________________________

Process End: ___________________________________________

Process Description/Objective:

Suppliers | Inputs | Process | Outputs | Customers
---|---|---|---|---

Process Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Purpose</th>
<th>Current</th>
<th>Goal</th>
</tr>
</thead>
</table>

Other Requirements:

Responsibilities: ___________________________________________

Resources: ___________________________________________

Development: ___________________________________________
FLOWCHARTS – TOP-LEVEL PROCESS DIAGRAM

**Description:** A process diagram is a tool for defining the process. Every process must be defined in the organization. Everyone should understand how their process satisfies customers (both internal and external). Each process is a customer, and each process as a supplier has a customer for their process. Everyone must constantly strive to improve their process both as a customer and for a customer. A top-level process diagram is a picture of the entire process. This type of process diagram shows the input(s), the process, and output(s) of a process. The top-level process diagram should focus on satisfying customers' needs and expectations. The expected results must be determined, and the process must be measured to determine if it is achieving results.

**Steps:**

1. Define the specific outcome of the process focusing on the customer.
2. State the process in terms of the work that has to be done for outcome.
3. Determine the input(s) required to satisfy the customer.
4. Measure the process. This measurement is usually the difference between inputs and outputs.
5. Analyze how the process is performing at the top level.
As we analyzed our system development process, we discovered the customer expects the product to be repaired in minimum time. This requires us to have trained technicians to service our product. Looking at the top-level process diagram shows the training process. The customer expects skilled people as the outcome of the process. Entering the process are unskilled people. The training process takes the unskilled people and transforms them into skilled people. Before the people enter training, a pre-test is administered to determine entry level skills. At the completion of training, a post-test is given to determine the overall effectiveness of training. This is the measurement of the process.
FLOWCHART – TOP-LEVEL PROCESS DIAGRAM TEMPLATE

SUPPLIER

OWNER

CUSTOMER

INPUT

What it takes to do the job

PROCESS

The Actual Work

OUTPUT

Deliverable provided to customer

MEASUREMENT
FLOWCHARTS – TOP-DOWN PROCESS DIAGRAM

Description: A process diagram is a tool for defining the process. Each organization, function, and person should define their specific process(es) and understand how the process satisfies customers' needs and expectations (both internal and external customers). Each process is a customer of the preceding process, and each process has a customer for their process. Everyone must constantly strive to improve their process both as a customer and for a customer.

A top-down process diagram is a chart of the major steps and sub-steps in the process. By examining the major steps, the opportunities for improvement are focused on the essential steps in the process.

Steps:

1. List the major steps in the process. Keep it to no more than seven steps.
2. List the major sub-steps. Keep it to no more than seven steps.
Using a training example, the top-down process flow diagram would list the major processes in the top-level process. In the example, the major processes are: analysis, design, development, implementation, and evaluation. The sub processes under each major process are the next items listed. For instance, under the major process "analysis" the following sub processes would be written: (1) training analysis, (2) job/process analysis, and (3) task analysis. Under "design", the sub processes are: (1) course objective, (2) lessons, (3) terminal objectives for lessons, (3) enabling objectives for each terminal objective, (4) trainee measurements, and (5) training plan. Under "development", the sub processes are: (1) lesson plan, (2) training materials, and (3) training production. Under "implementation", the sub processes are: (1) prepare for presentation, (2) present the training, and (3) training management. Under "evaluation", the sub processes are: (1) plan evaluations, (2) produce evaluation instruments, (3) conduct evaluations, (4) analyze results, and (5) continuous improvement.
FLOWCHART – TOP-LEVEL PROCESS DIAGRAM TEMPLATE

1. List major processes across the top of the worksheet.

2. List the major sub-steps. Keep it to no more than seven steps.
**FLOWCHARTS – DETAILED PROCESS DIAGRAM**

**Description:** A detailed process diagram is a flowchart consisting of symbols and words that completely describe a process. This type of diagram provides information indicating improvement opportunities, identifying areas for data analysis, determining which elements impact process performance, and documenting and standardizing the process. It is helpful in identifying non-value-added tasks and areas for simplification. Further, complex activities and unnecessary loops are visualized. This type of process diagram is useful for training, documentation, and explaining the process to others. Before deciding to do a detailed process diagram, decide on the specific detail and boundaries of the process diagram. Detailed process diagrams are time consuming. Therefore, specific boundaries are important to ensure progress on achieving improvements.

**Steps:**

1. Decide on specific detail and boundaries of the detailed process diagram.
2. List all the steps required in the process within the boundaries.
3. Construct a process flow diagram.

There are many detailed process diagram symbols. Today, there are many computer programs such as Visio, ABC Flowcharter, etc. that have numerous process diagram symbols. If you need a high level of detail, these programs are very useful. To keep it simple, four basic symbols are recommended. These symbols are shown on the side. They are enough for most process diagramming needs.
The following is an example of detailed process diagram.

1. A Subcontractor Data Requirements List (SDRL) is received by Materials. (INPUT)
2. Materials forwards the SDRL to Data Management. (ACTION)
3. Data Management logs the SDRL. (ACTION)
4. Data Management determines if an internal review is required before distribution. (DECISION)
5. If an internal review is not required, the SDRL is distributed. (NO)
6. If an internal review is required, Data Management forwards the SDRL to Reviewer(s). (YES)
7. The Reviewer(s) review the SDRL and make comments. (ACTION)
8. The Reviewer(s) forward the comments to Data Management. (ACTION)
9. Data Management determines if further review is required. (DECISION)
10. If no further review is required, the SDRL is distributed. (OUTPUT)
FLOWCHART – DETAILED PROCESS DIAGRAM TEMPLATE

<table>
<thead>
<tr>
<th>Steps/Activities</th>
<th>Operation</th>
<th>Decision</th>
<th>Wait</th>
<th>Other</th>
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VALUE STREAM MAPPING

Description: Value stream mapping combines process mapping and process analysis. Value stream mapping is a pictorial assemblage of all the actions (both value added and non-value added) occurring along a value stream. The major value streams include the series of individual operations required to create a design (new product), complete an order, or produce a product. These focal points are: design, administration and production. The design value stream starts with concept and ends with product launch. Although all administrative processes have a value stream, the most common administrative value stream goes from the customer order to delivery to the customer. The production value stream includes all the activities to bring a product or service from raw material to delivery to the customer. It includes the identification of all the specific activities occurring along the value stream for a product or product family. Besides actions, the value stream mapping can include information flows. The goal of value stream mapping is to identify non-value added activities and eliminate waste. The focus is on the seven common wastes: overproduction, waiting, transportation, overprocessing, inventories, wasted motion, and defects. In some cases, information is added as another waste.

Steps:

1. Define the scope of value stream map
2. Map the current state
3. Measure the value stream
4. Identify improvement opportunities
5. Map the future state
6. Collect data to prioritize and sequence improvement projects
7. Make improvements
8. Measure
9. Refine
VALUE STREAM MAPPING SYMBOLS

- **Process**
- **Assembly**
- **Control Center**
- **Warehouse**
- **Factory Customer or Vendor Facility**
- **Flow**
- **Data Box**
- **Weekly Schedule**
- **Orders**
- **Phone**
- **Delay**
- **Push Arrow**
- **Pull Arrow**
- **Supermarket**
- **PUSH Arrow**
- **Load Leveling**
- **Train Shipment**
- **Expedited Transport**
- **WOW**
VALUE STREAM MAPPING EXAMPLE

CURRENT STATE

FUTURE STATE
VALUE STREAM MAP TEMPLATE

1. Select Value Stream

   Product: ____________________
   Administrative: ______________
   Design: ______________

2. Map the current state

   CURRENT STATE VALUE STREAM MAP
3. Measure the current state value stream

<table>
<thead>
<tr>
<th>DATA BOX</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEASURE</td>
</tr>
</tbody>
</table>

4. Analyze the current state value stream

Look at the current state value stream to find:

- ___ non-value added activities
- ___ overproduction
- ___ waiting
- ___ excess transportation
- ___ overprocessing
- ___ inventories
- ___ wasted motion
- ___ defects
- ___ too much information
5. Identify potential improvements

The first challenges are for elimination of non-value by questioning the following:

___ excessive costs
___ inordinate waits, inventories, or transportation
___ duplicate efforts
___ inspection or oversight operations
___ layers of approval

Look for elimination. If elimination is not possible, can it be improved?

What
Can we do it another way? What should be done? What else can be done? What can be done differently?

When
Can we do it another time? Can we do it less frequently? When should it be done? What other time can it be done?

Where
Can we combine it with another activity? Where should it be done? Where else can it be done?

Who
Can someone else do it? Who should do it? Who else can do it?

How
How can we do it another way? How should it be done? How can we make it more consistent? How can we assure the right thing is done right the first time? How can we eliminate or reduce cost? How can we decrease or remove waits, inventories or transportation? How can we change or delete bureaucratic procedures or layers of approval? How can we eliminate or reduce inspection or oversight operations? How can we add flexibility?
### VALUE STREAM MAP TEMPLATE

<table>
<thead>
<tr>
<th>AREA FOR IMPROVMENT</th>
<th>FUTURE STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
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</tbody>
</table>

6. Map the future state value stream

---

**FUTURE STATE VALUE STREAM**
**INPUT-OUTPUT ANALYSIS**

**Description:** Input-Output analysis looks at all the inputs and outputs of a process. The input analysis lists all the inputs of the process. These inputs are based on the requirements of the process. Once the inputs are known, the prime owner and support responsibilities for each of the inputs are defined. This thorough analysis of all the inputs is used to match with outputs.

The output analysis lists all the outputs of the process. Again, the prime owner and support responsibilities are understood. This is accomplished by communicating with supplier(s), owner, and customer(s). The team needs to especially listen to the customer.

**Steps:**

1. Define the actual process.
2. List inputs and outputs of the process.
3. Determine prime (owner) and support (influencing) responsibilities.
4. Match inputs and outputs with organizations.
5. Define roles of the organizations.
The input-output analysis uses the information from the input-output diagram to complete the input-output analysis worksheet. In the example, the input-output diagram of the logistics process shown in the figure below is the basis for the input-output worksheet as shown below. The example shows an output of the logistics process as documentation. An input to the documentation is drawings. This shows the engineering drawings as an input for the output documentation. The prime owner of the documentation is the Technical Documentation Section of the logistics organization. The engineering function has the main support role providing the drawings for the documents. This relationship is shown on the input-output worksheet. This form can be used to look at relationships of output to input or input to output. Knowing this information, improvement opportunities can be identified and implemented using Improvement Process.
INPUT-OUTPUT ANALYSIS TEMPLATE

INPUTS | PROCESS | OUTPUTS

PROCESS INPUT OUTPUT PRIME SUPPORT
SUPPLIER-CUSTOMER ANALYSIS

Description: Supplier-Customer Analysis is a technique that involves your suppliers in the development of your requirements and their conformance to them. It also provides insight into your customer's needs and expectations, and meeting those expectations. It is important to develop a partnership with your suppliers and a relationship with the customers. Use surveys and interviews to ensure a mutual agreement on supplier requirements and customer expectations. The worksheet can be used to document results. It is important to communicate, listen, and thoroughly analyze supplier and customer perceptions to continuously improve supplier performance, the process, and customer satisfaction.

Steps:

1. Identify the process customer(s) (internal and external customers).
2. Determine the needs and expectations of your customer(s).
3. Identify the products or services you provide to meet these needs and expectations.
4. Develop measures of your output that reflect customer expectations.
5. Determine if the customer expectations have been met or not met.
6. Determine who owns or influences the product or service.
7. Identify your principal inputs (manpower, material, machine, method, and environment).
8. Determine if suppliers know their requirements and their impact on your meeting customer expectations.
9. Involve your suppliers in the development of your requirements and their conformance to them.
10. Identify suppliers that are not meeting requirements.
12. Use structured improvement methodology to improve supplier performance, the process, and customer satisfaction.
SUPPLIER-CUSTOMER ANALYSIS EXAMPLE

The supplier-customer analysis example uses the engineering drawings required for documentation. In the example, the input of drawings provides the data for the maintenance documentation output. The customer expects a usable document for maintenance personnel. This is determined by communication with the customer. A specific measurement must be determined. In this case, the customer expects the document to be 80 per cent accurate. Measure the performance. Determine if the document is meeting or not meeting customer expectations.

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>CUSTOMER</th>
<th>NEED/EXPECTATION</th>
<th>MET/NOT MET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair Manuals</td>
<td>Maintenance</td>
<td>100% correct</td>
<td>Not Met</td>
</tr>
</tbody>
</table>

To complete the supplier side of the equation, engineering must be informed of the drawing's impact on providing an accurate document to the maintenance personnel. The requirement for complete and accurate drawings must be measured to determine if engineering is meeting or not meeting requirements.

<table>
<thead>
<tr>
<th>INPUT</th>
<th>SUPPLIER</th>
<th>REQUIREMENTS</th>
<th>MET/NOT MET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing</td>
<td>Engineering</td>
<td>Complete and accurate</td>
<td>Met</td>
</tr>
</tbody>
</table>
## SUPPLIER-CUSTOMER ANALYSIS TEMPLATE

### Customer Analysis

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>CUSTOMER</th>
<th>NEED/EXPECTATION</th>
<th>MET/NOT MET</th>
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</table>

### Supplier Analysis

<table>
<thead>
<tr>
<th>INPUT</th>
<th>SUPPLIER</th>
<th>REQUIREMENTS</th>
<th>MET/NOT MET</th>
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</table>
Description: Process Analysis is a tool used to improve a process by eliminating non-value-added activities, waits, and/or simplifying the process. During process analysis you focus on specific defined outcomes like time and/or cost reduction. Process analysis helps get the output of the process to the customer as quick as possible at the lowest possible cost. The major goals of process analysis are elimination or reduction of high costs, non-value-added processes, activities, and tasks and the waits between processes. High cost areas are usually a primary area of focus. This is accomplished by adding cost figures to the process diagram to determine processes of excessive costs. In addition to high cost areas, many organizations lose money performing non-value added processes. These non-value added processes are another target. The value and non-value of a particular process, activity, or task is a judgment based on facts within a specific environment. Each process, activity, and task deserves a thorough analysis to determine its value. Once non-value-added tasks are evaluated for possible savings, the focus is on reducing or eliminating waits. Many hours are wasted between the performances of processes. This down time affects the organization’s ability to rapidly response to customers.

Steps:

1. Construct a process diagram (top-down or detailed).
2. Ensure waits between processes/activities are identified.
3. Determine time and cost of each process/activity and time of waits.
4. Reduce or eliminate waits.
5. Select critical activities (high time or cost).
7. Eliminate parts of the process.
8. Simplify value-added processes/activities.
The example uses the detailed subcontractor data requirements list (SDRL) process flow diagram. One diagram shows the process flowchart with times and the other figure shows the process flow diagram with costs. By examining the process flow diagram, the team decides the waits are extremely excessive. This would be their first area of focus for improvement. The team built a timeline of activities and waits. This is shown on the bottom of the time flowchart. This shows the process with an internal review takes 41 days. This includes 23 days of wait and 18 days of actual work. The team decides to aim at reducing the waits by 50%. This reduces the total time to 28.5 days with 8.5 days of wait. Next the team targets high time processes and high cost processes. In the example, the high time and high cost process is the review process as shown in the cost flowchart. The team would next do a detailed process diagram on just the review process. This process diagram would be used to eliminate non-value added activities and simplify value-added activities.
Process analysis allows more flexibility. It challenges the way things are done. The first challenges are for elimination of non-value by questioning the following:

* Excessive costs
* Inordinate waits
* Bureaucratic procedures
* Duplicate efforts
* Inspection or oversight operations
* Layers of approval

<table>
<thead>
<tr>
<th>Activity/Task</th>
<th>This activity could be eliminated if it were not for this basic reason. <strong>Why?</strong></th>
</tr>
</thead>
<tbody>
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<table>
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<tr>
<th>What would happen if we did not do this activity/task</th>
<th>Decide if elimination is possible</th>
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<tbody>
<tr>
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<td>Can eliminate</td>
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Once the above is examined, process simplification becomes the next step in process analysis. This step involves probing the high cost and high time processes for simple, innovative, and creative improvements for accomplishing the process.

If elimination is not possible, can it be simplified?

**What**
Can we do it another way? What should be done? What else can be done? What can be done differently? What is the waste, strain or problems?

**When**
Can we do it another time? Can we do it less frequently? When should it be done? What other time can it be done? When are the waste, strain and problems?

**Where**
Can we combine it with another activity? Where should it be done? Where else can it be done? Where are the waste, strain and problems?

**Who**
Can someone else do it? Who should do it? Who else can do it? Who should do it? Who is contributing to waste, strain and problems?

**How**
How can we do it another way? How should it be done? How can we make it more consistent? How can we assure the right thing is done right the first time? How can we eliminate or reduce cost? How can we decrease or remove waits? How can we change or delete bureaucratic procedures or layers of approval? How can we eliminate or reduce inspection or oversight operations? How can we add flexibility?
Description: Data analysis uses quantitative methods to continuously improve systems.

Data analysis includes tools for collecting, sorting, charting, and analyzing data to make decisions. A chart can make the process easier to understand by arranging the data so that comparisons can be made to focus on the right problems. Sorting and resorting the data can help the team focus on the most important problems and causes. Targeting smaller and smaller samples or categories funnels the data to the underlying causes. Even small improvements on the right problems can yield significant benefits.

Steps:

1. Collect data
2. Sort
3. Chart data
3. Analyze data
Data Collection

Data collection is the first step in data statistical analysis. It starts with determining what data is needed. Sometimes the data required is already available. In these cases, all that is required to do is sort, chart, and analyze it. However, in many cases, the specific data required for data statistical analysis is not available. If this is the case, the team needs to determine what data to collect, where to collect the data, and how to collect it.

Data collection plan

Data collection requires a plan. The data collection plan establishes the purpose, strategy, and tactics to get the data for data statistical analysis. The data collection plan answers the following question:

- Why does the team need to collect the data?
- What data is needed?
- What process provides the data?
- Where in the process the data is available?
- Is the data already being collected?
- If the data is not already collected, how will the data be collected?
- Who will collect the data?
- How long will the data be collected?
- What data collection method will be used?
- What sampling method is needed?
- Who will chart the data?
- How will the data be reported/presented?
- Is a pilot or test necessary?
- How will the pilot or test be conducted?
- Who will participate in the pilot or test?
- Is the data timely, accurate, and consistent?
Data Collection Methods

Data must be collected to measure and analyze a process. There are many methods for data collection. Data collection methods include the following:

* Observation
* Questionnaire
* Interview
* Tests
* Work samples
* Check sheets

**Check sheet**

<table>
<thead>
<tr>
<th>EVENT</th>
<th>TALLY</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 1 1 1</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>1 1</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>1 1 1 1 1 1 1 1</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>1 1 1 1 1 1 1 1 1</td>
<td>10</td>
</tr>
<tr>
<td>E</td>
<td>1 1 1</td>
<td>3</td>
</tr>
</tbody>
</table>
Data Charting

Once sorted, data must be put on a chart. Charts are pictures of the data that highlight important trends and significant relationships. Charts present the data in a form that can be quickly and easily understood. Charts serve as a powerful communication tool and they should be employed liberally to describe performance, support analysis, gain approval and support and document the improvement process.

When using charts and graphs, label titles and categories for clarity. Keep it simple, and report all the facts needed to be fair and accurate.

Data charting - bar chart

A bar chart is useful when comparing between and among many events or items. The chart show is Pareto chart.
Data Charting

Pie chart

A pie chart shows the relationship between items and the whole.

![Pie chart image](image)

Line chart

A line chart is used when describing and comparing quantifiable information. A line chart provides insight into statistical trends particularly over a specified period of time.

![Line chart image](image)
Data Charting

Scatter Chart

A scatter chart and their related correlation analysis permit the combination of two factors at once and the relationship that exists between them. A graphic display can help reveal possible relationships and causes of a problem even when links between the two factors are not evident. The pattern or distribution of the data points in a scatter diagram indicates the strength of the relationship between the factors being examined. It also indicates the type of relationship i.e. positive, negative, curve, and no relationship.

![Scatter Chart Diagram]

Histogram

A histogram is a vertical bar chart that shows frequency of data in column form. This type of data charting is useful in identifying changes in a process. A histogram can provide insight into the performance of a process and appropriate corrective actions by examining its centering, width, and shape. The closer the columns of the histogram are to the center of the chart, the more the process is on target. The wider the spread of the columns from the center, the greater the variation of the process from the target. Any change from a normal bell-shape may indicate a problem area.

![Histogram Diagram]
Data Charting

Control Chart

A control chart displays the process performance in relation to control limits. The control chart displays the data over time and shows the variation in the data. Control charts illustrate this variation. Control charts are used to show the variation on a variety of variables. The control chart allows you to distinguish between measurements that are within the variability of the process and measurements that are outside the normal range and are produced by special causes.

![Control Chart Diagram]

Analysis of the data

Once the data has been collected, sorted, and put on charts, the data is analyzed to identify significant findings.

- Ask specific problem identification questions with "what," "when," "where," "who," "how much," "what are the causes," and "what's the impact?"
- Identify underlying causes
- Clarify expected outcome
Description: A Pareto chart is a bar chart used to separate the “vital few” from the “trivial many.” These charts are based on the Pareto Principle which states that 20 percent of the problems have 80 percent of the impact. The 20 percent of the problems are the “vital few” and the remaining problems are the “trivial many.” The exact percentage is not important. In some cases the ratios may be 15/85, 30/70 or even 40/60. A Pareto chart can help you:

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

Steps:

1. Collect data.
2. Complete the worksheet.
3. Label the chart. Label the units of measure on the left vertical axis and the categories of problems on the horizontal axis.
3. Plot the data. Order the categories according to their frequency (how many), not their classification (what kind). Use a descending order from left to right.
PARETO CHART EXAMPLE

In the example below, data was collected using a data collection worksheet. In the example, data was collected on five potential underlying causes of engineering changes. The frequency data is listed in column one of the Pareto chart worksheet. Second, the percentage of the total for each cause is calculated. The results of this calculation are annotated in column two of the Pareto chart worksheet. Third, the cumulative percentage is computed. This is shown in column three of the Pareto chart worksheet. Fourth, the chart is drawn on graph paper. The horizontal axis is the causes. The vertical axis is the frequency. Fifth, the graph is scaled. Put zero at the bottom and the total at the top. Mark equal intervals in between the bottom and top. Sixth, arrange the causes from highest to lowest. Seventh, construct the bar chart. Start with the cause with the highest number on the left and work right in descending order to the lowest cause. The height of each bar indicates the number of times (frequency) that cause was counted. Eighth, indicate the percentages on the right of the chart. Ninth, put dots to mark cumulative percentages from Pareto chart worksheet. Tenth, analyze the chart. In this chart, the vital few are performance, cost, and producibility. By focusing on correcting these problems, over 80 per cent of the engineering changes can be eliminated.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Frequency (or other measure)</th>
<th>Percentage of Total</th>
<th>Cumulative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Performance</td>
<td>30</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>2 Cost</td>
<td>15</td>
<td>23</td>
<td>69</td>
</tr>
<tr>
<td>3 Producibility</td>
<td>10</td>
<td>15</td>
<td>84</td>
</tr>
<tr>
<td>4 Quality</td>
<td>5</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>5 Supportability</td>
<td>5</td>
<td>8</td>
<td>100</td>
</tr>
</tbody>
</table>
PARETO CHART EXAMPLE
**PARETO CHART TEMPLATE**

1. Collect data.

2. Complete worksheet.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Frequency (or other measure)</th>
<th>Percentage of Total</th>
<th>Cumulative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Label the Chart.

4. Plot the data.
**Description:** A histogram is a bar graph that shows the central tendency and variability of a dataset. Histograms are sometimes referred to as frequency distributions. A histogram is a vertical bar chart that shows frequency of data in column form. The columns may be presented vertically or horizontally. This type of data charting is useful in identifying changes in a process. A histogram can provide insight into the performance of a process and appropriate corrective actions by examining its centering, width, and shape. The closer the columns of the histogram are to the center of the chart, the more the process is on target. The wider the spread of the columns from the center, the greater the variation of the process from the target. Any change from a normal bell-shape may indicate a problem area.

**Steps:**

1. Collect data.
2. Arrange the data from lowest to highest.
3. Determine class intervals. The class intervals should be equal. One method for determining class intervals is highest value minus lowest value divided by number of classes.
4. Sort the data into classes and count the number of points. Determine the range by subtracting the smallest value in the dataset from the largest. This value is the range of your dataset. Determine the interval width by dividing the range by the number of intervals. Round your answers up to a convenient value. Determine the starting point of each interval by using the smallest data point value as the starting point of the first interval. The starting point for the second interval is the sum of the smallest data point plus the interval width.
5. Determine relative frequency and/or cumulative frequency of the data.
6. Display the data on a histogram chart.
HISTOGRAM PATTERNS

Normal Curve and Spread Curve

Positive And Negative Skew

Two Peaks and No Pattern
A histogram is usually a chart of frequency distribution. Frequency distribution is a table showing the number of elements in each class of a set of data. It arranges data into classes with the number of observations in each class. Classes are groups of data describing one characteristic of the data. A frequency distribution displays the number of times an observation of the characteristic falls into each class.

In constructing a histogram, the first step is to collect the data. The raw data for the average inventory of work in-process of one assembly area over a 15 day period is as follows:

```
1  1  5  2  4  2  3  1  2  2
3  4  3  2  2
```

Step 2. Arrange the data from lowest to highest:

```
1  1  1  2  2  2  3  3  3  3
3  3  4  4  5
```

Step 3. Determine class intervals. The class intervals should be equal. One method for determining class intervals is highest value minus lowest value divided by number of classes. For the example, the formula provides a class interval of .8 being used. This gives the following class levels:

```
1   -   1.8
1.8 -   2.7
2.8 -   3.6
3.7 -   4.5
4.6 -   5.3
```
HISTOGRAM EXAMPLE

Step 4. Sort the data into classes and count the number of points.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.8</td>
<td>3</td>
</tr>
<tr>
<td>1.8</td>
<td>2.7</td>
<td>3</td>
</tr>
<tr>
<td>2.8</td>
<td>3.6</td>
<td>6</td>
</tr>
<tr>
<td>3.7</td>
<td>4.5</td>
<td>2</td>
</tr>
<tr>
<td>4.6</td>
<td>5.3</td>
<td>1</td>
</tr>
</tbody>
</table>

Step 5. Determine relative frequency and/or cumulative frequency of the data. The following array shows relative frequency and cumulative frequency of the example data.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>Relative</td>
<td>Cumulative</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1.8</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>1.8</td>
<td>2.7</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>2.8</td>
<td>3.6</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>3.7</td>
<td>4.5</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>4.6</td>
<td>5.3</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

Step 6. Display the data on a histogram chart.
1. Collect the data.
2. Arrange the data from lowest to highest.
3. Determine class intervals.
4. Sort the data into classes and count the number of points.
5. Determine relative frequency and/or cumulative frequency of the data.
6. Chart the data
**CAUSE AND EFFECT ANALYSIS**

**Description:** Cause and effect analysis is a graphical representation of the relationship between a problem or goal (the effect) and its potential contributors (the causes). It is a useful technique for helping a group examine the underlying causes of a problem. It is a useful tool in association with brainstorming because it takes the brainstorming to core issues or root causes. Application of the technique usually results in a more specific definition of the problem to the underlying cause.

**Steps:**

1. Define the effect (problem, issue, goal or opportunity).
2. Define the major categories.
3. Brainstorm possible causes.
4. Identify the most likely causes.
5. Verify the most likely cause.
1. Define the problem. The team is asked to identify the problem, and the problem becomes the effect. In the example the problem is a piece of equipment with a mean time between failures (MTBF) of 400 hours. This MTBF is too low. The desired goal is a MTBF of over 800 hours. Thus, the MTBF is the problem or effect.

2. Define the major categories. Next, the major categories of possible causes of the problem are identified. The most popular categories are the machines, methods, people, and materials. These categories were selected for the example. It is important to tailor the categories to the specific problem. Remember, you are not limited to these categories.

3. Brainstorm possible causes. The team then brainstorms possible causes. These causes are listed under the appropriate category. The brainstorming rules apply in this step. It is sometimes helpful for the leader to keep repeating the heading for the cause in relation to the effect. For instance, under method, what is a cause of low MTBF? What is another method causing the low MTBF? This questioning is continued in each category until all ideas are exhausted. If someone comes up with an idea that applies to more than one category, list the idea in each category. If someone comes up with an idea that falls into a category other than the one being brainstormed, list the idea in the appropriate category. If an idea is generated that the person cannot immediately categorize, list the idea to the side of the diagram. The idea can be categorized at the completion of the brainstorming session. If someone cannot generate an idea, the person can pass or build on other people’s ideas. Continue the brainstorming session until the team is satisfied they have completed their search for the underlying causes for the problem.

4. Identify the most likely causes. The team looks for clues to the most likely causes. Once all the causes are examined, the team selects by consensus the most likely cause by using selection techniques.

5. Verify the most likely cause. The most likely cause is verified by using data statistical analysis, a test, collecting more data on the problem or communicating with customers to verify or reject the cause.
CAUSE AND EFFECT TEMPLATE

1. Define the problem, issue, goal or opportunity
__________________________________________________________________

2. Define the major categories

Category: ________________  Category: ________________
Category: ________________  Category: ________________
Category: ________________  Category: ________________

3. Brainstorm possible causes

4. Identify the most likely causes

5. Verify the most likely cause

  ![Fishbone Diagram](attachment:fishbone_diagram.png)
Description: The Five whys is a technique for discovering the root cause (or causes) of a problem by repeatedly asking the question, “Why?” Five is an arbitrary number. You never know exactly how many times you’ll have to ask why. It is important to remember to focus on the process aspects of the problem, rather than the personalities involved. Finding blame or a scapegoat does not solve problems. Five whys is useful for root cause analysis.

Steps:

1. Describe the problem in very specific terms.
2. Ask why it happens.
3. If the answer does not identify the root cause, ask why again. You know you’ve identified the root cause when asking why doesn’t yield any more useful information.
4. Continue asking why until the root cause is identified. This may take more or less than five whys.
FIVE WHYS EXAMPLE

A project manager wanted to know why the project was late.

Why did we miss the completion date? Our contract delivery schedule slipped.

Why? There were lots of engineering changes.

Why? Our suppliers did not understand our requirements.

Why? Our supplier requirements were not specific.

Why? We only gave verbal requirements.

At this point, we recognize poor communication of requirements as the root cause of the problem. They decide to provide written specifications to suppliers.
FIVE WHYS – TEMPLATE

Problem Statement:

Why?
Does this identify the root cause?
If not, ask again.
If yes, what can be done to make sure it does not happen again?

Why?
Does this identify the root cause?
If not, ask again.
If yes, what can be done to make sure it does not happen again?

Why?
Does this identify the root cause?
If not, ask again.
If yes, what can be done to make sure it does not happen again?

Why?
Does this identify the root cause?
If not, ask again.
If yes, what can be done to make sure it does not happen again?
FORCE FIELD ANALYSIS

**Description:** Force field analysis is a technique that helps a group describe the forces at work in a given situation. The underlying assumption is that every situation results from a balance of forces; restraining forces and driving forces. The Force Field starts with a goal that is the change to be made. Restraining forces are those things that keep the situation from improving. Driving forces are those things that are pushing toward the achievement of the goal. Force field analysis forces the team to examine strengths, as well as problems. Sometimes by building on a driving force or strength, a team can bring about the needed improvement.

<table>
<thead>
<tr>
<th>CURRENT STATUS</th>
<th>GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving Force</td>
<td>Restraining Force</td>
</tr>
<tr>
<td>Driving Force</td>
<td>Restraining Force</td>
</tr>
<tr>
<td>Driving Force</td>
<td>Restraining Force</td>
</tr>
<tr>
<td>Driving Force</td>
<td>Restraining Force</td>
</tr>
</tbody>
</table>

**Steps:**

1. Define the current state and goal.
2. Identify and prioritize the restraining forces.
3. Identify the driving forces for each critical restraining force.
4. Identify owners and level of management best suited to take action.
5. Develop plan and take action.
FORCE FIELD ANALYSIS EXAMPLE

In the example, the goal is to provide continuous improvement training. The current status is no training exists. The restraining forces are: delivering results, trainers, funding, participants with conflicting priorities, and organizational culture. It is suggested when performing a force field analysis that the team select the predominant restraining force first. Then, if needed, other restraining forces can be analyzed one restraining force at a time. The restraining force of delivering results is selected to develop the driving forces. The team brainstorms the driving forces. In the example, the team determined the driving forces that can be used to weaken or eliminate the stress of delivering results are: careful selection of trainers, ongoing assessment, working closely with finance to develop reporting structure, working closely with the executive team and management to identify priorities, provide success stories, and develop a plan. Next, the team decides which alternatives the team can do. This is shown by marking T for team or O for outside the team's control. Finally, the team selects an alternative or alternatives to act upon.

<table>
<thead>
<tr>
<th>No Training</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Careful selection of trainers</td>
<td>T</td>
</tr>
<tr>
<td>Ongoing assessment</td>
<td>T</td>
</tr>
<tr>
<td>Work closely with Finance to develop reporting structure</td>
<td>O</td>
</tr>
<tr>
<td>Work closely with executive team and management to identify priorities</td>
<td>O</td>
</tr>
<tr>
<td>Provide success stories</td>
<td>T</td>
</tr>
<tr>
<td>Develop plan</td>
<td>T</td>
</tr>
</tbody>
</table>

Delivering results

- Trainers
- Funding
- Participants have conflicting priorities
- Organizational culture

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FORCE FIELD ANALYSIS TEMPLATE

1. Define the current state and goal. Write current status and goal on figure below.

2. Identify and prioritize the restraining forces. Brainstorm restraining forces and write in the right column below. Select the critical issue or issues.

3. Identify the driving forces for each critical restraining force and write in the left column.

4. Identify owners and level of management best suited to take action.

5. Develop plan and take action.
CONTINUOUS IMPROVEMENT ACROSTICS
Continuous Improvement

Establish excellence policy
Expect continuous improvement
Create process orientation
Establish improvement methodology
Learn improvement tools
Establish Excellence Policy

P - Provides the standard for excellence
O - Orients the organization to target excellence
L - Launches continuous improvement
I - Inspires an excellent organization
C - Communicates standards of excellence
Y - Yields excellence
Xpect Continuous Improvement

Institute a systems view
Make perfection a passion
Pursue continuous improvement of people, product and processes
Require metrics of critical areas of success
Operate using continuous improvement cycle
Verify results
Establish and maintain documentation
Institute Systems View

Study the complete organization system

Yearn to know interrelationships of organization subsystems

Share systems view throughout the organization

Treat each organizational development opportunity as a system

Emphasize the impact of people in the system

Make the most use of information systems and technology
Make Perfection an Passion

Pursue perfection
Agree on view of perfection
Set perfection targets
Specify perfection in standards
Institute perfection
Observe indicators for perfection
Nurture passion for perfection
Require Metrics

**M**eaningful to the customer (internal/external)

**E**stablishes appropriate action

**T**ells how well the organization is performing

**R**epeatable over a period of time

**I**ndicates a trend

**C**lear operational definition

**S**imple to collect
Operate Using Improvement Cycle

Clarify the focus
Yearn to discover all improvement opportunities
Choose improvement opportunities
Launch improvements
Evaluate results
Verify Results

Make measures meaningful
Emphasize business results
Adopt objective measures
Specify subjective measures
Understand consequences of measures
Reinforce positives of measures
Eliminate unnecessary measures
Establish and Maintain Documentation

D - Define the system
O - Outline the organization
C - Clarify the goals of the system
U - Understand key processes
M - Make a documentation plan
E - Establish documents
N - Need records
T - Temper documentation
Create Process Orientation

Provide process overview
Require process plans
Observe process performance
Create process diagrams
Establish benchmarks
Systemize process analysis
Stress data analysis
Observe Process Performance

Items defective
Number of
Delivery times
Items available
Characteristics of quality
Accuracy
Time
Orders complete
Reliability
Satisfied customers
Process Diagram

D - Display the details of a process
I - Identifies process relationships
A - Allows an analysis of the results of a process
G - Gives a graphic display of process
R - Reexamines roles, responsibilities, and interrelationships
A - Assesses the elements that impact process performance
M - Measures process performance
Benchmarking

B
Builds a target for improvement efforts
E
Emphasizes desired outcomes
N
Nurtures competitiveness
C
Creates a desire to be the best
H
Holds the organization together while striving for excellence
M
Measures critical areas
A
Analyzes critical areas against the best
R
Reinforces continuous improvement
K
Keeps everyone moving toward excellence
Process Analysis

Simplify
Modify
Accelerate
Remove
Trade-off
Eliminate
Reengineer, redesign, or reorganize
Data Analysis

Seek factual data
Treat statistics as factual
Allow use of statistics everywhere in the organization
Temper conclusions with common sense
Identify tools for collecting, sorting, charting and analyzing data
Sort and resort data to focus
Target smaller and smaller samples to funnel data
Interpret data to find root causes
Chart data when appropriate
Seek alternatives and solutions using data
Establish Improvement Methodology

Make improvement methodology organization-wide

Establish a basic improvement methodology

Train everyone on use of improvement methodology

Have same methodology for process improvement and problem-solving

Omit steps only when appropriate

Document improvement process and results
Improvement Methodology

I dentify the opportunity
M easure an opportunity for improvement
P robe the selected opportunity
R equire improvement
O perate the new way
V erify the results
E ncourage continuous improvement
Learn Improvement Tools

Train basic improvement tools to everyone

Outline use of basic tools in improvement methodology

Organize support system

Launch new tools as appropriate

Specify additional tools for specific improvement areas
James H. Saylor is the founder of The Business Coach, a consulting firm focusing on helping organizations achieve their specific VICTORY. He has assisted many organizations in discovering, designing, developing and doing successful management systems. In addition, he has led, managed, coached, trained and facilitated many individuals and organizations in achieving their specific VICTORY. Jim has over 30 years experience in operations, organizational development, sales, marketing, training, and logistics. He also has many years of practical experience in project and quality management. He has prepared and presented many highly proclaimed training seminars and workshops globally. Jim is a widely recognized leading champion of Total Quality Management in the 1980s and 1990s. Jim is the author of the *TQM Simplified*, and co-author of *Customer-Driven Project Management* published by McGraw-Hill. For further information about Jim’s books, guides and workshops see websites:

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Contact Jim at: coachjim@thebusinesscoach.org or coachjim@managingforvictory.com
This Handbook of the VICTORY series provides guidelines for any organization seeking to achieve excellence through continuous improvement. Specifically, this VICTORY Guide provides step-by-step methods for:

- Establishing an excellence policy
- Expecting continuous improvement by instituting a system
- Creating a process orientation
- Establishing an improvement methodology
- Learning improvement tools

In addition, this book provides an outline of basic continuous improvement tools with examples and templates. You can get started on getting rapid results with the continuous improvement cycle, the improvement methodology and guidance on when and how to use tools.

Finally, we have provided MANAGING FOR VICTORY acrostics for continuous improvement to make it easy to implement and learn the continuous improvement system.

This guidebook is ideal for any organization seeking to achieve excellence. You can create an easy to implement, practical, inexpensive, and rapid results quality and productivity improvement system. This is a proven effective continuous improvement system. In addition, it provides the foundation that is compatible with total improvement programs like Total Quality Management, Six Sigma, Lean, Lean Six Sigma, MANAGING FOR VICTORY, and beyond!