Methods for Managing Quality

Module 3

Process Measurement, Standardization & Improvement

Lesson 1 Select In-Process Measurements

Lesson 2 Standardize and Collect Data

Lesson 3 Analyze & Improve the Process

Module 3, Viewgraph 1

☞ **INSTRUCTOR NOTE.** This module covers steps 8 through 11 of the Process Management Flowchart. Point out to the participants that we will be moving from the "P" to "D" to "C" to "A" in the PDCA cycle.

This module is presented in three lessons:

- **Lesson 1** - Concentrates on process measurement, emphasizing the importance of selecting measurements that are key to meeting customers' needs.
- **Lesson 2** - Emphasizes the importance of standardization in process management and identifies ways to achieve standardization.
- **Lesson 3** - Focuses on identifying causes of variation and acting on them to achieve stability and capability.

Methods for Managing Quality

Module 3

Lesson 1

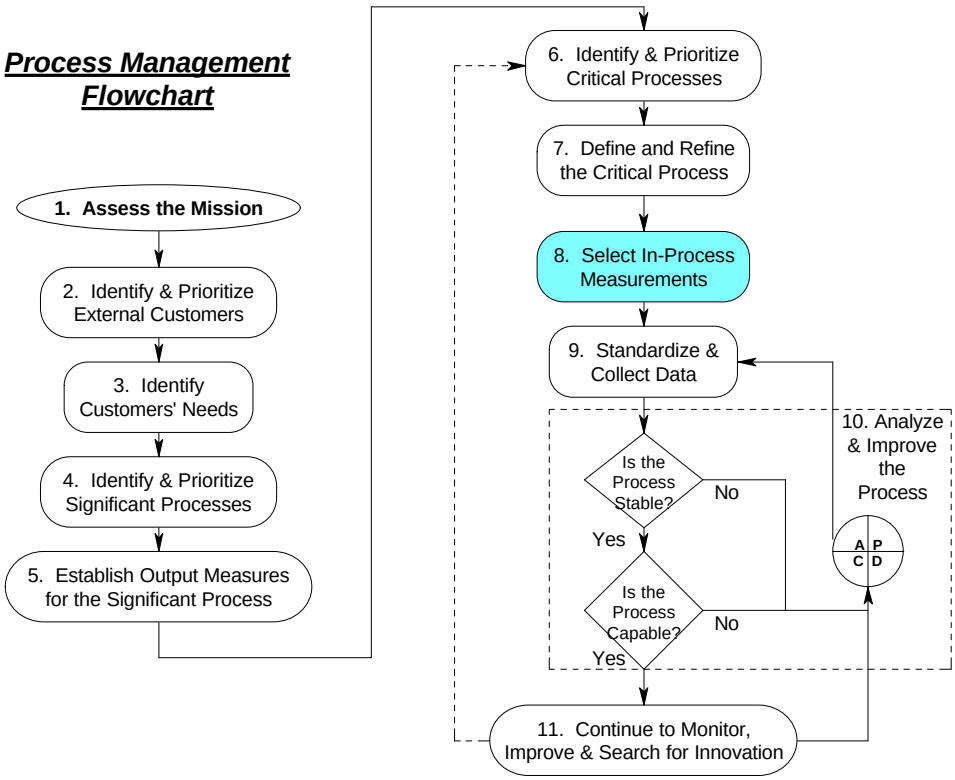
Select In-Process Measurements

Learning Objectives:

- Define in-process measurements
- Describe how to select process measurements
- Describe how to construct a Process Measurement Chart

Module 3, Lesson 1, Viewgraph 1

LESSON OVERVIEW Step 8 of the Process Management Flowchart—Select In-Process Measurements—is the focus of this lesson. We will use the Key Quality Characteristics Worksheet to help translate output measures (identified in Step 5) into possible process measurements. A brief review on selecting and interpreting process measurements to determine whether the process is capable of meeting the customer's needs will conclude this lesson.



Module 3, Lesson 1, Viewgraph 2

☞ **INSTRUCTOR NOTE.** Orient the participants by showing the Process Management Flowchart with Step 8 highlighted.

Does the Refined Process Produce a Product or Service Which Meets Customer Needs?

- The answer to this question requires data
- The data must come from measurements of processes that produce key quality characteristics
- The collection of data used in measurement must be planned

Module 3, Lesson 1, Viewgraph 3

- **The answer to this question requires data**

There are two types of data:

- **Subjective** - Based upon experience, intuition, or opinion.
- **Objective** - Based upon fact, numbers, or statistics. Objective data is either:

Attribute data - A qualitative term meaning the data can be counted or classified. Examples of countable attribute data are the number of errors produced by a process, or the number of accidents on a highway. Classifiable attribute data is expressed as, for example, good/bad, yes/no, or conforming/non-conforming.

Variable data - A quantitative term meaning data which can be measured or which is continuous. Examples are length, weight, temperature, or time. Data samples for these measurements would be expressed in inches, pounds, degrees, or seconds.

Collecting meaningful data is one of the most important aspects of process improvement. Bear in mind, however, that to collect the right data for your purpose—untainted by error or bias—it is wise to confirm the reliability of the data collection methods being used.

- **The data must come from measurements of processes that produce key quality characteristics**

  - ♦ Data can be derived from two types of measurements:

    ⇒ **Output** measurements are taken at the completion of a process.

    ⇒ **In-process** measurements are taken at selected steps within the process.

The output and in-process measurements should be consistent with each other. For example, if you are measuring an accuracy characteristic of the output, then you should also perform the in-process measurement on an accuracy characteristic.

- **The collection of data used in measurement must be planned**

Although output measurements are important in determining whether your products and/or services are meeting customers' needs, both in-process and output measurements are needed to manage and improve the processes that provide your products and/or services.

However, before any measurement data can be taken, the QMB must develop a Data Collection Plan to ensure the right measurements are taken at the right steps by the right people to identify where process improvements can be made.

Things to Consider When Developing a Data Collection Plan

- What will you do with the data?
- What type of data will be collected?
- How will you collect the data?

Module 3, Lesson 1, Viewgraph 4

- **What will you do with the data?**

This question also relates to your purpose. What use will you make of the data?

- Will you use data to *improve* your products or services? Will you use the data for predictive purposes? Data will help you decide what you need to do to make positive changes.
- Will you use the data to *describe* some event or thing? This information will let you know what has happened. Data provide information as to past performance.
- Do you want the data for the *archives,* just to document what has occurred? Sometimes data are collected, stored, and only reviewed when something goes wrong and someone is going to be blamed. This use of data is not recommended.
- Will the data be used to *control* processes, products, or people? Are the data intended to find fault or assign blame? If so, this is no different than the traditional way data have been used. This only increases fear and a reluctance to provide accurate assessments.

The kind of data you gather should be based on your planned purpose for using it. With this in mind, you can determine, not only the subject of the data-gathering effort, but also how general or specific you need the data to be.

- For example, you might need to decide whether to collect information on the number of defects or the *types* of defects that occur in a process. Requirements dictated by the potentially different uses for the data would guide you in determining whether data on defect quantity or defect type give you the information you need for your purpose.

- **What type of data will be collected?**

We generally classify data as either attribute or variable data. The type of data collected determines which statistical tool you will use.

- **How will you collect the data?**

Whatever method of collecting data you use, try to make it simple to obtain, record, and use.

♦ **Indirect observation** - Some common methods used for indirect observation are *interviews* and *surveys.* Interviews are generally conducted face-to-face, but can also be conducted over the telephone. Surveys are generally conducted using a written, structured format such as a questionnaire. Surveys can also be conducted over the telephone. In the future, interview and survey data will probably be obtained using computers. Marketing research organizations use a technique called *focus groups* to gather product-relevant information. Participants go through a series of questions, discussions, and other activities regarding the desirability of various product or service characteristics.

♦ **Direct observation** - Another form of data collection is direct observation of the behavior of interest. Collecting information this way can be done by using *check sheets, work diaries,* or *data summary forms.*

Things to Consider When Developing a Data Collection Plan

- Who will collect the data?
- From what sources will the data be collected?
- How often and how much data will be collected?

Module 3, Lesson 1, Viewgraph 5

- **Who will collect the data?**

Should employees or teams of people collect the data, or should supervisors be in charge of this activity? Is there a convenient way to have computers collect the data automatically?

Generally, the people closest to the data have the best opportunity to record the results. They can most readily detect when problems occur. If special causes of variation are signaled, these people can make changes fairly soon. A check sheet can be used to record events expeditiously.

If improvements are to be made when the data give signals that actions are to be taken—that is, when the process is out of statistical control—it may be important to have people with process knowledge collect the data. These people might be operators, technicians, engineers, clerks, or managers.

Regardless of how the data are collected, the people involved will probably need training in data collection methods. In addition, other resources needed to obtain information such as time, paper, pencils and other necessary measurement recording tools—must be provided.

- **From what sources will the data be collected?**

The source of the data also needs to be identified. If you are concerned with a manufacturing process, it may be clear that data should come from a particular machine or tool. In dealing with customers, you need to determine who to consult—the person who sells your product to others, the one who uses your product personally, or the one who uses your product to produce another product.

- ♦ Some of the sources of data are:
  - ⇒ Individual product or service users
  - ⇒ Organizational product or service users
  - ⇒ Equipment
  - ⇒ Materials
  - ⇒ Personnel
  - ⇒ Environment

- **How often and how much data will be collected?**

This question relates to how the data will be sampled and the best way to answer it depends on your knowledge of the process. There are two kind of sampling techniques you can apply:

- ♦ **Random-enumerative sampling** - For enumerative studies, a random sample using random numbers is the least biased procedure.
- ♦ **Judgment-analytic sampling** - Analytic studies require a judgment sample. This judgment needs to come from knowledge of the process. This may include knowledge of a production run, when special causes are least likely to be identified and still be representative of what is occurring in the process. The decision comes from knowing your process.

While the data collection plan identifies the things which must be considered before collecting data, you must have a method of documenting this information. One way of documenting these decisions and ideas is with a Process Measurement Chart.

Process Measurement Chart

Process Step	What data are being collected?	Who is collecting data	Data collection method	Frequency of data collection	Data collection form	How will data be analyzed?	Frequency of review	Who reviews?	Comments

Module 3, Lesson 1, Viewgraph 6

The Process Measurement Chart can help the QMB standardize measurement of performance and manage the process. This chart is one way to record process measurements. The chart is a valuable tool to continue process monitoring. Entries are made as follows:

- **Process Step.** Write in the description of the process step using the process flowchart.
- **What data are being collected?** Record what you will measure. Some examples are number of errors, cycle time in days or hours, temperature, thickness.
- **Who is collecting data?** Identify the person or persons who will measure and record the data.
- **Data collection method.** Record the method being used, as, for example, surveys, a random sample of 5, or 100% inspection.
- **Frequency of data collection.** Set a frequency, such as hourly, daily, weekly, every third shift.

- **Data collection form.** Specify the form, such as a check sheet, that will be used to record data.

- **How will data be analyzed?** Enter the method that will be used to analyze the data—a histogram, a control chart, or a run chart.

- **Frequency of review.** Specify how often the data will be examined—for example, weekly, biweekly, or each time the process is out of control.

- **Who reviews?** Enter the name of the person who will review the data. Will the process owner review it? Will the employees in the process be responsible for identifying special causes and reporting them to the supervisor?

- **Comments.** Any additional information or Concern should be recorded here.

☞ **INSTRUCTOR NOTE.**

⇒ Communicate to the participants that patience, persistence, and discipline are required if they are to succeed in establishing new habits of process monitoring. At first completing the chart may not be easy.

⇒ Tell them that there may be resistance to standardizing; they will learn more about standardization in Lesson 2.

⇒ Emphasize that this resistance must be overcome to ensure that the work done thus far is maintained and continued.

How to Select In-Process Measurements

- Review current in-process measurements to determine whether they reflect customer needs
- Compare Key Quality Characteristics Worksheets with the selected process to identify quality characteristics produced in this process
- Develop a list of possible process measurements for the identified key quality characteristics

Module 3, Lesson 1, Viewgraph 7

- **Review current in-process measurements to determine whether they reflect customer needs.**
  - Do the existing measurements reflect what customers want?
  - Do they shed light on the critical activities of the process?
- **Compare Key Quality Characteristics Worksheets with the selected process to identify quality characteristics produced in this process.**
  - Determine whether the key quality characteristic is an outcome of the selected process.
  - Determine whether the selected process contributes to the development of an outcome which could be identified as the quality characteristic.
- **Develop a list of possible process measurements for the identified key quality characteristics.**
  - What are the fundamental, repetitive activities needed to produce this product or service?

- What activities are linked to the characteristic the customer cares about?

- What are the inputs and outputs? At each handoff to the next activity, there is an opportunity to measure process performance.

☞ **INSTRUCTOR NOTE.** Emphasize that in-process measurements do not always relate directly to customer needs. The connection may not be obvious. The Case Study's critical process, Receive and Stock Materials, is an example. Receiving and stocking material does not have a direct connection to the customer, but has strong influence on our ability to satisfy customer identified quality characteristics.

☞ **INSTRUCTOR NOTE.** Stress the importance of using operational definitions, especially at handoffs. Remind participants that the term is frequently misused. A true operational definition must include all three elements (criterion, test & decision).

Key Quality Characteristics Worksheet

Customer Needs Customers perceive quality when they receive…	**Operational Definition** How do customers define the quality characteristic?	**Output Measurement** What can I measure to tell me if I am meeting my customer's needs?
Material with adequate shelf life	When received by customer, material must have 80% of the suggested shelf life from date of manufacture remaining	♦ Shelf life remaining when received by Supply Center ♦ Shelf life remaining when order shipped
Undamaged material	Material is functional in accordance with designed operation and has no aesthetic blemishes such as scratches, chips, cracks, dents or breaks	♦ Damage when received by Supply Center ♦ Damage when order shipped to customer
Certification documents included with material	When required, certification documents are included, match the product serial number, and are complete, undamaged and legible 100% of the time	♦ Condition of certification documents when material received at Supply Center ♦ Condition of certification documents when order shipped to customer
Orders received quickly	Orders are received by customer within 5 working days of receipt a telephone or fax order (Priority) Orders are received by customer within 15 working days from postmark for mailed order or Date Time Group (DTG) for message order (Routine)	♦ Cycle time between Supply Center receipt of telephone or fax order and material receipt by customer for priority orders ♦ Cycle time between postmark or Date Time Group and material receipt by customer for routine orders

Module 3, Lesson 1, Viewgraph 8

The Key Quality Characteristics Worksheet was completed immediately after a significant process was selected. It documents the essence of how the customer defines quality in the product or service that process produces. This is usually an abstract concept, such as good, fast, or inexpensive.

Because the Key Quality Characteristics Worksheet lists almost all of the Quality Characteristics for the selected significant process, and the critical process is only a part of the development of the product or service, not all quality characteristics will be associated with the critical process.

A new Key Quality Characteristics Worksheet should be used at this point, to **translate output quality characteristics** (Step 5) **into process quality characteristics** that contribute to the quality of the output.

The organization worked with the external customer to establish the operational definitions for the first translation (outcome to output). For the output to process translation, **internal customer-supplier relationships** must be represented.

Video Presentation

Module 3, Lesson 1, Viewgraph 9

☞ **INSTRUCTOR NOTE.**

- Introduce the videotape, “An Inside Job,” which is 23 minutes.
- When the video is over discuss the concept of internal customers and their impact on external customers.

  Learning Points:

  1. How internal customers treat each other extends to the external customer.
  2. Management’s reaction to problems without understanding the system.
  3. Internal customers reaction to management “point the finger”.

- Have the participants identify some of the internal customers of their own processes.

✉ **CASE STUDY NOTE.** Post the Case Study Key Quality Characteristics Worksheet (CASE-14) on the Storyboard, with the “Output Measurement” column highlighted and label it Step 8.

How to Select the Best Measurements

- Review the list of possible process measurements
- Consider the effect of measurements on employees
- Select the measurements that best determine whether process performance can meet customer needs

Module 3, Lesson 1, Viewgraph 10

- **Review the list of possible process measurements**

You have developed a comprehensive list of measurements from which to select a critical few. You have considered the importance of process control. You have translated customers' expectations of quality into possible process measurements. You have reviewed the terms and concept of process control to understand their importance in measurement.

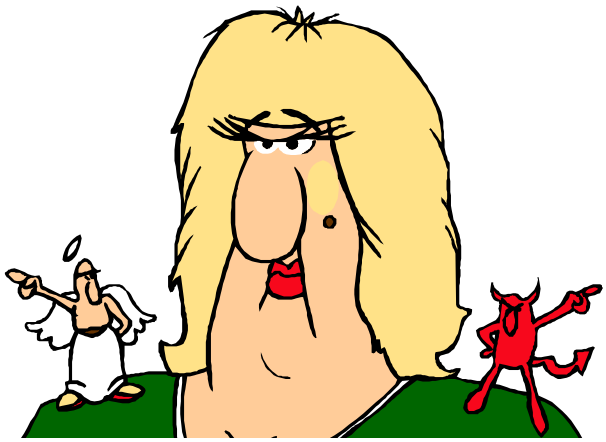
Now the QMB, using its collective knowledge, experience, insight, and intuition, must select the best measurements to serve as surrogates for customer satisfaction.

- **Consensus.** It may be that the choices are obvious and the QMB can readily agree on the key measurements to be selected.

- **Matrix Method.** Using a Matrix, the QMB can compare possible measurements to customers' key quality characteristics to help identify the key measurements.

The QMB should be willing to revisit its selection after evaluating whatever insight the measurement data provide.

Will the Measurements Encourage Positive or Negative Behavior?



Module 3, Lesson 1, Viewgraph 11

- **Consider the effect of measurements on employees**

♦ Will the measurements encourage positive attitudes and behaviors on the part of employees? What are the possible negative effects of these measurements? Areas to consider include:

⇒ Competition

⇒ Positive feedback vs. negative feedback

⇒ Emphasis on individual performance vs. process performance

♦ Ensure that measurements affect employees' attitudes and behaviors in ways that will help you satisfy customers. Take care that emphasizing a given customer expectation does not jeopardize your ability to deliver on another expectation. Communicating these risks to employees will go a long way toward preventing them.

☞ **INSTRUCTOR NOTE.** Provide an example to illustrate this point such as: if the only measurement stressed in a reception area is timeliness, there is a risk that employees may treat customers abruptly.

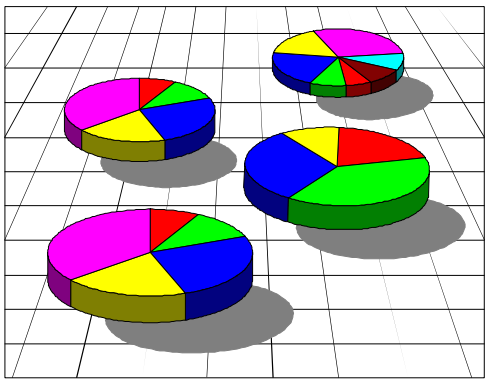
Keep Measurements Simple

Data Rich and Information Poor

Module 3, Lesson 1, Viewgraph 12

There is a saying, "data rich and information poor," that applies here. Data is abundantly available from various reports and computer printouts. This abundance of data is often overwhelming and complicated. Looking at a two-inch-thick computer printout can bring on analysis paralysis. What may be lacking is data that provides information on which to base predictions directed at improvement; data that will answer your questions. Often, the sheer volume of data creates complexity. Remember, the role of measurement data is insight—not numbers. **KEEP IT SIMPLE!**

Can Performance Meet Needed Goals?



Compare the results of measurement data to customer needs

Module 3, Lesson 1, Viewgraph 13

- **Select the measurements that best determine whether process performance can meet customer needs**

  - **Process Control.** Is routine monitoring detecting out-of-control conditions? Are out-of-control conditions being eliminated? Is the process consistently being performed in the same manner? Is the measurement taken consistently?

  - **Process Capability.** Can your process meet your customers' needs? In other words, "Is your process stable?" Both conditions, being in control and meeting customer needs, are required for capability.

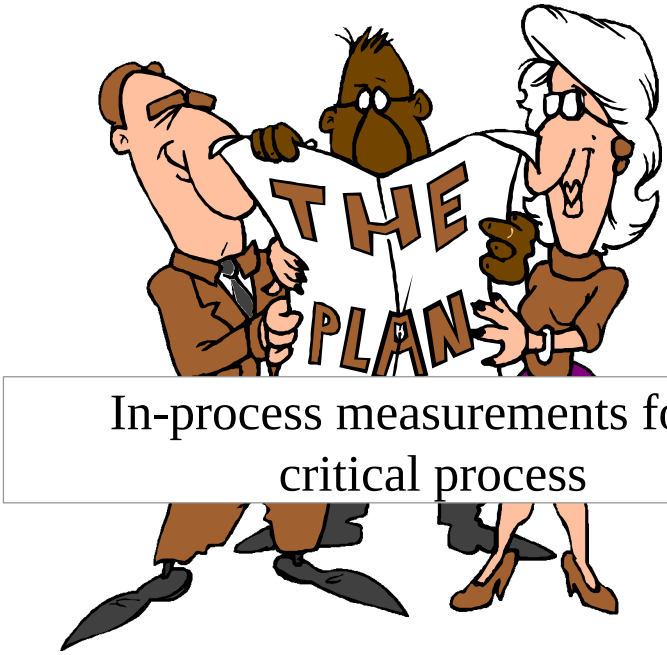
  - **Process Improvement.** What can you do to get improved results from the process? A fundamental change in the process will be required to achieve new levels of performance.

☞ **INSTRUCTOR NOTE.** Inform participants that Lesson 3 will show them the steps to take to improve processes. Process improvement is mentioned here because setting process goals will eventually mean making the decision to improve.

✉ **CASE STUDY NOTE**

Post the Case Study Process Measurement Chart (CASE-22) on the Storyboard and label it Step 8.

Product of Lesson 1



In-process measurements for the critical process

Module 3, Lesson 1, Viewgraph 14

LESSON SUMMARY. The detail work of measuring is often overlooked and undervalued. QMB members are responsible for turning this around. To equip you to do this, the concept of a data collection plan was introduced. You learned why and how to collect measurement data and how to use it.

In this lesson you learned the importance of measuring processes in ways that are important to your customers and that will help you to improve.

Methods for Managing Quality

Module 3

Lesson 2

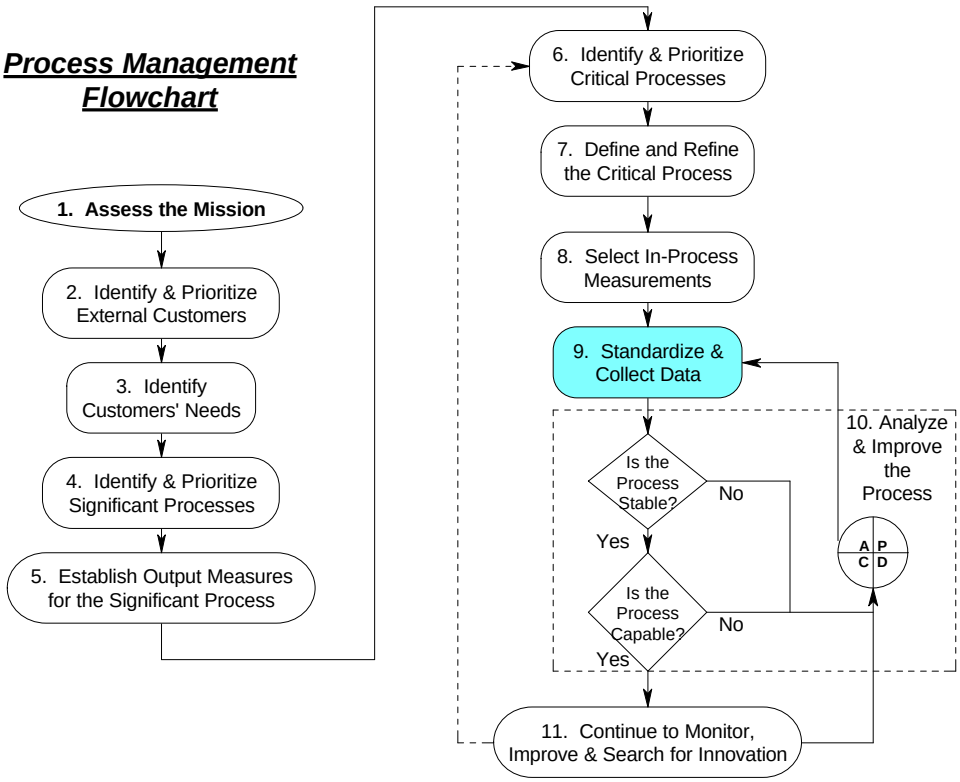
Standardize and Collect Data

Learning Objectives:

- Explain the importance of process standardization
- Explain how to achieve process standardization
- Explain the importance of baseline data

Module 3, Lesson 2, Viewgraph 1

LESSON OVERVIEW. Step 9 of the Process Management Flowchart is the focus of this lesson. The concept of standardization—what it is, what its benefits are, and how to achieve it will be discussed.



Module 3, Lesson 2, Viewgraph 2

☞ **INSTRUCTOR NOTE.** Orient the participants by showing the Process Management Flowchart with Step 9 highlighted.

Standardization

- Performing the present process as it is defined
- Benefits of Standardization
  - Provides reliable data
  - Is required to change the system
  - Builds trust
- Standardization and Improvement
  - Standardization - before improvement
  - Baseline - the starting point in any improvement

Module 3, Lesson 2, Viewgraph 3

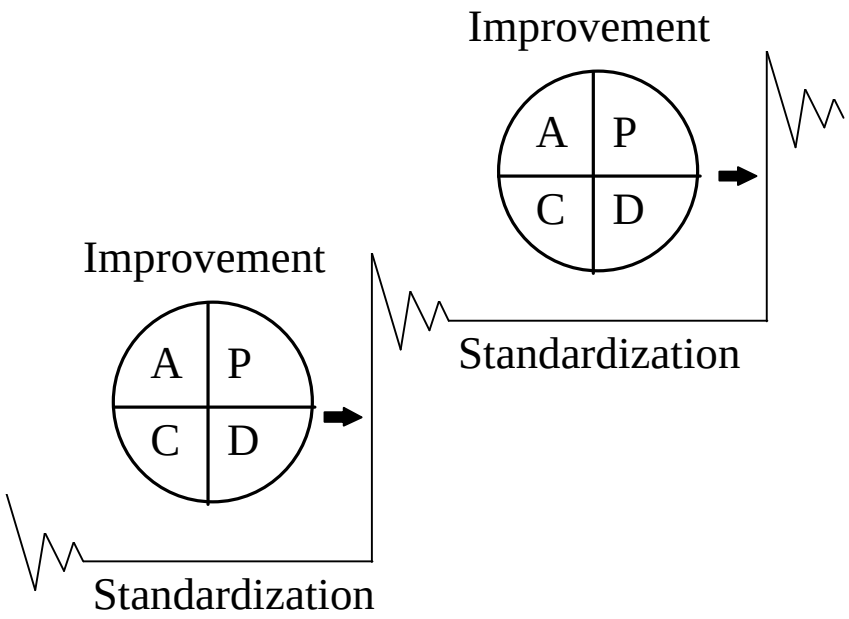
- **What are the benefits of standardization?**

  - **It provides reliable data.** Standardization produces valid data, representative of the way things are being done. If the process is not performed consistently in the same way, the data collected is not reliable and should not be used. You cannot predict what will happen next if the data the prediction is based upon is not consistent.

  - **It is required to change the system.** Improvement to the overall system should ONLY be based on data collected from a standardized process. Processes should be improved after they are brought into control. They can only be brought into control when they are standardized. Standardization prevents backsliding.

  - **It builds trust.** Because the process is performed routinely in the same manner, trust is built. Standardization brings the reassurance that things won't be changed from day-to-day. It becomes easier to focus on the process, not the worker. Standardizing the process produces data which illustrates the variability of the process. The need to interfere by reacting to a single data point is eliminated.

Process Standardization



Module 3, Lesson 2, Viewgraph 4

- **Standardization and improvement**

The PDCA cycle is an essential tool for realizing improvement and ensuring that the benefits of improvement last. Even before the PDCA cycle is employed, it is critical that the current process be standardized.

- **Standardization.** A process must be standardized—that is, everyone performs the process the same way every time—before it can be improved using data.

- **Baseline.** The starting point in any improvement effort is to know exactly where things stand. Unless you establish a baseline, you can't tell whether changes in the process have any effect on the output of the process.

☞ **INSTRUCTOR NOTE.** Post a copy of the Process Standardization viewgraph (CASE-23) on the Storyboard and label it Step 9.

How to Achieve Standardization

- Identify and remove barriers
- Demonstrate benefits
- Train
- Recognize/reward

Module 3, Lesson 2, Viewgraph 5

What are the actions required of the QMB to standardize? Each member must lead the way by asking questions, reviewing Process Measurement Charts and measurement data, and exhibiting a personal interest in the efforts of others to standardize. Members of the QMB should provide positive reinforcement. Some of the ways to achieve standardization are:

- **Identify and remove barriers**

As a QMB member, you have the responsibility to identify and remove barriers to standardization. Typical barriers you might encounter include:

- The belief by employees that "their way is better." There is a fine line to watch for in defining the level of detail you are attempting to standardize. If the level of detail is too minute, it can infringe on the individuality of the person performing the work, creating a barrier.
- Managers who are not interested in solving the problem, only in getting the job done this time.
- Fire fighting.
- People's fear of becoming robots.

Standardization requires a change in both our beliefs and performance. Resistance to change in itself, is a barrier.

- **Demonstrate benefits**

Communicating the importance of standardization by presenting the benefits of this step to employees and higher level managers will enhance your ability to standardize. A standardized process—one that is well defined and documented—can be performed even if an employee is absent or unavailable.

- **Train**

Training is an important factor in achieving standardization. Managers often assume that employees know how to do a task when this may not be the case. Use a flowchart to train employees on how to perform their work so that they can see the benefits of standardization.

- **Recognize/reward**

Standardization is not often recognized or rewarded. The current practice is to recognize and reward individuals rather than teams, often encouraging non-standard performance and sub-optimization. Managers must understand how important standardization is to improvement if this practice is going to change.

☞ **INSTRUCTOR NOTE.**

- ASK the participants to identify some of the reasons why standardization is resisted.
- ANSWERS might include:

  ⇒ It's an emotional issue

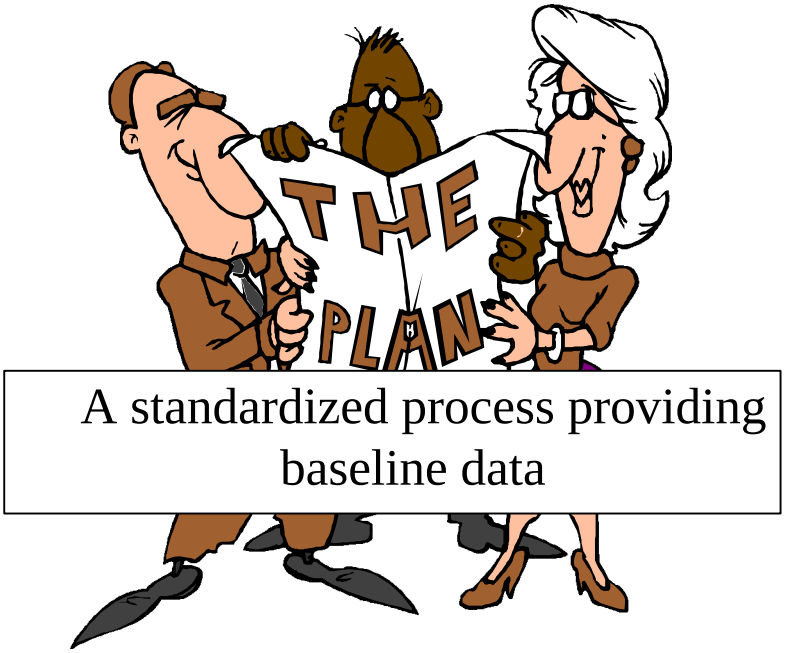
  ⇒ Eliminating steps brings the fear that the job will be eliminated

  ⇒ People don't trust the process

  ⇒ It won't be done my way

  - Use the discussion to surface the participants' own resistance to standardization.

Product of Lesson 2



A standardized process providing baseline data

Module 3, Lesson 2, Viewgraph 6

LESSON SUMMARY. In this lesson you have learned the importance of and how to achieve a standard process. The product of this step will be used in Step 10 to analyze baseline data.

Methods for Managing Quality

Module 3

Lesson 3

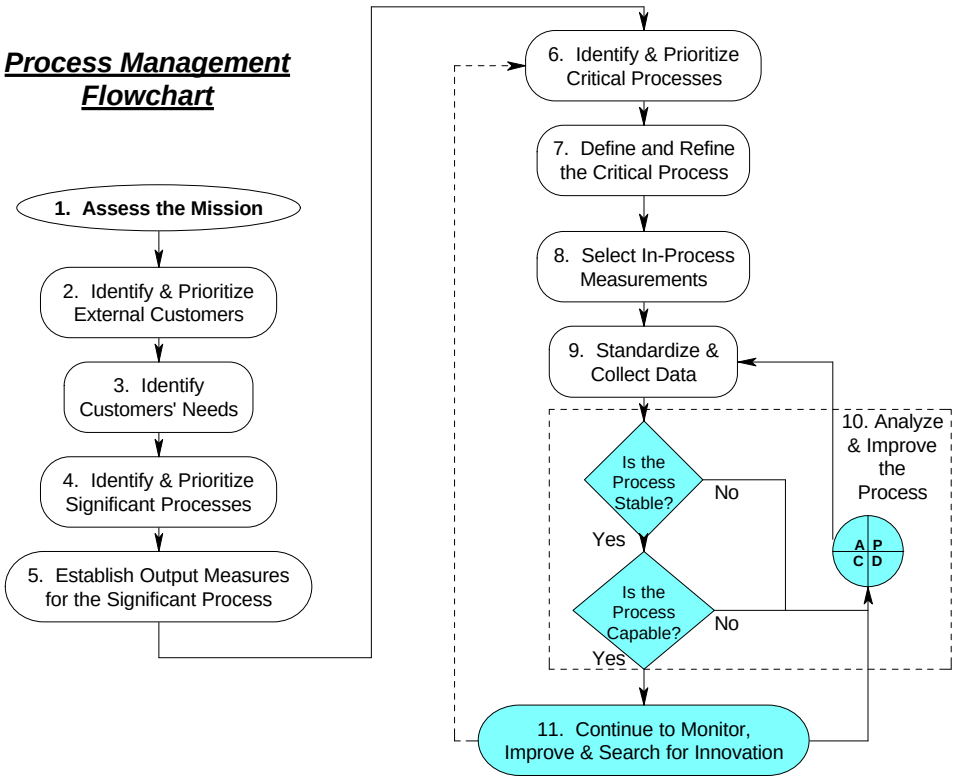
Analyze & Improve the Process

Learning Objectives:

- Explain the importance of assessing and achieving stability of a process
- Explain the importance of assessing and achieving capability of a process
- Explain the importance of continually improving a process

Module 3, Lesson 3, Viewgraph 1

LESSON OVERVIEW. Steps 10 and 11 of the Process Management Flowchart are the focus of this lesson. The importance of data analysis and process improvement will be discussed.



Module 3, Lesson 3, Viewgraph 2

☞ **INSTRUCTOR NOTE.** Orient the participants by showing the Process Management Flowchart with Steps 10 and 11 highlighted.

Process Control versus Process Improvement

The decision to act is made after analyzing measurement data

Module 3, Lesson 3, Viewgraph 3

You have identified what you need to know to determine customer needs and translate them into output and in-process measurements. This activity usually results in a long list. Because it is not practical to measure everything on this list, you will need to select just a few key measurements. By anticipating how you will use measurement data, you will improve your ability to make the right process measurement selection. To anticipate how your data will be used, it is important to understand the concept of control and the strategy and techniques of using control charts to gain insights into your process.

- **Process control:** The detection and elimination of special causes.
- **Process Improvement:** The introduction of beneficial change (reducing common causes of variation). The decision to improve is made after analyzing measurement data.

Measurements taken from a repeatable process form a pattern that reveals the variability and central tendency of a process. Knowing how your process performs—by identifying its variability and central tendency—can provide vital information that will help you make the decision to continue performing the process or to start a formal process improvement effort.

To be successful at process improvement, you must:

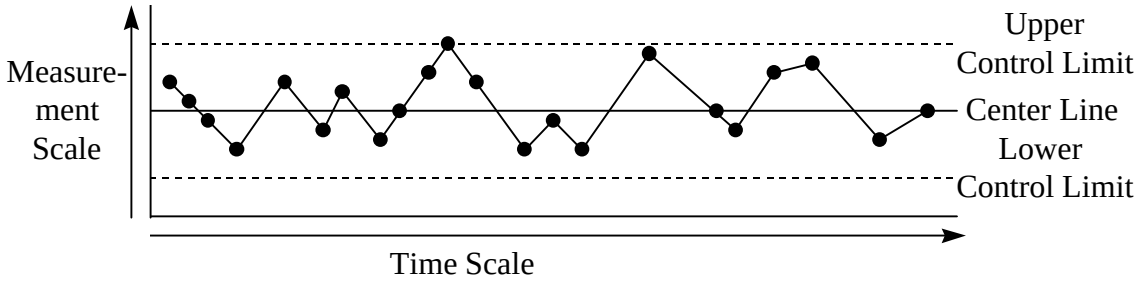
- Understand the pattern of the data. You need to be able to distinguish between special and common cause variation.

- Act to eliminate whatever is degrading the process. Special cause conditions must be identified and removed or incorporated into the process.

- Be able to predict what will happen. Only by analyzing data which depicts stable past performance can you predict.

☞ **INSTRUCTOR NOTE.** Discuss the pitfalls of acting on common cause variation as though it were special cause variation, and vice versa.

Control Chart



- Graphic display of process variation over time
- Used to determine process stability

Module 3, Lesson 3, Viewgraph 4

A tool you can use to analyze data from a process is the Control Chart, which uses graphical means to show process variation over time. This tool helps you to differentiate between common and special causes of variation in a process. Identifying common and special causes of variation allows you to determine whether your process is stable.

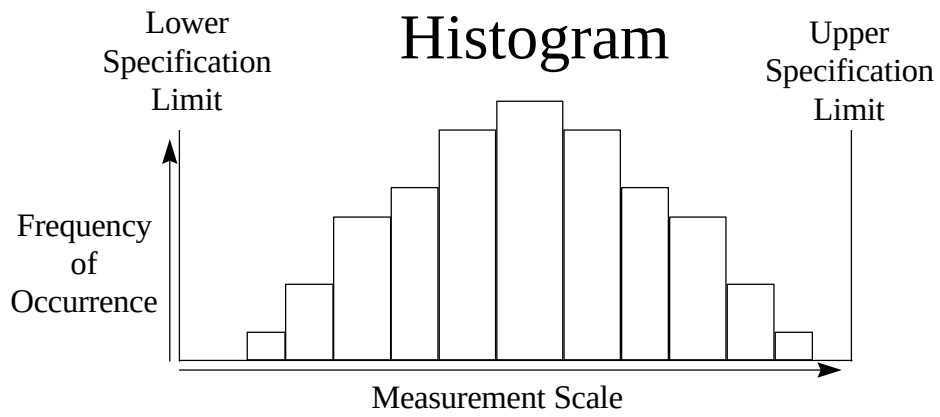
When your Control Chart shows signals of special cause variation, specific action must be taken before you endeavor to improve the process. The source and effect of the special cause must be investigated. The result of this investigation will determine the action to be taken.

- If the effect was negative, the source must be identified and eliminated, if possible. If it cannot be eliminated (natural catastrophic, etc.) it must at least be documented.

- If the effect was positive, the source must be identified and, if possible, incorporated in the process (standardized).

- Only after all signals of special cause variation have been investigated and eliminated, incorporated or accounted for, can the capability of the process be assessed and process improvement pursued.

☞ **INSTRUCTOR NOTE.** Post a copy of the Control Chart viewgraph (CASE-24) on the Storyboard and label it Step 10.



- A picture of process capability
  - Time independent
  - Order of data not important
  - Performance of process within specification limits
  - Prerequisite is stability

Module 3, Lesson 3, Viewgraph 5

Another tool you can use to analyze data from a process is a Histogram, a vertical bar graph that depicts the distribution of a set of continuous data. It shows the frequency, or the rate, of occurrence of the values present in a data set.

Process capability describes the predictable distribution of performance within specifications of a stable process. It is usually shown in a Histogram.

The Histogram will help determine if a stable process is meeting customer needs.

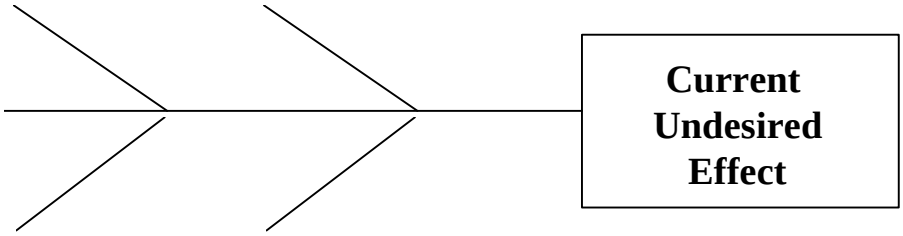
- If it **is not** meeting customer needs (not capable), you must improve the process to achieve capability.

- If it **is** meeting customer needs (capable), you must continue to monitor and improve the process.

The currently accepted definition of "World-Class Quality" is "on target with minimum variance." To achieve this, process performance must be centered on the nominal value specified by the customer and vary minimally from that value. The histogram is very effective at depicting process centering and variation around the target value relative to customer defined specifications.

☞ **INSTRUCTOR NOTE.** Post a copy of the Histogram viewgraph (CASE-25) on the Storyboard next to the Control Chart and label it Step 10.

Root Cause Analysis



- Identify root causes
- Verify causes with data

Module 3, Lesson 3, Viewgraph 6

- **Identify root causes.**

Use root cause analysis to determine root causes that prevent the process from delivering the desired results. This analysis identifies root causes which, when appropriately acted upon, will improve the process.

The primary tool for identification of root causes is the Cause-and-Effect Diagram (also known as the fishbone or Ishikawa diagram).

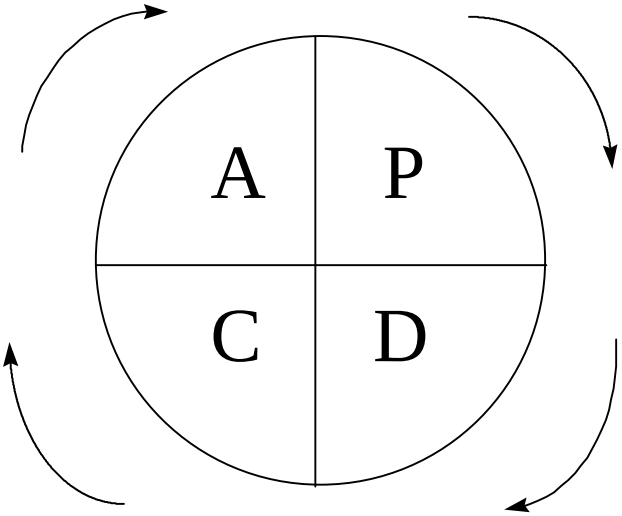
✉ **CASE STUDY NOTE** Post a copy of the Cause-and-Effect Diagram viewgraph (CASE-26) on the Storyboard and label it Step 10/11.

- **Verify causes with data.**

  - Gather data using check sheets, surveys, and existing records.

  - Verify cause-and-effect relationship using data analysis tools such as the Scatter Diagram.

To Act on Causes of Variation...



Module 3, Lesson 3, Viewgraph 7

- **Use the PDCA Cycle**

Step 10 introduces a PDCA Cycle nested in the larger PDCA Cycle of the Process Management Flowchart.

- Beginning in the **PLAN** phase, you identify possible root causes of variation. You use prioritization tools such as the Interrelationship Digraph and Matrices to help you determine which cause(s) to attend to first. You verify those cause(s) with data, analyzing the relationship between process variation and output variation. You theorize improvements to reduce the variation and plan tests of your theories.

- In the **DO** Phase, you implement improvement(s) on a small scale. You collect data, ensuring that the measurements taken before and after implementation of the improvement correlate, so a meaningful comparison of performance can be made.

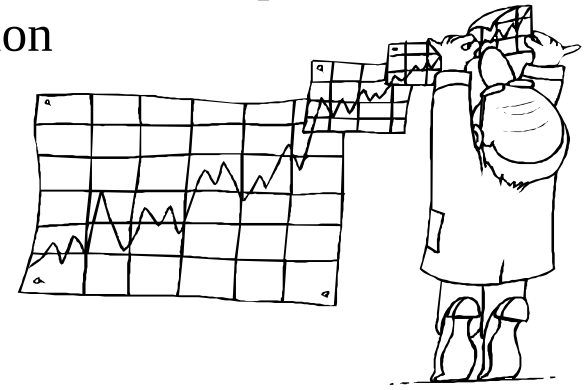
- In the **CHECK** phase, you compare “before” and “after” data to determine if your improvement theory was correct.

- In the **ACT** phase, you return to Step 9 and either standardize the verified improvement into the process or, in the event of an unsuccessful test, return to the previously standardized process and try again.

☞ **INSTRUCTOR NOTE.** Convey the importance of using a systematic approach to improve a process. The benefits of using a structured approach, proven techniques, and the basic graphic tools cannot be emphasized strongly enough. The SAPI course covers the PDCA activities in detail.

Holding the Gains

- Standardize the improved process to hold the gains
- Continue to monitor, improve, and search for innovation



Module 3, Lesson 3, Viewgraph 8

- **Standardize the improved process**

The final step (Step 11) of the Process Management Flowchart is to continue to monitor and search for innovation. Once a process has been improved and is meeting the customers' needs, then the process changes that led to the improvement must be maintained to hold the gains.

It is important to incorporate the change into the standard operating procedures and train employees on the new process. It may be necessary to get higher level QMB or ESC assistance to ensure that these steps are accomplished.

- **Continue to monitor, improve and search for innovation**

Holding the gains for a higher level of quality requires the ongoing measurement of critical process variables. The purpose of such measurement or monitoring is to ensure that process performance does not deteriorate.

Monitoring is used to prevent backsliding, prevent the introduction of new complexities, and ensure that the customers' needs are continually being met.

Since the process is doing what it's supposed to do, the process owner should examine how the process is being monitored to determine whether the way measurements are taken should be changed. If the process has a history of stability, reducing the frequency of taking measurements may be appropriate. Is the process being monitored hourly, daily, weekly, monthly? Could the frequency be reduced from hourly to daily; from daily to weekly; from weekly to bimonthly?

It may be worth considering changing the method used to monitor the process. Could the number of in-process measurements be reduced? Could the sampling be accomplished using fewer resources? The important thing is to continue to monitor the process and periodically revisit your strategy.

Remember that process management efforts are a continuous activity. Holding the gains does not mean we stop here. The QMB should always strive to improve the process and search for innovation. As resources allow, the QMB should return to Step 6 and select the next Critical Process for improvement. **The iterative selection and study of critical processes should always be carried out with optimization of the significant process as the goal.**

☞ **INSTRUCTOR NOTE.** One evolution of the PDCA cycle of the Process Management Flowchart is complete. Take a few minutes to discuss with the participants what happens next. Make the following points:

⇒ If your real-life experience is similar to the Case Study, in which only one process was selected initially, you should revisit your Combination Interrelationship Digraph Matrix to determine whether the next highest priority process should be the next target for improvement.

⇒ Continuous communication between the organization and its customers, the ESC and QMBs, process workers and process owners is essential to maintain the systems view and avoid suboptimization.

⇒ Periodically, you should review each step of the Process Management Flowchart to ensure that new information and goals are considered and factored in.

⇒ By consistently following the Process Management Flowchart, you will change the direction of your efforts so that the tasks you do will be directed at meeting the customers' needs and the organizations' needs and are continually improved at every opportunity.

✉ **CASE STUDY NOTE.** This is the final activity involving the Case Study. It is important not to let it be anticlimactic, so be enthusiastic and positive.

⇒ Ask the participants to retrieve the Case Study Wrap-up (CASE-27) to use as the mechanism for reviewing process management.

⇒ Review the QMB's journey to improvement, incorporating participant input by asking questions about each section of the Case Study.

⇒ Highlight what occurred as the QMB analyzed the measurement data and what action resulted.

- Be sure to recognize the benefits of the QMB's efforts besides the bottom-line rewards of increased customer satisfaction and reduced costs:

⇒ focus on the Mission of the organization

⇒ experience in process improvement

⇒ development of team dynamics

⇒ awareness of the importance of customer input

⇒ a completed PDCA cycle

⇒ standardization

- A learning organization, defined in the *DON TQL Glossary* as “A term popularized by Peter Senge in reference to organizations characterized by a cycle of learning that produces new capacities and fundamental shifts of mind, both individually and collectively.” Wrap up with a discussion of this concept.

Product of Lesson 3

A predictable process that is
"on target with minimum variance"

Module 3, Lesson 3, Viewgraph 9

LESSON SUMMARY. The product of Lesson 3 is an improved process which has been standardized, measured, and monitored. You realized this improvement by applying the PDCA Cycle. In order to hold the gains achieved by using the PDCA Cycle, you learned the importance of continuous monitoring. Because the drive for improvement is continuous, the next step is to select the next process for improvement.