Methods for Managing Quality

Module 2

Identify the Critical Process

Lesson 1	Identify & Prioritize Critical Processes
Lesson 2	Define & Refine the Critical Process

Module 2, Viewgraph 1

Module 2 teaches the steps and tools needed to identify and select the critical process and to define and refine this process using a systematic approach. In this module, participants will learn to select the critical process for the QMB's significant process, define it by flowcharting, and refine it by eliminating obvious complexity such as duplicate steps, rework, and delays.

☞ **INSTRUCTOR NOTE.** Inform participants that Module 2 further reduces the big picture, translating it into smaller pieces. This module will take the big picture—our significant process—and break it down by identifying the individual critical processes on which to focus.

Methods for Managing Quality

Module 2

Lesson 1

Identify & Prioritize Critical Processes

Learning Objectives:

- Explain the importance of identifying & prioritizing critical processes
- Describe the purpose and construction of an Interrelationship Digraph (ID)

Module 2, Lesson 1, Viewgraph 1

LESSON OVERVIEW This lesson concentrates on Step 6 of the Process Management Flowchart. The product from this step is a prioritized list of processes critical to improving customer satisfaction. The Case Study continues to provide an opportunity for participants to practice the tools in context of the Process Management Flowchart.

Learning Objectives:

- Explain the importance of identifying & prioritizing critical processes
- Describe the purpose of an Interrelationship Digraph (ID)

Identify & Prioritize Critical Processes

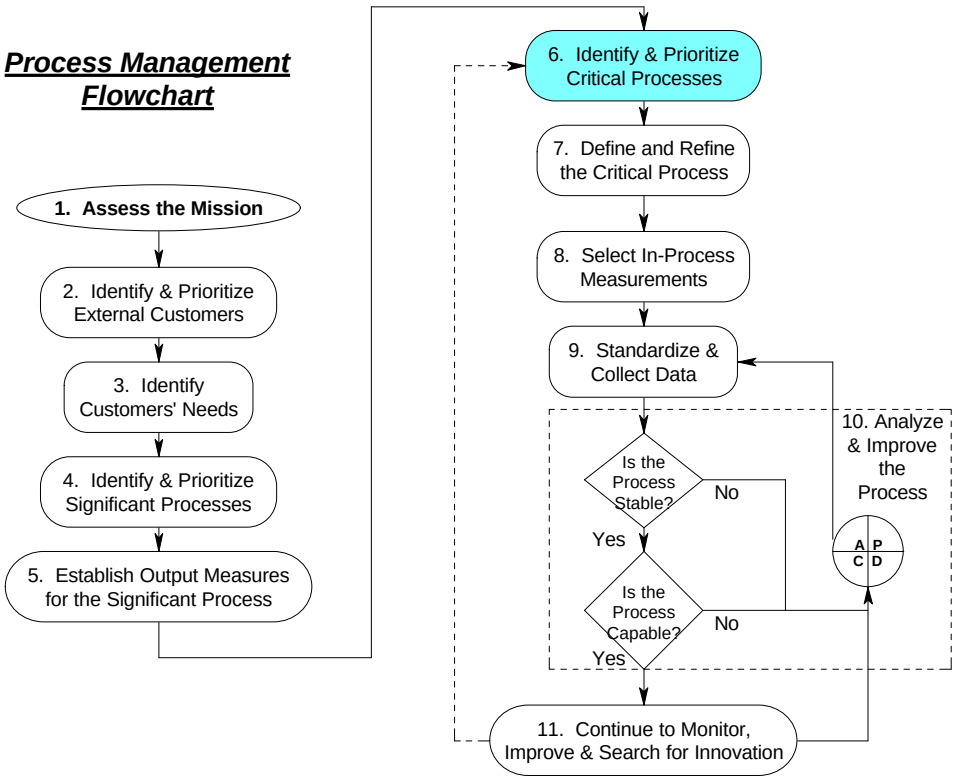
Learning Objectives (Cont.):

- Describe the purpose and construction of a Combination Interrelationship Digraph/Matrix
- Construct a Combination Interrelationship Digraph Matrix to prioritize an organization's critical processes

Module 2, Lesson 1, Viewgraph 2

Learning Objectives (Cont.):

- Describe the purpose and construction of a Combination Interrelationship Digraph/Matrix
- Construct a Combination Interrelationship Digraph Matrix to prioritize an organization's critical processes



Module 2, Lesson 1, Viewgraph 3

☞ **INSTRUCTOR NOTE.** Orient the participants by showing the Process Management Flowchart with Step 6 highlighted.

How to Identify the Critical Processes

- Make a list of all processes required to provide the product or service
- Review the list for completeness
- Record the results
- Choose the critical process

Module 2, Lesson 1, Viewgraph 4

Typically, we converge resources on the process making the most “noise.” As the saying goes, “The squeaky wheel gets the grease.” In these instances, band aids are affixed or new remedies provided. Tampering often takes over until there is no recognizable process. The message here is that processes need to be managed. Improvement efforts must be planned and directed to those processes that yield the greatest increase in customer satisfaction. These are called the “critical” sub-processes of the significant process the QMB has been chartered to manage.

- **Prepare a list of all processes required to provide the product or service using:**
    - a macro-level flowchart of the Significant Process provided by the ESC (the steps will indicate critical processes)
    - the Tree Diagram created in Step 4 of the Process Management Flowchart
- **Review the list for completeness**

In addition to the processes directly required to provide the major product or service, are there additional processes which should be included (e.g., the planning process)?

- **Record the results**

Always remember to document your work on the storyboard.

- **Choose the critical process(es)**

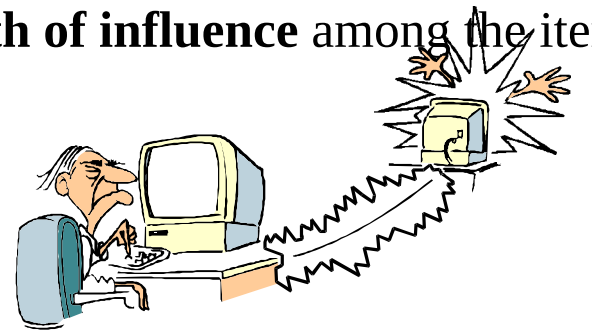
You will learn here two methods of choosing the critical process(es).

  - Group consensus. When it is overwhelmingly evident that one or more of the processes identified as critical is in immediate need of improvement, the group can select the critical process by consensus.

  - Combination Interrelationship Digraph Matrix. If the choice is not obvious, or if the team is not in agreement, use the Combination Interrelationship Digraph Matrix method.

What is a Combination Interrelationship Digraph Matrix?

A tool that helps define causal relationships among data by exploring the **direction** and **strength of influence** among the items.



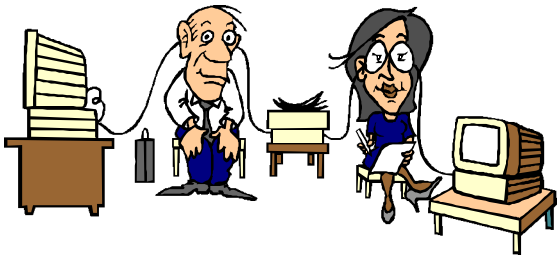
Module 2, Lesson 1, Viewgraph 5

People sometimes use combinations of the 7MP tools for specific purposes. The *Memory Jogger+* introduces a hybrid called the Combination Interrelationship Digraph Matrix. This matrix helps you identify leverage points for study and improvement by identifying the causal relationships in sets of data. It is, as the words imply, a combination of two of the 7MP tools, the Interrelationship Digraph and the Matrix Diagram (introduced in Module 1).

However, before you can fully understand and apply the power of the Combination Interrelationship Digraph Matrix, you must first understand the concepts of the Interrelationship Digraph.

What is an Interrelationship Digraph?

A diagram of **causal relationships** used to solve complex problems



Module 2, Lesson 1, Viewgraph 6

Many people are accustomed to using graphic tools such as bar charts and flow charts that show linear relationships among items. What is often harder to see is the web of cause and effect that is really at work in a complex process or organization.

The interrelationship Digraph (ID) is an “out of the box thinking” tool that graphically displays the **pattern** of relationships and interaction—particularly cause and effect--within a set of items. The ID allows you to focus your team’s efforts by distinguishing between **root causes** and **outcomes**. Some sources call this tool a relations diagram.

How to Construct an Interrelationship Digraph

- ◆ State the problem, issue or question
- ◆ Record/display elements on cards
- ◆ Connect cards with cause & effect arrows
- ◆ Study and analyze the diagram
- ◆ Revise and finalize the diagram

Module 2, Lesson 1, Viewgraph 7

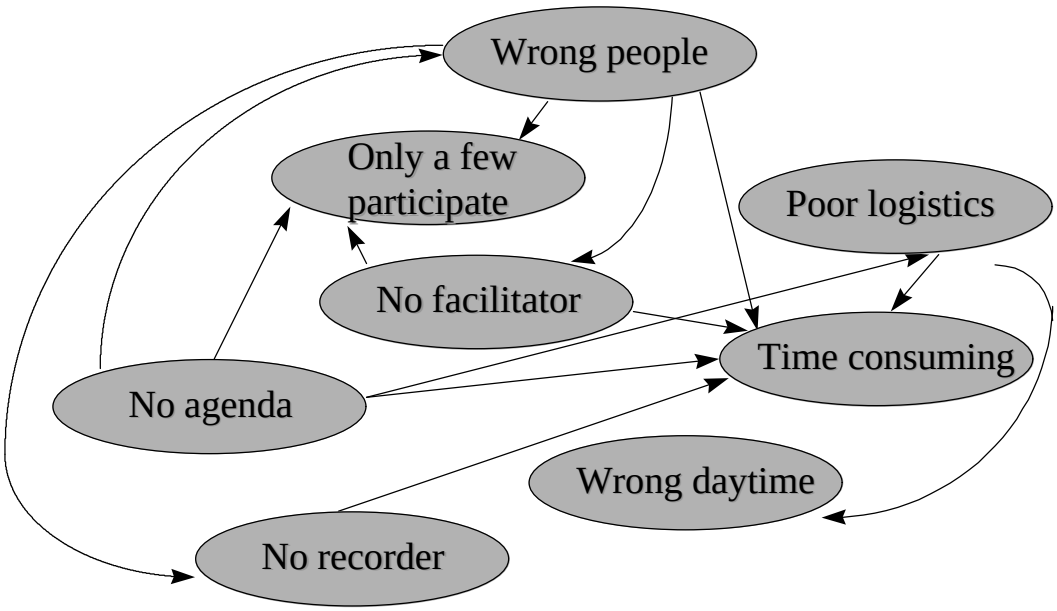
- **State the problem, issue, or question**

Compose one statement that clearly defines the key issue. In the ID example illustrated on the next two pages, the issue is low attendance at meetings.

- **Record/display elements on cards**

Obtain ID cards from the header cards of an Affinity Diagram, from a Cause-and-Effect or Tree Diagram, or by brainstorming. Display the cards on a large work surface so that all of the cards can be seen at once by everyone.

Interrelationship Digraph



Module 2, Lesson 1, Viewgraph 8

- **Connect card with relationship arrows**

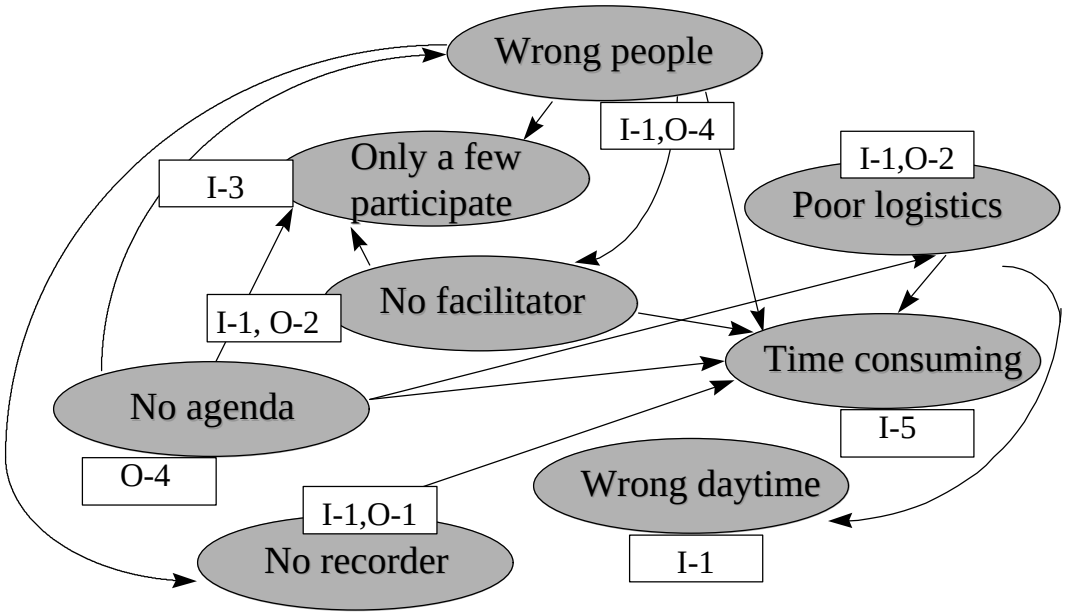
  - Compare items one at a time by selecting a card and asking the question, “Does this card have an effect on this other card?”

  - Draw an arrow from the selected card to all other cards which are caused or influenced by it.

  - Repeat the question for each card in the diagram.

    - Ask questions only in one direction. This helps eliminate confusion and ensures that each card is addressed.
    - Arrows can go in only one direction. Draw the arrow in the direction of the stronger influence.
      - To avoid confusion when lines cross, bridge over the line. __∩__

Evaluate and Interpret the ID



Module 2, Lesson 1, Viewgraph 9

- **Revise and finalize the diagram**

You may decide to make changes in the diagram based on input from team members or others. For this reason, it helps to build the I.D. on a white board or other surface that makes it easy to change the arrows. Using "stickies" for the elements lets you easily move the cards around too. Sometimes teams are tempted to *add* elements during this process. If you do you may find that the diagram grows out of control and the meaning becomes muddled. Try to stick with what you have and focus on relationships among the existing cards.

- Count and record the total number of arrows leaving an item. These are referred to as the **out** arrows.

- Count and record the total number of arrows entering an item. These are referred to as the **in** arrows.

- Identify root causes. A high number of **out** arrows indicates a **root cause**. Changing this item will have an impact on each item it causes or influences.

- Determine **effects**. A high number of **in** arrows indicates an **effect** or secondary issue. Although this item may be very important, a change in it will have little effect on any other item. Additionally, to change this item, many other items—the ones from which this item receives arrows—may have to be changed first.

The ID is a very powerful technique for uncovering unknown patterns of cause and effect. However, it does not distinguish the strength of the cause-and-effect relationship. The Combination ID Matrix method may be more useful for process management because it shows both the direction of influence and the strength of that influence. In developing a Combination ID Matrix, the entire team can bring its collective expertise to bear to achieve consensus on process relationships and strengths.

☞ **INSTRUCTOR NOTE.** Have the students build the Interrelationship Digraph. Explain that the Interrelationship Digraph is another tool; however, this exercise is only for practice. It will not be used with the CASE STUDY. Either have the students select their own idea or give examples of subjects (i.e., effective or ineffective meeting, training, or sports practice).

How to Construct a Combination Interrelationship Digraph Matrix

- State the problem, issue, or question
- Enter the items to consider on the vertical and horizontal axes
- Block out the cells that compare each item to itself

Module 2, Lesson 1, Viewgraph 10

- **State the problem, issue, or question**

Ensure that everyone understands the aim of using the matrix. This tool can become complex and involved in the completion of the cells. Teams can become “lost” in the details if there isn’t a clear understanding going into it as to what question you are trying to answer.

- **Enter the items to consider on the vertical and horizontal axes.**

The items can be obtained from the header cards of an Affinity Diagram, the bones of a Cause-and-Effect Diagram, a level of a Tree Diagram, or from brainstorming.

- **Cross out cells that compare items to themselves**

A diagonal line of cells across the center of the matrix represents the comparison of each item to itself. Most teams find it less confusing to line through, color in, “X” out, or otherwise block out these cells before they begin working through the matrix.

How to Construct a Combination Interrelationship Digraph Matrix (Cont.)

- Determine relationship strengths
- Draw a symbol for each relationship

◉	For a strong relationship
○	For some relationship
△	For a weak relationship
———	For no relationship

Module 2, Lesson 1, Viewgraph 11

- **Determine relationship strengths. Determine the strength of relationships, if any, one at a time**
- **Draw a symbol for the strength of each relationship:**

⦿ Strong relationship

○ Some relationship

Δ Weak relationship

— No relationship

How to Construct a Combination Interrelationship Digraph Matrix (Cont.)

- Draw arrows to show cause and effect
  - Ask, “Does the item on the left cause or influence the item above?”
  - If the answer is “yes,” draw an OUT arrow
  - If the answer is “no,” draw an IN arrow
- Total the data and draw your conclusions

Module 2, Lesson 1, Viewgraph 12

- **Draw arrows to show cause and effect**

  Working along a row, ask the question, “Does the item on the left cause or influence the item above?”

  If the answer is “yes,” draw an arrow pointing toward the item above. This is an OUT arrow.

  If the answer is “no,” and the item above seems to be causing or influencing the item on the left, draw an arrow pointing toward the item on the left. This is an IN arrow.

- **Total the data and draw your conclusions**

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs
Ensure Connectivity							
Deconflict BG units and contacts							
Detach ASW attack units							
Receive contact reports							
Advise BG Commander							
Position ASW units							
Coordinate with other Warfare Cdr							

Construct an L-shaped matrix comparing all processes to each other

Module 2, Lesson 1, Viewgraph 13

Now, let's walk through construction of a Combination Interrelationship Digraph Matrix (Combo ID) as it is used for Process Management. The same ASW scenario as was used with the Matrix Diagram (Step 4) will be used. The items listed here are sub-processes of the significant process "Coordinate BG ASW CCC."

- **Construct an L-shaped matrix comparing all of the processes to each other**

List the items to be prioritized on both the vertical and horizontal sides of the matrix.

☞ **INSTRUCTOR NOTE.** Mention that the recommended method for constructing a Combination ID Matrix is to enter the full item description on both the vertical and horizontal axes. Explain that using coding or numbering on one of the axes, rather than the full description, sometimes causes confusion.

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs
Ensure Connectivity							
Deconflict BG units and contacts							
Detach ASW attack units							
Receive contact reports							
Advise BG Commander							
Position ASW units							
Coordinate with other Warfare Cdr							

Block out cells that compare items to themselves

Module 2, Lesson 1, Viewgraph 14

- **Block out cells that compare items with themselves**

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs
Ensure Connectivity	X	⊙	△	⊙	—	⊙	○
Deconflict BG units and contacts		X					
Detach ASW attack units			X				
Receive contact reports				X			
Advise BG Commander					X		
Position ASW units						X	
Coordinate with other Warfare Cdr							X

Compare each item to all others for relationship and strength

Module 2, Lesson 1, Viewgraph 15

- **Compare each item to every other item to determine whether there is a relationship**

Ask the following questions:

Is there a relationship between the item on the left and the item above?

If yes, what is the strength of the relationship?

☞ **INSTRUCTOR NOTE.** Emphasize that the comparison should be done by rows and that entries should be made on the right side of the diagonal line only.

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs
Ensure Connectivity	X	⊙	△	⊙	—	⊙	○
Deconflict BG units and contacts	⊙	X					
Detach ASW attack units	△		X				
Receive contact reports	⊙			X			
Advise BG Commander	—				X		
Position ASW units	⊙					X	
Coordinate with other Warfare Cdr	○						X

Fill in the left side of the matrix (mirror image)

Module 2, Lesson 1, Viewgraph 16

- **Fill in the left side of the Matrix**

The left side of the Matrix is a mirror image of the right side.

To complete the left side, copy the entry in the row for the first item into the column for the same item, and continue making entries down the column until all have been copied.

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs
Ensure Connectivity	X	⊙ ↑	△ ↑	⊙ ↑	—	⊙ ←	○ ↑
Deconflict BG units and contacts	⊙	X					
Detach ASW attack units	△		X				
Receive contact reports	⊙			X			
Advise BG Commander	—				X		
Position ASW units	⊙					X	
Coordinate with other Warfare Cdr	○						X

For each relationship, determine the direction of cause or influence

Module 2, Lesson 1, Viewgraph 17

- **For each pair of items which have a relationship, determine the direction of cause or influence**

  Ask the following question: “Does the item on the left cause or influence the item above?”

  If the answer is “yes,” draw an OUT arrow (OUT of the row or UP).

  If the answer is “no,” ask whether the item above causes or influences the item on the left.

  ⇒ relationship If the answer is now “yes,” draw an IN arrow (INTO the row or LEFT).

  ⇒ If the answer is “no,” reevaluate the pair of items for any relationship.

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Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs
Ensure Connectivity	X	⊙ ↑	△ ↑	⊙ ↑	—	⊙ ←	○ ↑
Deconflict BG units and contacts	⊙ ←	X					
Detach ASW attack units	△ ←		X				
Receive contact reports	⊙ ←			X			
Advise BG Commander	—				X		
Position ASW units	⊙ ↑					X	
Coordinate with other Warfare Cdr	○ ←						X

Complete the left side of the matrix (mirror image)

Module 2, Lesson 1, Viewgraph 18

- **Complete the left side of the Matrix**

Copy the relationship arrows from the **ROW** for the first item to the **COLUMN** for the same item.

If an arrow is vertical in the row, it will be horizontal in the column when it is copied.

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs
Ensure Connectivity	X	⊙ ↑	△ ↑	⊙ ↑	—	⊙ ←	○ ↑
Deconflict BG units and contacts	⊙ ←	X	△ ↑	○ ←	△ ↑	⊙ ←	○ ←
Detach ASW attack units	△ ←	△ ←	X	⊙ ←	△ ←	○ ←	○ ←
Receive contact reports	⊙ ←	○ ↑	⊙ ↑	X	⊙ ↑	○ ↑	△ ←
Advise BG Commander	—	△ ←	△ ↑	⊙ ←	X	○ ↑	△ ←
Position ASW units	⊙ ↑	⊙ ↑	○ ↑	○ ←	○ ←	X	○ ←
Coordinate with other Warfare Cdr	○ ←	○ ↑	○ ↑	△ ↑	△ ↑	○ ↑	X

Complete the remainder of the matrix, by rows

Module 2, Lesson 1, Viewgraph 19

- **Complete the remainder of the Matrix**

Working by rows, complete the Matrix.

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs	IN	OUT	TOTAL	STRENGTH
Ensure Connectivity	X	⊙ ↑	△ ↑	⊙ ↑	—	⊙ ←	○ ↑	1	4	5	31
Deconflict BG units and contacts	⊙ ←	X	△ ↑	○ ←	△ ↑	⊙ ←	○ ←	4	2	6	26
Detach ASW attack units	△ ←	△ ←	X	⊙ ←	△ ←	○ ←	○ ←	6	0	6	18
Receive contact reports	⊙ ←	○ ↑	⊙ ↑	X	⊙ ↑	○ ↑	△ ←	2	4	6	34
Advise BG Commander	—	△ ←	△ ↑	⊙ ←	X	○ ↑	△ ←	3	2	5	15
Position ASW units	⊙ ↑	⊙ ↑	○ ↑	○ ←	○ ←	X	○ ←	3	3	6	30
Coordinate with other Warfare Cdr	○ ←	○ ↑	○ ↑	△ ↑	△ ↑	○ ↑	X	1	5	6	14

Tabulate the relationship arrows and strengths across each row

Module 2, Lesson 1, Viewgraph 20

- **Total the data across each row**
  - Add the total number of IN arrows (those arrows pointing to the left) and enter in the IN column.
  - Add the total number of **OUT** arrows (arrows pointing upward) and enter in the **OUT** column.
  - Combine the total **IN** and **OUT** numbers in the **TOTAL** column.
  - Add up the values for all of the relationship symbols across the row and enter in the **STRENGTH** column.

☞ **INSTRUCTOR NOTE.** Ask the participants why IN arrows point to the left. Ask why OUT arrows point up. Use the discussion to clarify and reinforce their understanding of the direction of the arrows.

Combination ID Matrix in Process Management

	Ensure Connectivity	Deconflict BG units and contacts	Detach ASW attack units	Receive contact reports	Advise BG Commander	Position ASW units	Coordinate with other Warfare Cmdrs	IN	OUT	TOTAL	STRENGTH
Ensure Connectivity	X	⊙ ↑	△ ↑	⊙ ↑	—	⊙ ←	○ ↑	1	4	5	31
Deconflict BG units and contacts	⊙ ←	X	△ ↑	○ ←	△ ↑	⊙ ←	○ ←	4	2	6	26
Detach ASW attack units	△ ←	△ ←	X	⊙ ←	△ ←	○ ←	○ ←	6	0	6	18
Receive contact reports	⊙ ←	○ ↑	⊙ ↑	X	⊙ ↑	○ ↑	△ ←	2	4	6	34
Advise BG Commander	—	△ ←	△ ↑	⊙ ←	X	○ ↑	△ ←	3	2	5	15
Position ASW units	⊙ ↑	⊙ ↑	○ ↑	○ ←	○ ←	X	○ ←	3	3	6	30
Coordinate with other Warfare Cdr	○ ←	○ ↑	○ ↑	△ ↑	△ ↑	○ ↑	X	1	5	6	14

Interpret the Combo ID and choose the most critical process(es)

Module 2, Lesson 1, Viewgraph 21

- **Analyze the data in the matrix and choose the most critical process.**

In analyzing the Combination ID Matrix, you should maintain a balance between direction of influence and strength of relationship. Therefore, rather than looking at any one number to make final selections, try the following sequence:

- ♦ Review rows for patterns in the symbols. Look for **ROWS** where symbols are absent—an indication a process has no relationship to any other process.
- ♦ Review **STRENGTH** column. Choose the highest totals to investigate further.
- ♦ Review the **IN** and **OUT** columns to determine the impact of those identified in the previous step.
- ♦ Look for a dominant **IN-OUT** direction among those identified above.
  - ⇒ Predominantly **OUT** indicates a **ROOT CAUSE** (improvement opportunity).
  - ⇒ Predominantly **IN** indicates an **EFFECT** or secondary issue

If there is an even, or nearly even, split between the number of incoming arrows and the number of outgoing arrows, you can select the highest priority items by looking at the strength of the relationship among the arrows going in each direction. If **two** or more items are evenly split and the relationship strengths are about even, choose the process which has a causal relationship to the other choices or which occurs first in the development of the product or service.

☞ **INSTRUCTOR NOTE.** Suggest to the participants that this is a good time to perform a "sanity check." Surface and discuss issues before continuing to the next step. Remember the Abilene trip!

Choose the critical process that seems to be a root cause and/or that offers the best improvement opportunity. If resources permit, additional critical processes can also be selected.

The Matrix could be used as data to communicate back to the ESC (or higher level QMB) regarding decisions the QMB makes.

☞ **INSTRUCTOR NOTE.** Ask participants to relate existing traditional methods used in selecting priorities. Ask for feedback on the benefits of using a structured approach, such as one or more of the 7MP Tools.

By whatever method, decisions will be made about what to work on first. Sometimes there is logic, data, and criteria behind the choice. Other times priorities are set by whim, luck, or prejudice. Organizations that prefer data-based decisions often find that the 7MP tools help them organize and use language data effectively.

EXERCISE. In their Case Study team setting, have participants practice using the Combination ID Matrix method.

- ♦ Write directions for the exercise on a chartpack in advance.

- ♦ Retrieve the completed Case Study Identifying Critical Processes Chart (CASE-15) for the significant process Maintain Inventory & Fill Orders

- ♦ Distribute blank copies of the Combination ID Matrix form with the Case Study headings filled in (CASE-16).

- ♦ Instruct the participants to:

⇒ Complete the Combination ID Matrix on which the Case Study headings have been filled in.
⇒ Tabulate the relationship arrows and relationship strengths (by converting symbols to the values identified in the key) across each row and record the result in the appropriate column.
⇒ Interpret and analyze the Combination ID Matrix to identify the critical process(es).
⇒ Report out, presenting their analysis and identifying the two processes they think should be worked on first.

- ♦ Ask the participants to retrieve the completed Case Study Combination ID Matrix (CASE-17) and identify the three highest-rated processes on it.

- ♦ Stress that you expect the matrices will differ from team to team and from the Case Study Matrix. There are no wrong answers.

- ♦ Underscore your previous guidance not to let the tools make the decision by pointing out that the QMB selected the second ranked process—Receive and Stock Material—instead of the first ranked process. In this particular case, the QMB understood the interaction between the top-rated processes, considered the narrow difference in their scores, and gave weight to the fact that the Receive and Stock process occurred prior to the Fill Orders process. Their final selection was influenced by this sequence and the fact that improvements in the Receive and Stock process would be passed on to the Fill Orders process.

- ♦ Use as an example of avoiding suboptimization the fact that the QMB also decided to identify the Fill Orders process as critical, selecting it to continue defining and refining once the Receive and Stock process was made stable and capable.

✉ **CASE STUDY NOTE.** Inform the participants that you will use the Case Study results in the exercises that follow for the sake of continuity. Place the Case Study Identifying Critical Processes Chart (CASE-15) and Combination ID Matrix (CASE-17) on the Storyboard and label them Step 6.

Product of Lesson 1

A prioritized list of critical processes

Module 2, Lesson 1, Viewgraph 22

LESSON SUMMARY. The product of this lesson is identification of the processes which are critical to the selected significant process. You arrived at this by:

- Listing the macro-level processes required to accomplish a priority significant process.
- Identifying the critical process(es) through consensus or by constructing a Combination ID Matrix.

Even though the steps are intricate and possibly time consuming, the end result is a place to begin the improvement effort. There may be many improvement efforts happening, although they often are not focused in the right direction. By taking the time to identify the significant processes of the organization, talking to the customers, and integrating the significant processes with the customers' needs, processes selected will have a powerful impact in achieving organizational goals and customer satisfaction through process standardization and improvement.

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Methods for Managing Quality

Module 2

Lesson 2

Define & Refine the Critical Process

Learning Objectives:

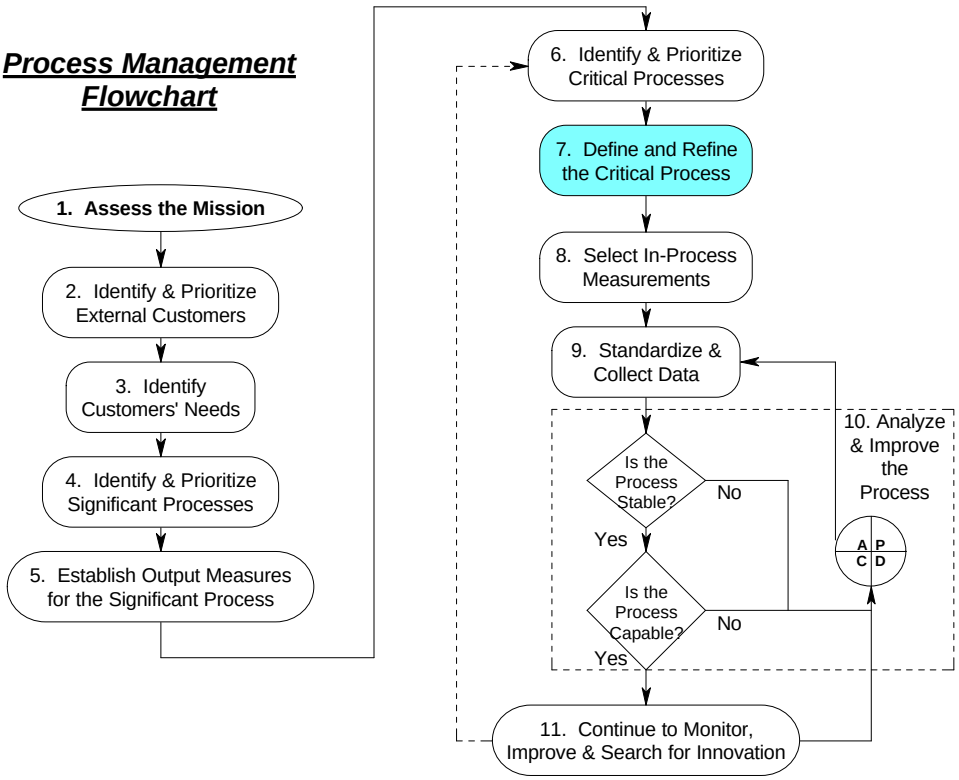
- ◆ Explain the importance of defining a process
- ◆ Describe how to use a deployment flow chart to define a process
- ◆ Explain the importance of eliminating complexity in a process
- ◆ Describe how to use an opportunity flowchart to refine a process

Module 2, Lesson 2, Viewgraph 1

LESSON OVERVIEW. This lesson focuses on Step 7 of the Process Management Flowchart. It answers two key questions: "How is this critical process currently performed?" and "Is the current performance of the critical process appropriate to standardize?" Participants will learn how to define a process by using a deployment flowchart and refine it using an opportunity flowchart.

Learning Objectives:

- Explain the importance of defining a process
- Describe how to use a deployment flowchart to define a process
- Explain the importance of eliminating complexity in a process
- Describe how to use an opportunity flowchart to refine a process

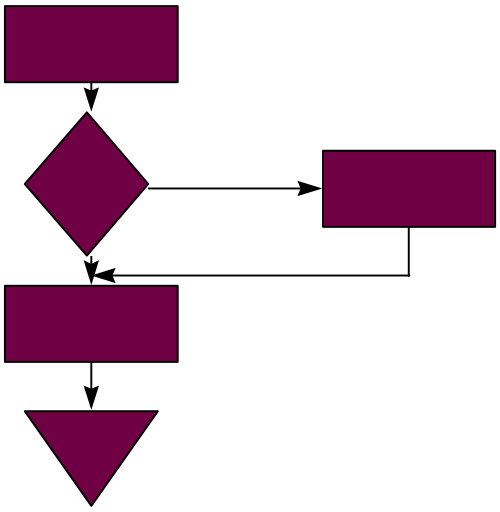


Module 2, Lesson 2, Viewgraph 2

☞ **INSTRUCTOR NOTE.** Orient the participants by showing the Process Management Flowchart with Step 7 highlighted.

Define the Critical Process

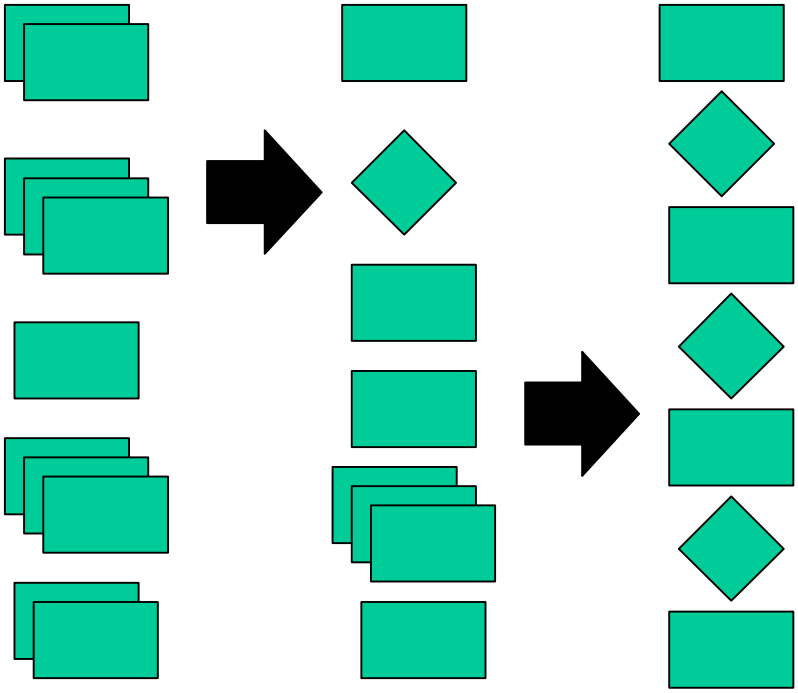
- Construct a detailed as-is flow chart to illustrate the process



Module 2, Lesson 2, Viewgraph 3

- **Construct a detailed as-is flowchart to illustrate the process.**
  - The first step in defining a process is to construct a flowchart—a step-by-step picture used to describe the process. A flowchart is an outline of a sequence of actions that provides team members with common reference points and a standard language to use when talking about a process.
  - Establish the boundaries. Identify where it begins and ends.
  - List the sequence of process steps as they are currently being performed.

Top-Down Flow Charting



Module 2, Lesson 2, Viewgraph 4

Macro-level flowchart: A simple illustration of the major activities of the cross-functional process, it provides an overall view of the process. Quality problems are not visible.

Mini-level flowchart: The field of vision has narrowed to focus on only one step of the macro-level flowchart. More detail is provided. Everyone who knows how the process is performed should be involved in preparing the flowchart.

Micro-level flowchart: The field of vision has narrowed again to focus on only one step of the mini-level flowchart. The micro-level flowchart illustrates a specific activity with a high level of detail. It is commonly used to chart how a particular task is performed and could be used as an aid to train others in performing the work.

- **Advantages of a top-down approach:**
  - Keeps you from diving into the wrong process or wrong part of the process
  - Enables you to backtrack and make mid-course corrections
  - Ensures that we do not omit part of the process

- Enables you to document progress and avoid rework
- Allows you to see how a change at a lower level affects higher levels

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☞ **INSTRUCTOR NOTE.** It is important to know the level of detail desired and the scope of the process in determining the type of flowchart to select: macro-level, mini-level, or micro-level.

⇒ Emphasize that a separate flowchart for each step of a mini-level flowchart is required at the micro-level. The macro-level flowchart becomes the aggregate of the views below it.

⇒ Mention that a possible cause of difficulty in teams flow charting a process may be the “right” team members. Members need to be at the “right” level in the organization to see the process from the same view.

⇒ Ask the participants how this relates to having the right level members on an ESC, QMB, lower level QMB, or PAT.

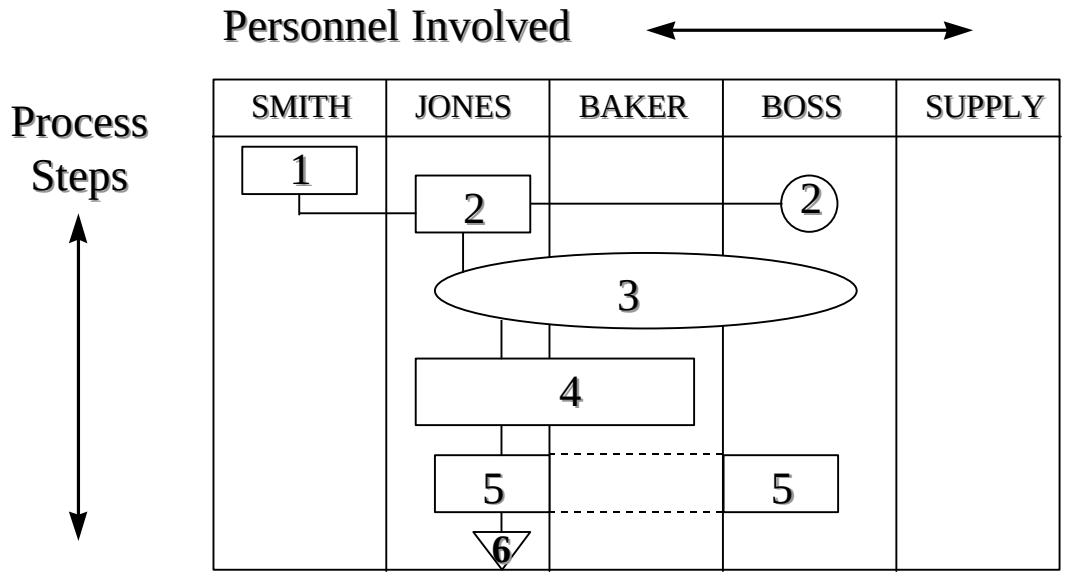
The QMB, collectively, has the responsibility for the significant process, which was identified by the ESC and assigned to the QMB for improvement. This cross-functional process probably entails many sub-processes for which responsibility lies with individual QMB members (the process owners). The QMB’s responsibility is to oversee improvement of the macro-level process, ensuring that refinements and improvements of sub-processes are coordinated to optimize the significant process.

☞ **INSTRUCTOR NOTE.**

⇒ Make the point that defining and refining can be done by the QMB, functional manager, or PAT, depending on the level of detail needed.

⇒ Recommend strongly that the QMB define the cross-functional process at its level before assigning subsets of this process to functional managers or PATs to define and refine. By doing this, the QMB can use its broader, cross-functional view to identify process complexity which might go unnoticed by functional managers or PATs.

Deployment Flowchart



Module 2, Lesson 2, Viewgraph 5

A flowchart also makes it easy to identify ways to refine the existing process by identifying **complexity** that was generated by compensating for a problems. Complexity is a general term for unnecessary work—anything that makes a process more complicated without adding value to the end product or service.

☞ **INSTRUCTOR NOTE.** Remind the students that they learned about Deployment Flowcharts in *Fundamentals of TQL*.

A deployment flowchart is useful in process management because it combines two ideas—what happens in a process and who is responsible for each step. It is crucial to know both of these things if you want to understand a process at this level.

- The deployment flowchart both shows the flow of a process and identifies who is involved at each step.

- This chart is useful for keeping track of what each functional area is supposed to do, where the people involved fit in, the sequence, and how they will relate to each other.

The deployment flowchart shown here uses symbols explained below, matching numbers in the blocks.

1 - Process Step. This block shows a process step which involves only one individual (or group of individuals).

2 - Inform Connector. This block shows a process step accomplished by a single individual (or group of individuals) with a second individual being informed.

3 - Meeting. This block shows a meeting being conducted by those individuals covered by the oval.

4 - Process Step. This block shows a process step which involves multiple individuals (or groups of individuals).

5 - Process Step. This block shows a process step which involves multiple individuals (or groups of individuals) who are not adjacent on the flowchart.

6 - Return. This symbol shows the point where the sequential process flow of this level flowchart stops. At this point the flow returns to the higher level flowchart of which this flowchart is a part.

Deployment flow charting is explained in more detail in two videotapes included in the DON Command Kit. See “The Tribus Tapes, Deployment Flow Charting, Volumes I and II.”

Development of a Process Flowchart

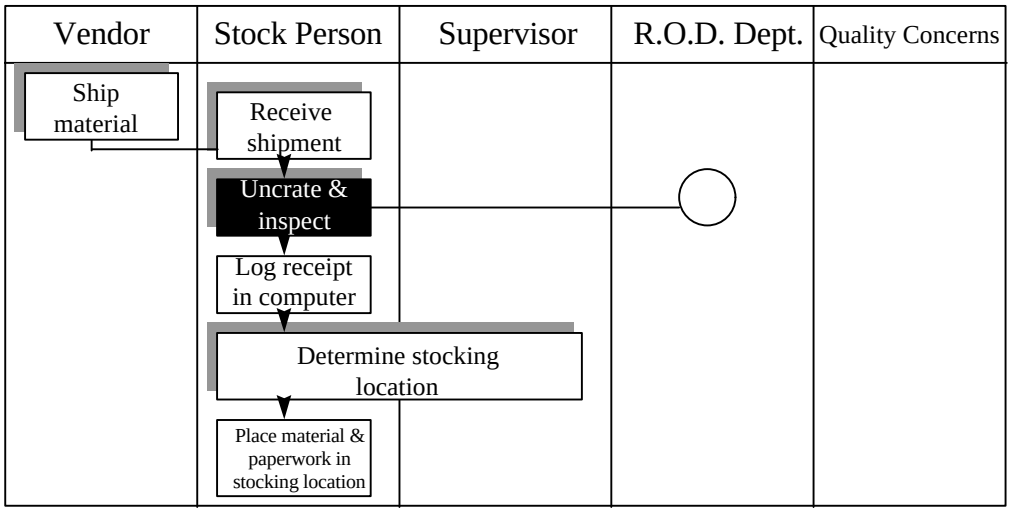
- Develop a Macro-Level Flowchart of the steps of the process
- Develop a Mini-Level Flowchart for each subprocess of the Macro-Level Flowchart
- Develop a Micro-Level Flowchart for each subprocess of the Mini-Level Flowchart

Module 2, Lesson 2, Viewgraph 6

A process flowchart breaks the critical process into the detail needed to determine how the product or service is developed. The level of detail ranges from a broad overview down to specific tasks.

Macro-Level Flowchart

Process: Receive & Stock Prepared by:_____
Activity: _____ Date: _____



Module 2, Lesson 2, Viewgraph 7

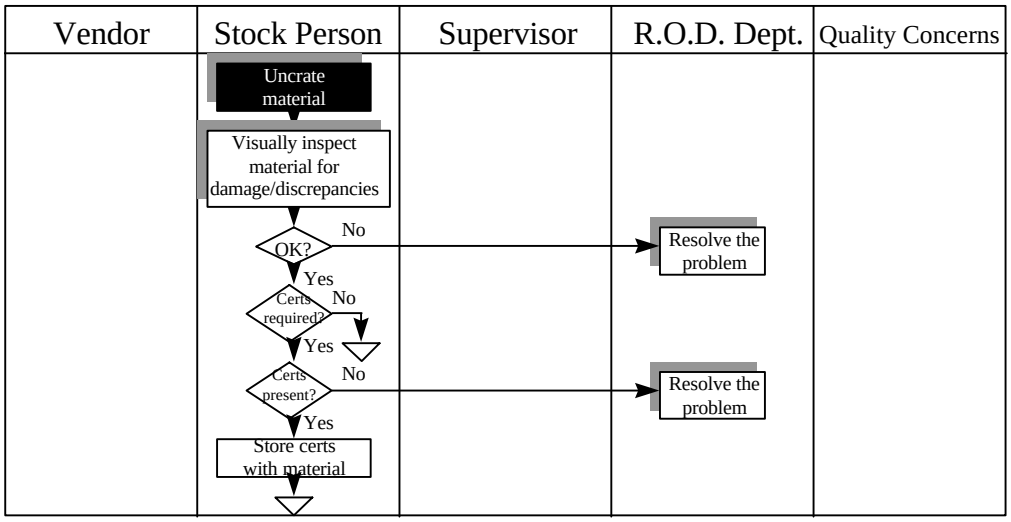
- **Develop a macro-level flowchart of the steps of the process**

List the big-picture steps that must be accomplished to complete the critical process. Identify any of these steps which can be broken into smaller steps or sub-processes by using a drop shadow.

☞ **INSTRUCTOR NOTE.** Advise participants that the critical process, Receive and Stock, is identified at the top of the form. (R.O.D. is Report of Discrepancy)

Mini-Level Flowchart

Process: Receive & Stock Prepared by:_____
Activity: Uncrate & Inspect Date: _____



Module 2, Lesson 2, Viewgraph 8

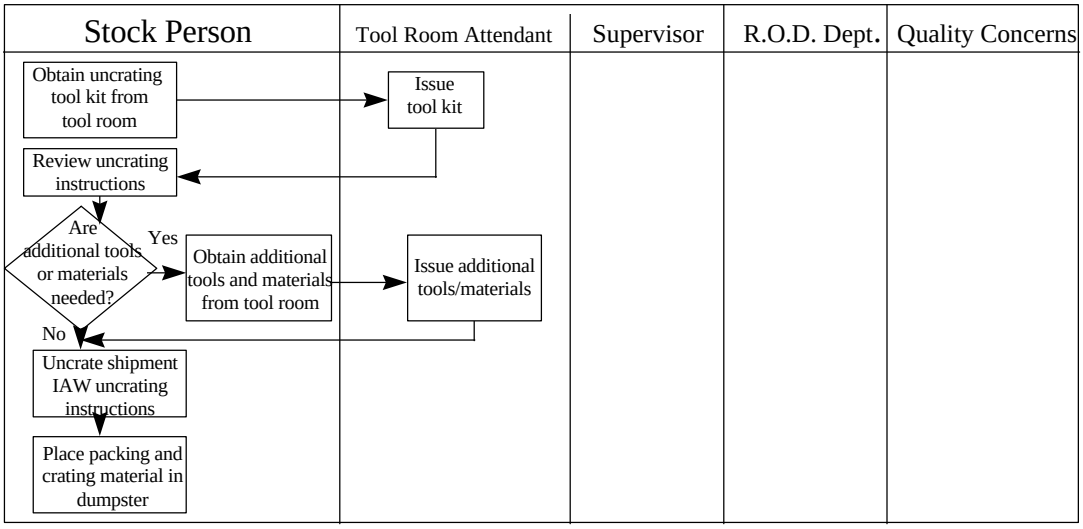
- **Develop a mini-level flowchart for each sub-process of the macro-level flowchart**

For those macro-level processes which have a drop shadow, list the steps which must be accomplished to complete the sub-process. At this level, some of the decisions made within the process can be seen. Additional personnel with more detailed knowledge of the process may be needed to construct the mini-level flowchart. As with the macro-level flowchart, identify with a drop shadow, any steps of the mini-level flowchart that can be broken into greater detail.

☞ **INSTRUCTOR NOTE.** The process remains Receive and Stock, but the Activity line is now used to identify the process step being presented in greater detail: Uncrate & Inspect.

Micro-Level Flowchart

Process: Receive & Stock Prepared by:_____
Activity: Uncrate Material Date: _____



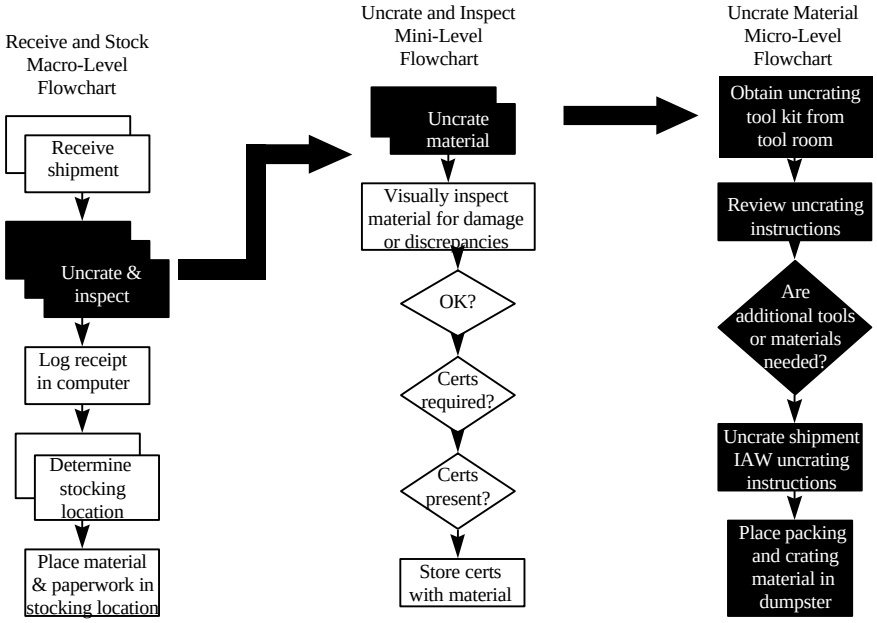
Module 2, Lesson 2, Viewgraph 9

- **Develop a micro-level flowchart for each sub-process of the mini-level flowchart**

This is the greatest level of detail of the critical process. Identify all of the tasks and decisions required to complete the sub-processes of the mini-level flowchart. This level of detail requires a thorough understanding of the tasks needed to complete the process. Workers in the process may need to provide information for developing the micro-level flowchart or a team of workers may be chartered to actually develop the micro-level flowchart.

☞ **INSTRUCTOR NOTE.** The Process line remains unchanged, but the Activity line now identifies the process step of the mini-level flowchart that is being presented in greater detail: Uncrate Material.

Case Study Receive and Stock Material Process



Module 2, Lesson 2, Viewgraph 10

✉ CASE STUDY NOTE

- Post the single-page Defined Case Study Receive and Stock Material Process Flowchart (CASE-18) on the Storyboard and label it Step 7.

Refine the Critical Process

- Distinguish between process refinement and process improvement
- Review and revise the flowchart to eliminate complexity

Module 2, Lesson 2, Viewgraph 11

- **Eliminate complexity to refine the process**

The next step is to analyze and eliminate the obvious “cost-added-only” steps in a process. There is waste in cost-added-only work. Another word for cost-added-only work is “complexity.” Complexity is defined as anything that makes a process more complicated without adding value. By first identifying the complexities involved in performing a process, we find the answer to another key question: “How is waste created in performing these tasks?” Some examples of things you should consider to eliminate complexity are:

- Eliminating redundant activities or tasks
- Combining similar activities or tasks
- Reducing the amount of handling
- Performing tasks concurrently rather then serially
- Changing the sequence of activities or tasks
- Reducing transportation or hauling distance
- Eliminating or reducing paperwork

☞ **INSTRUCTOR NOTE.** It is important for participants to understand what cost-added-only work is. Use the examples in F. Timothy Fuller's article, "Eliminating Complexity from Work: Improving Productivity by Enhancing Quality", to explain to participants how complexity steps are built into the process and how this step in the Process Management Flowchart—refining—is concerned with eliminating cost-added-only steps. A reprint of this article is included in the supplemental materials behind the Readings tab.

- **Process refinement and process improvement**.

  - **Refinement**. The process flowchart is developed before refinement because it is likely to be the first formal depiction of how the work is actually performed. Until a process is documented in an as-is flowchart, such complexities as duplicate tasks, unnecessary movements, and inspections are not evident. Refinement means eliminating complexity or removing obvious cost-added-only steps.

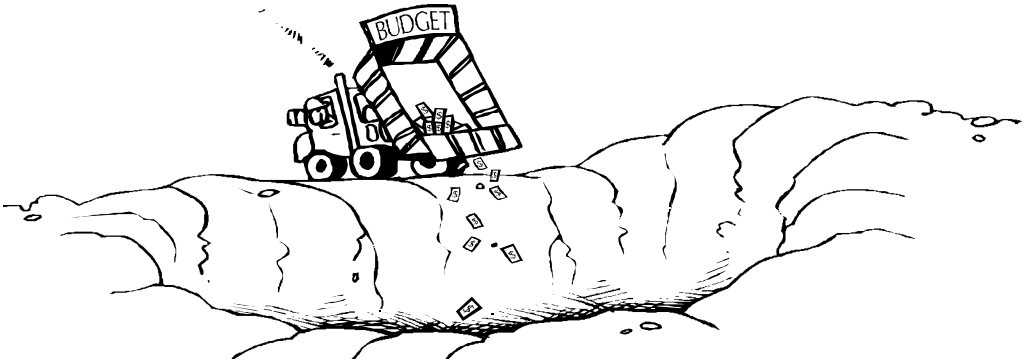
  - **Continuous improvement**. Continuous improvements are considered in Step 10 of the Process Management Flowchart. A determination of the process's capability to meet the customers' needs is made after analyzing process measurement data. A decision is then made to seek improvement of the process by applying the PDCA cycle using a team approach. Before a process improvement methodology is formally implemented, standardization—learning how to do the same process the same way—is crucial for determining how and what measurements to use and whether the process is stable.

- **Review and revise the flowchart to eliminate complexity.**

Such things as initial hand-off spots, decision points, and inspections should be examined first to determine whether there are cost-added-only steps. It is a common sense decision to edit out of the process steps that are creating more work, which are redundant, or are causing delays. This must take place before the process can be standardized and measurements are taken to find out whether the process is stable and capable of meeting customers' needs.

Opportunity Flowchart

- Identifies steps that are essential to produce the required outputs (value added)
- Identifies activities that add to costs, not quality (cost added only)



Module 2, Lesson 2, Viewgraph 12

- **Opportunity Flowchart**

Another tool to help gain knowledge of our processes is the opportunity flowchart. Opportunity flowcharts help us identify steps in the process that add value, and steps that add cost only. They are useful for identifying refinement opportunities. The opportunity flow chart was developed to *highlight* areas of unproductive work due to errors, defects, and omissions, and processes that are carried out as a result of failures found during test and inspection. Opportunity flow charts identify and show activities that add only to costs and not to quality. Opportunity flowcharting is based on the notion that there are steps in the process that *add value* and steps that *add only cost*. **Value-added (VA)** steps are those in a process that are essential for producing the required outputs. They add value to the outputs. In other words, the outputs cannot be produced without them. Steps in the process that do not add value but only add cost are not essential for producing the required outputs. They are called **cost-added-only (CAO)** steps that exist because of defects, errors, omissions, waste, or rework.

Constructing an Opportunity Flowchart

- Divide the page into two columns and label Value-Added(VA) and Cost-Added Only(CAO)
- List vertically the steps in the process
- Determine if each activity is Value-Added or Cost-Added Only
- The ideal process is depicted under the VA column

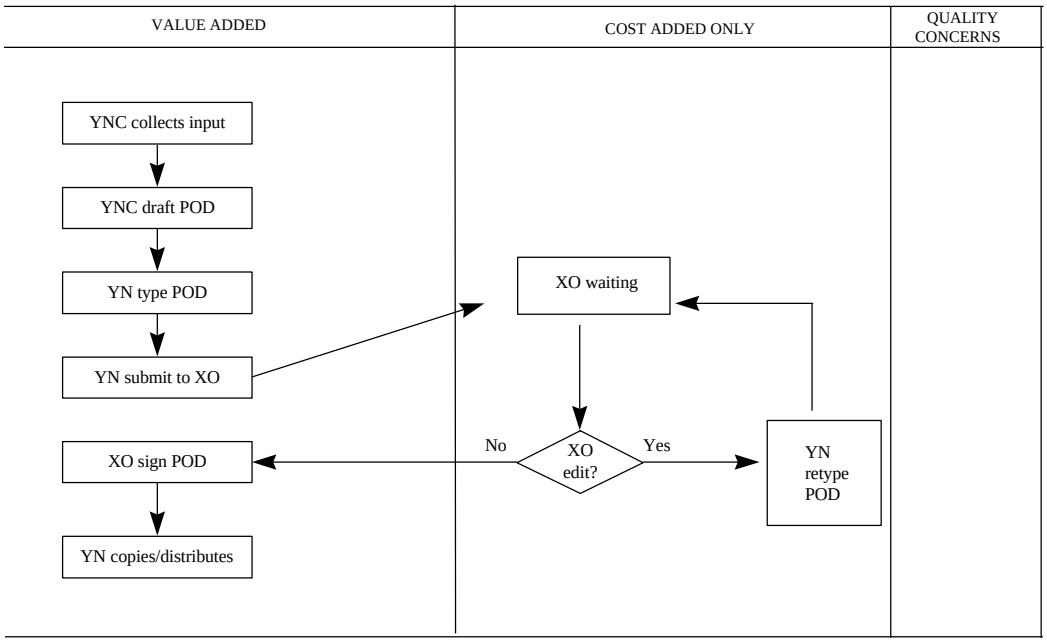
Module 2, Lesson 2, Viewgraph 13

- **Constructing an Opportunity Flow Chart**

These are steps in constructing an opportunity flow chart:

- Divide the page into two columns, i.e. Value Added (VA) and Cost-Added-Only (CAO).
- List vertically the steps in the process in terms of the VA steps and the CAO steps.
- Connect the steps.

Opportunity Flowchart for Develop and Distribute the Plan of the Day



Module 2, Lesson 2, Viewgraph 14

- **Example of an Opportunity Flow Chart**

This viewgraph shows an opportunity flow chart developed by one of the Fleet TQL teams. Notice how obvious the refinement opportunities are. The causes of high costs and low quality can easily be seen. Often, one CAO step will lead to another CAO step. When no CAO steps exist between VA steps, the VA steps can be joined. Otherwise the VA steps flow via the relevant CAO steps.

The ideal process is depicted under the VA column. All steps shown under the CAO column are activities that cause unnecessary costs, customer problems and dissatisfaction.

- **Guidelines for determining when a step is VA or CAO:**

♦ If the activity adds value to the output to the customer it is VA. If not, then the step is CAO, specifically:

⇒ **Inspection in anticipation of failure.**
⇒ **Scrap and/or rework.**
⇒ **Wait loops (delays/periods of inactivity).**
⇒ **Multiple movement (anytime something or someone in the process goes to the same place more than once).**

The four criteria listed above provide an objective method by which to identify complexity in processes. These CAO activities are easily identifiable on the flowchart.

- A step is VA if it is necessary to produce the output.
- Process measurement is considered VA.

- **Refining Processes**

One way to refine processes is to work to reduce or remove CAO steps. Where possible just eliminate the CAO steps.

Step by Step Refinement of a Process Flowchart

- Select a step of the Macro-Level Flowchart to be refined (Mini-Level Process)
- Select a step of the Mini-Level Flowchart to be refined (Micro-Level Process)
- Use an opportunity flowchart to refine the Micro-Level Process
- Repeat for each step of the Mini-Level Flowchart

Module 2, Lesson 2, Viewgraph 15

Step by Step Refinement of a Process Flowchart

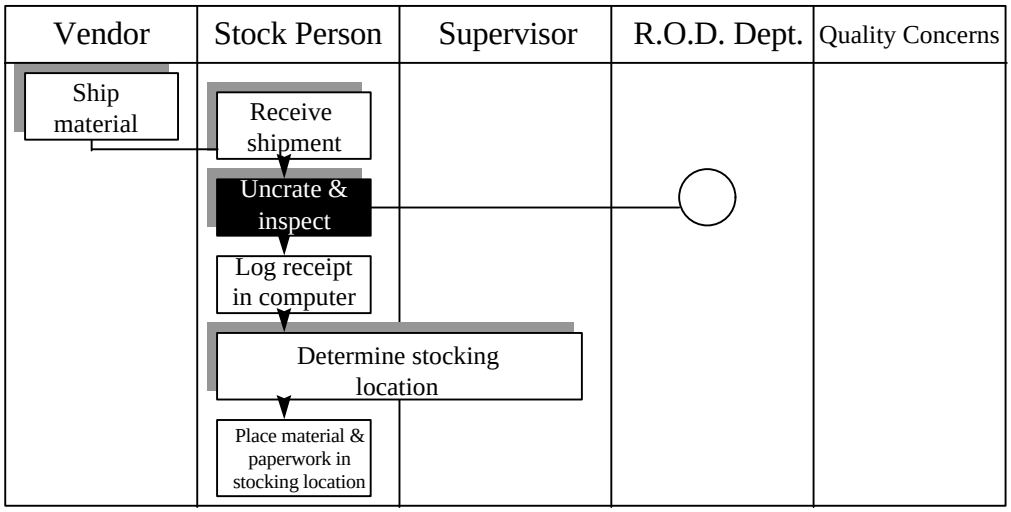
- Use an Opportunity Flowchart to refine the Mini-Level Process
- Repeat for each step of the Macro-Level Flowchart
- Use an opportunity flowchart to refine the Macro-Level Process

Module 2, Lesson 2, Viewgraph 16

Start refining at the most detailed level (micro) and work your way up (mini, macro).

Macro-Level Flowchart

Process: Receive & Stock Prepared by:_____
Activity: _____ Date: _____

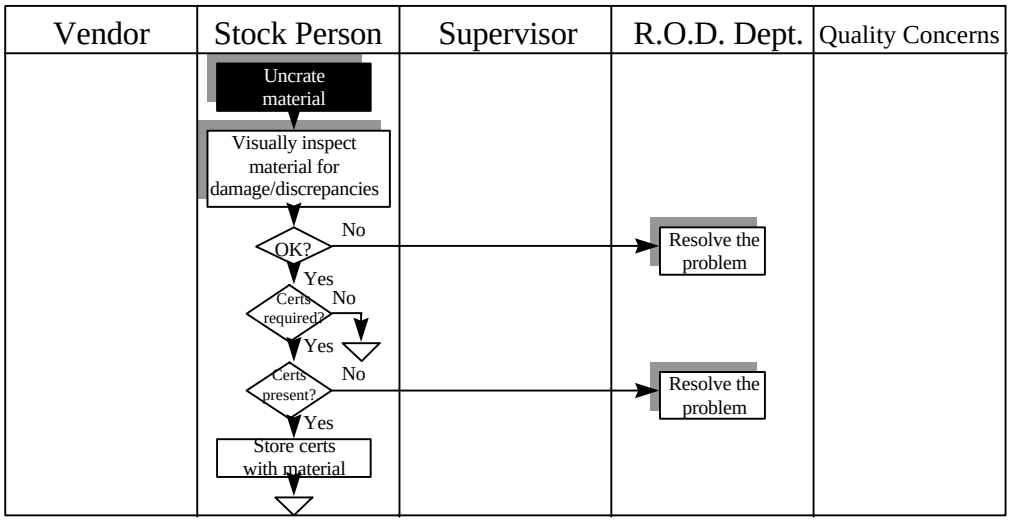


Module 2, Lesson 2, Viewgraph 17

- **Select a step of the Macro-Level Flowchart to be refined**

Mini-Level Flowchart

Process: Receive & Stock Prepared by:_____
Activity: Uncrate & Inspect Date: _____



Module 2, Lesson 2, Viewgraph 18

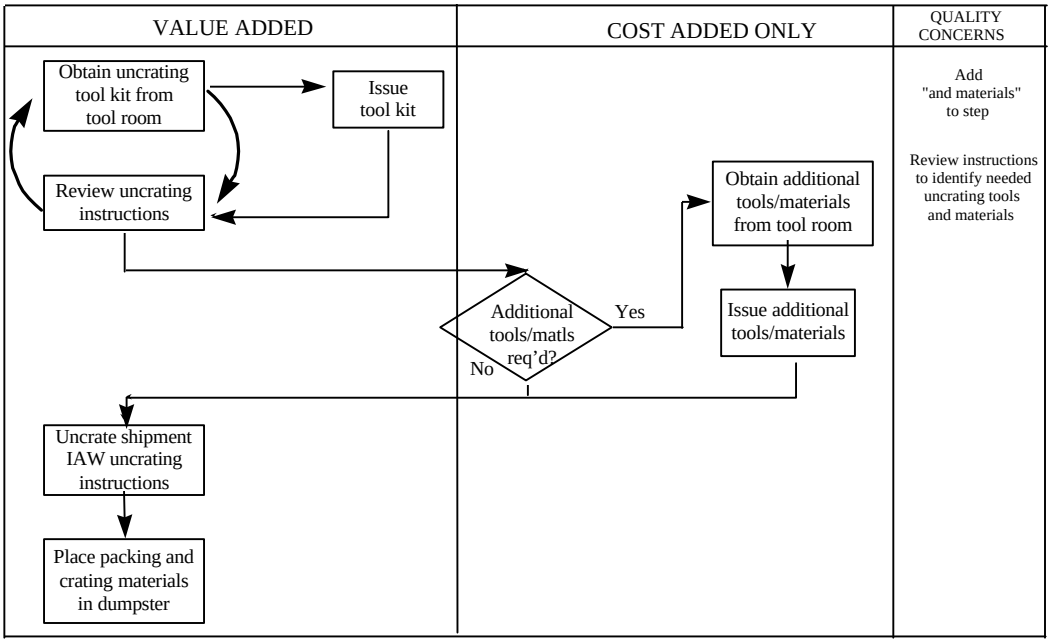
- **Select a step of the Mini-Level Flowchart to be refined**

Micro-Level Flowchart

OPPORTUNITY

PROCESS: Receive and Stock PREPARED BY:

ACTIVITY: Uncrate Material DATE:



Module 2, Lesson 2, Viewgraph 19

- **Refine the steps of the Micro-Level Flowchart**

  - Ask: Does the Micro-Level Flowchart add value to the process? If not, delete the entire Micro-Level Flowchart.

  - Review each step of the flowchart, asking "does this step or activity add value or cost only?" Use the following guidelines to assist in this determination:

    Signals of Cost:

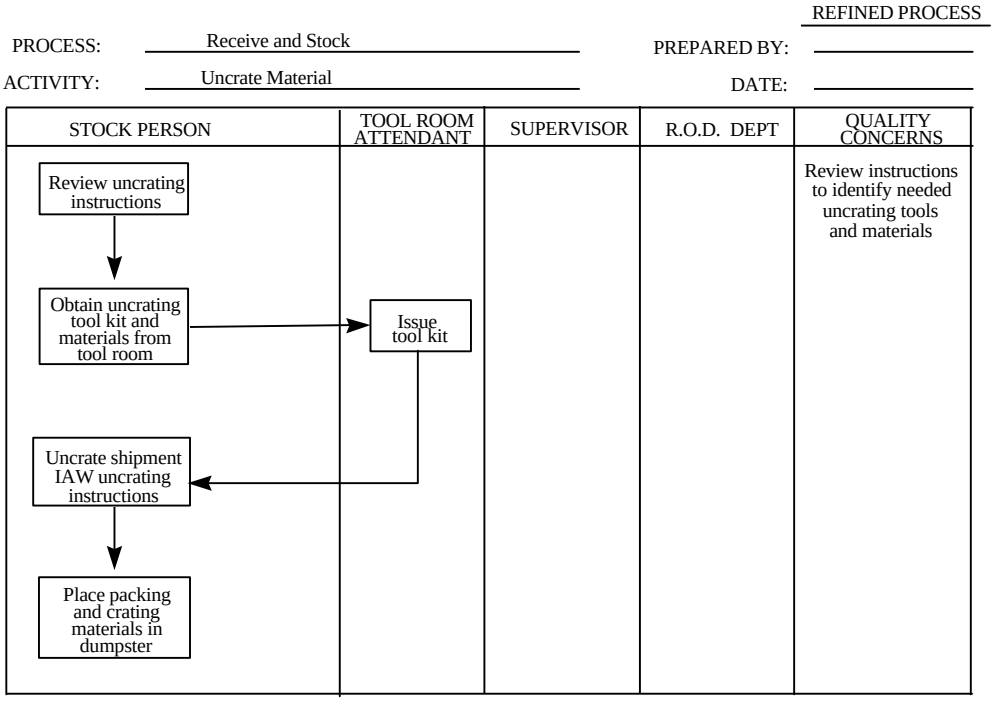
    Inspection or review in anticipation of defects.

    Rework, correction or scrap built into the process.

    Wait loops or idle time built into the process.

    Multiple movements of people or things to the same place more than once.

Micro-Level Flowchart



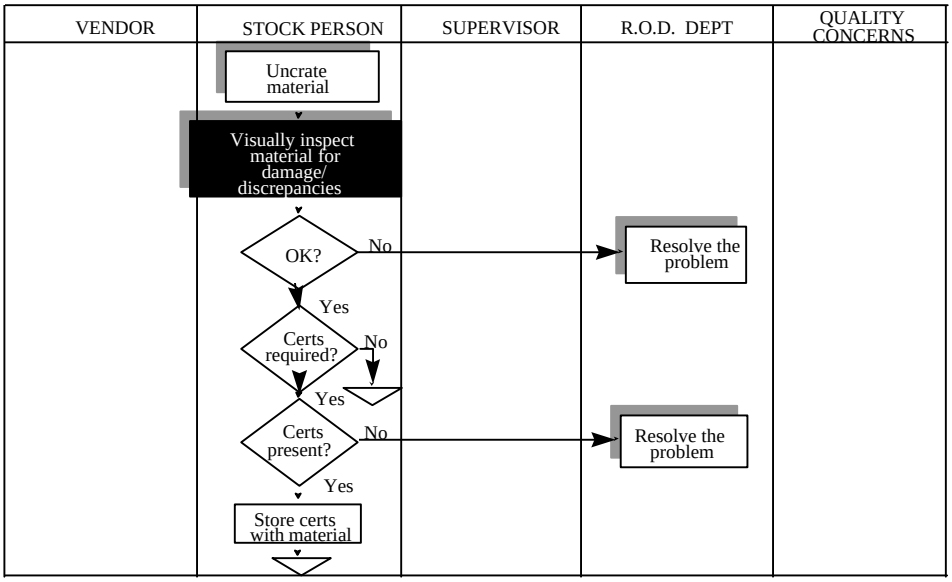
Module 2, Lesson 2, Viewgraph 20

- **Generate and label a refined flowchart**

Mini-Level Flowchart

PROCESS: Receive and Stock PREPARED BY: _____

ACTIVITY: Uncrate and Inspect DATE: _____



Module 2, Lesson 2, Viewgraph 21

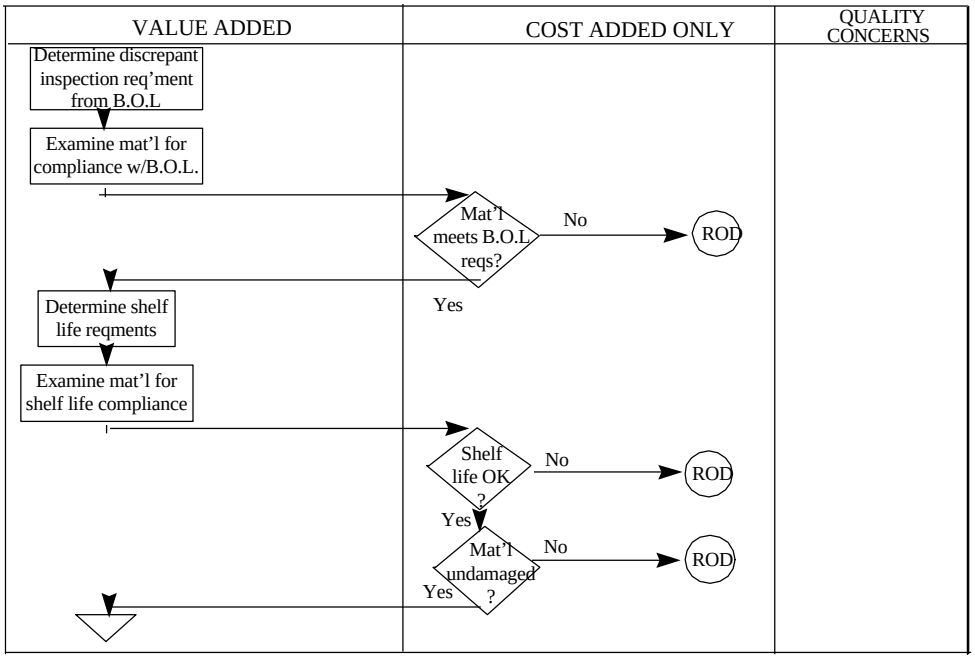
- **Repeat for each step of the Mini-Level Flowchart**

Micro-Level Flowchart

OPPORTUNITY

PROCESS: Receive and Stock PREPARED BY: _____

ACTIVITY: Visually inspect material for damage/discrepancies DATE: _____



Module 2, Lesson 2, Viewgraph 22

☞ **INSTRUCTOR NOTE**. Caution participants that some cost-added-only steps or activities may be impossible to remove during the "Refinement" step. In this micro-process we see three examples of inspection in anticipation of failure, and three of rework Report of Discrepancy (ROD). We have to identify and eliminate or reduce the causes of these anticipated failures before we can eliminate or reduce the requirement for inspection and rework. We would keep this Opportunity Flowchart for use in later steps of the Process Management Flowchart (Analyze and Improve the Process). Bill of lading (B.O.L.)

Micro-Level Flowchart

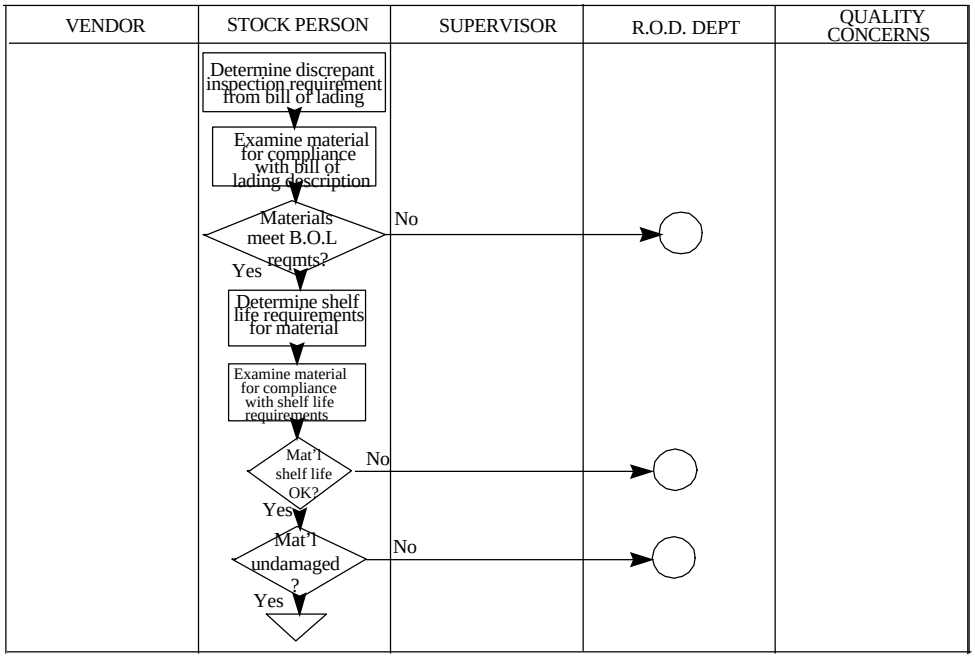
REFINED PROCESS

PROCESS: Receive and Stock

PREPARED BY:

ACTIVITY: Visually inspect material for damage/discrepancies

DATE:



Module 2, Lesson 2, Viewgraph 23

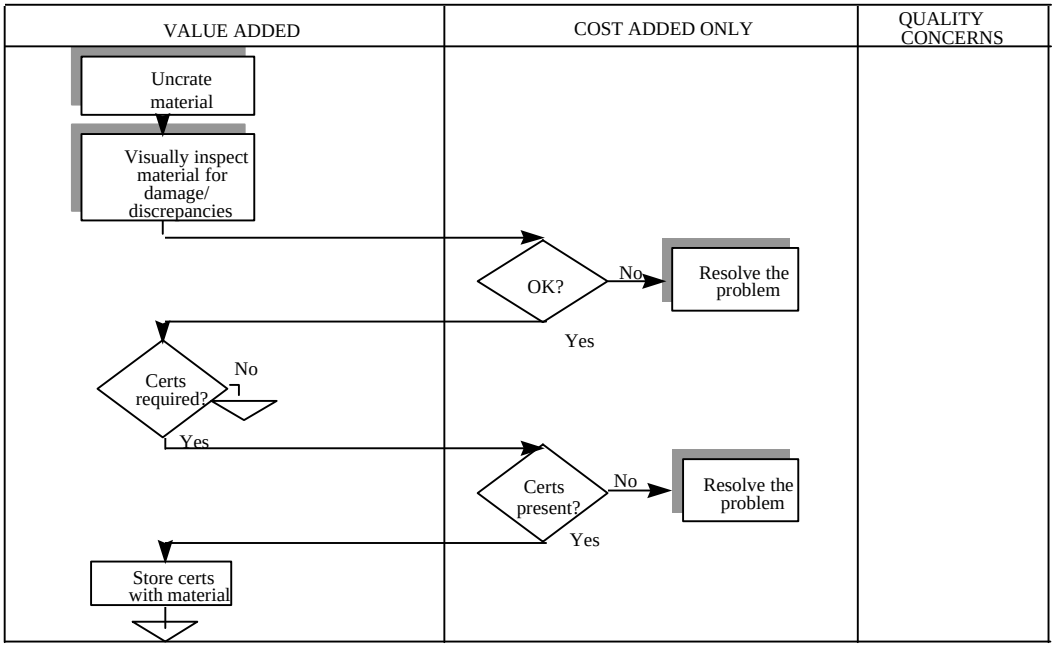
- **Some levels may not require or permit changes**

Mini-Level Flowchart

OPPORTUNITY

PROCESS: Receive and Stock PREPARED BY:

ACTIVITY: Uncrate and Inspect DATE:



Module 2, Lesson 2, Viewgraph 24

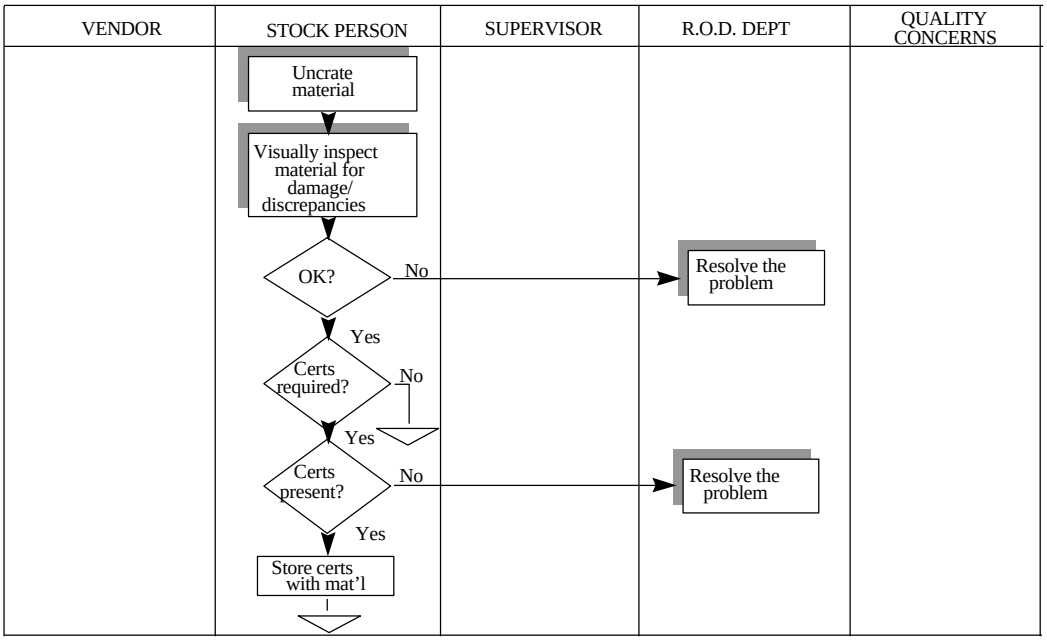
- **Refine the steps of the Mini-Level Flowchart**
  - ♦ Consider all changes to Micro-Level Flowcharts that could affect the Mini-Level Flowchart.
  - ♦ Ask the same questions that you asked for the Micro-Level Flowchart.

Mini-Level Flowchart

REFINED PROCESS

PROCESS: Receive and Stock PREPARED BY:

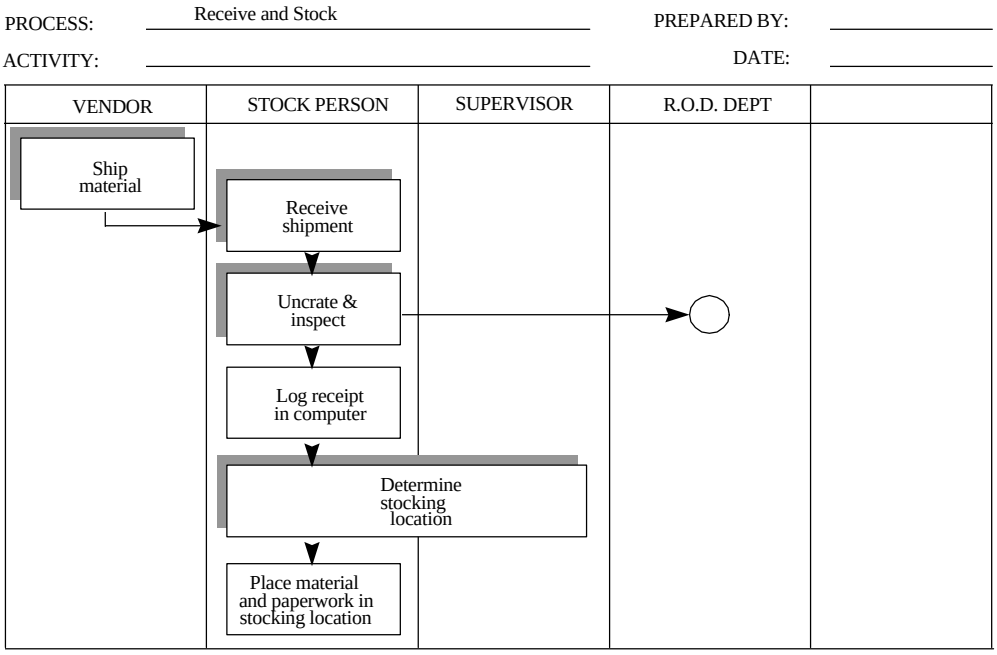
ACTIVITY: Uncrate and Inspect DATE:



Module 2, Lesson 2, Viewgraph 25

- **Generate and label refined flowchart**

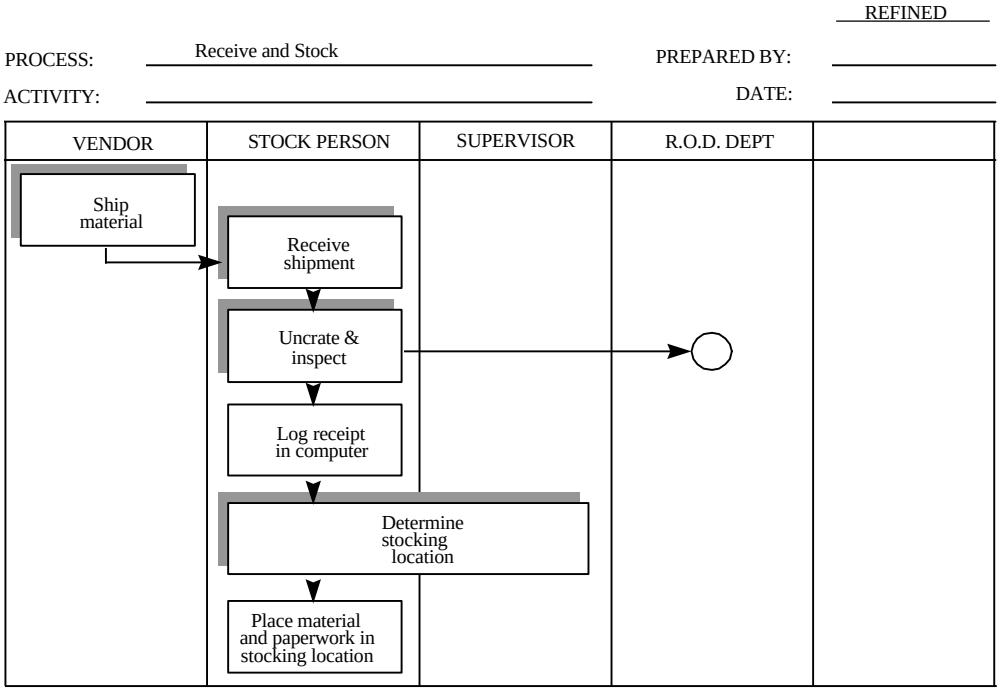
Macro-Level Flowchart



Module 2, Lesson 2, Viewgraph 26

- **Repeat for each step of the Macro-Level Flowchart**

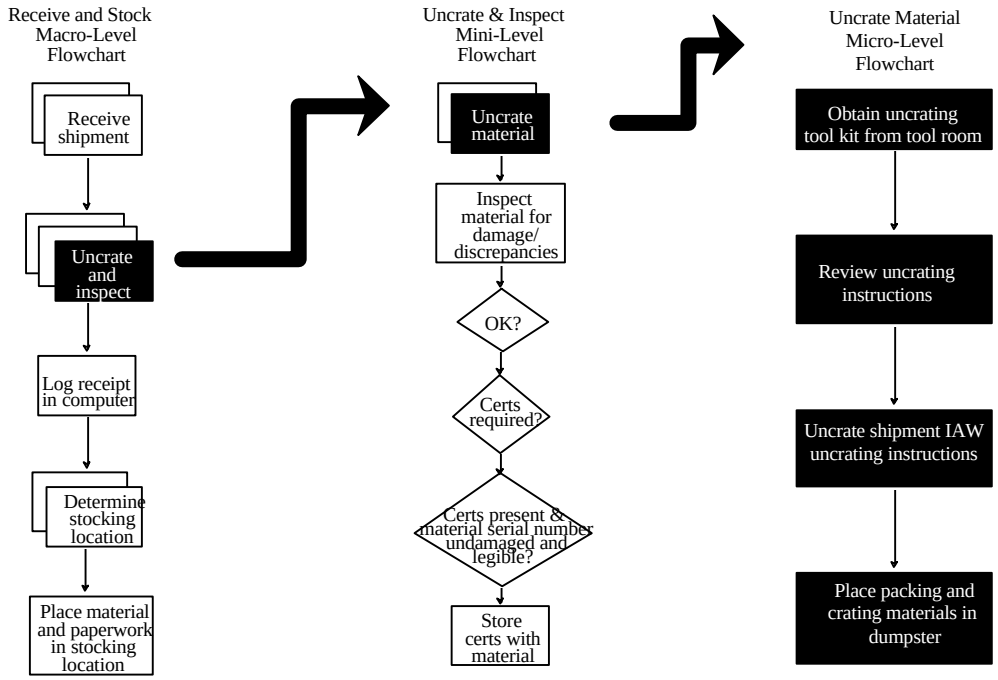
Macro-Level Flowchart



Module 2, Lesson 2, Viewgraph 27

- **Refine the steps of the Macro-Level Flowchart.**
  - ♦ Consider all changes made to Mini-Level Flowcharts that could affect the Macro-Level Flowchart.
  - ♦ Ask the same questions that you asked the Micro-Level Flowchart, using an opportunity flowchart.
  - ♦ Generate and label the refined flowchart.

Refined Case Study Receive and Stock Material Process



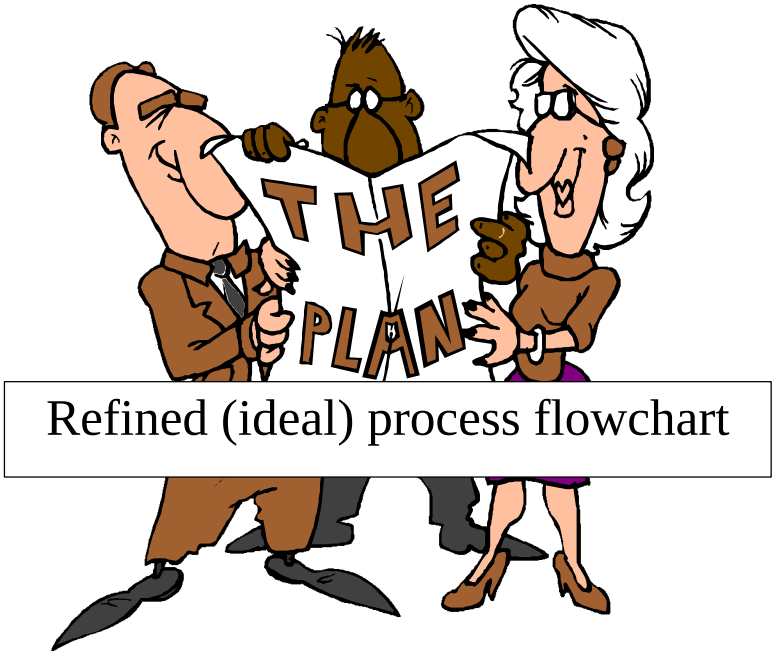
Module 2, Lesson 2, Viewgraph 28

✉ **CASE STUDY NOTE.**

⇒ Post the single-page Refined Case Study Receive and Stock Material Process Flowchart (CASE-19) on the Storyboard and label it Step 7.

⇒ Point out to the participants that the multiple-page flowchart of the Case Study Refined Receive and Stock Material Process (CASE-20), with the full macro-, mini-, and micro-levels, is included in the Case Study.

Product of Lesson 2



Refined (ideal) process flowchart

Module 2, Lesson 2, Viewgraph 29

LESSON SUMMARY: One of the learning points of the *Fundamentals of TQL* Course was that a process can be flowcharted from three different views: as is—how it is currently operating; as specified—by regulation or manual; and the ideal—our vision of the future. The product of this lesson is a flowchart of the critical process as it is currently operating which now contains our ideal refinements. Keep in mind that we are still in the Plan phase of the PDCA cycle and that process improvement can only begin once baseline data have been collected and the process has been stabilized.