QUALITY JOURNAL

1. SHOW CURRENT PROCESS

2. DEFINE IMPROVEMENT OPPORTUNITY

3. MEASURE CURRENT PROCESS

THE PDCA IMPROVEMENT PROCESS

4. PLAN A CHANGE

5. SHOW NEW PROCESS

6. CHECK RESULTS OF CHANGE

A Guide to Foster
Continuous Improvement,
Customer Satisfaction
and
Teamwork

7. ACT ON RESULTS

April 1995

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MODULE 1:

An Introduction to the Continuous Improvement Process

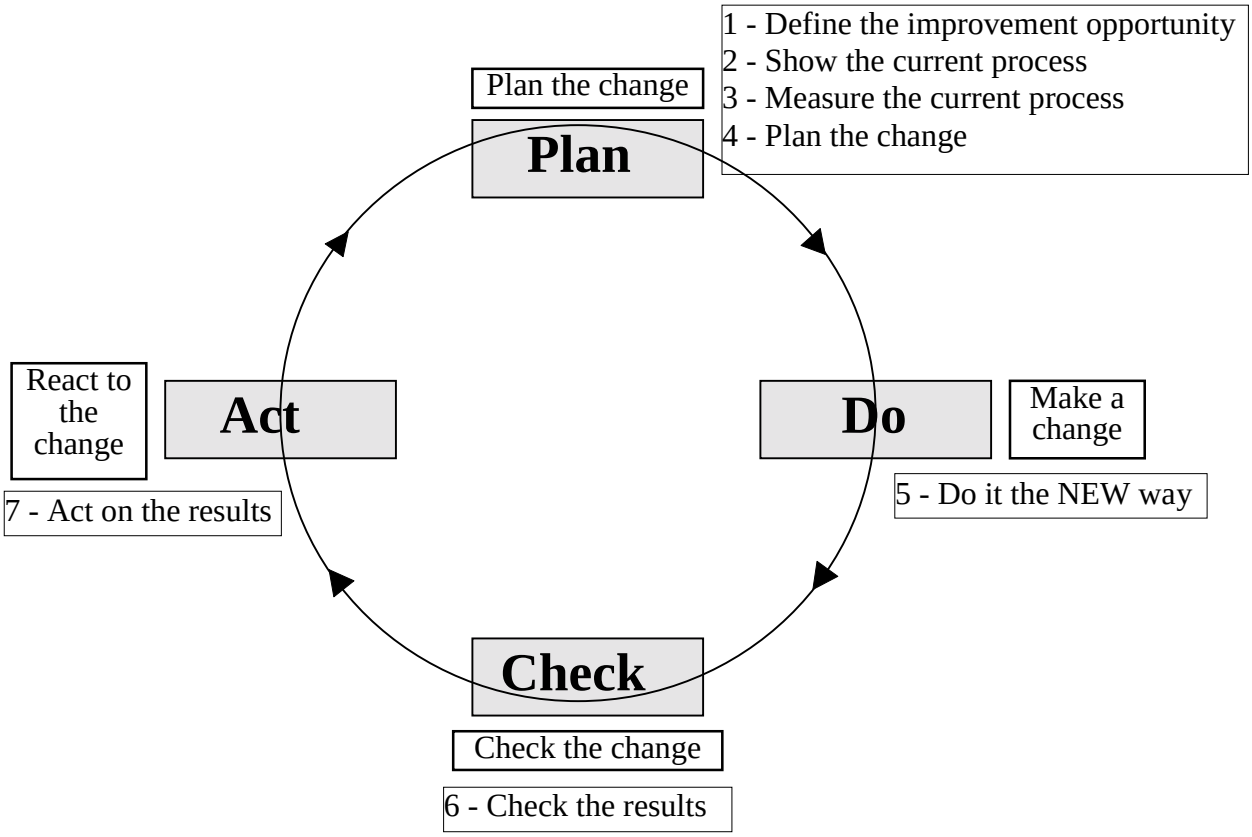
Objectives

Upon completion of this module, participants will be able to:

- Use specific criteria to identify those processes that, if improved, would have the greatest impact.
- Identify the process owners and stakeholders of a given process.
- Understand the connection between journalizing the improvement process and its success.

THE PLAN-DO-CHECK-ACT (PDCA) CYCLE

- Developed by Walter Shewhart (Shewhart Cycle)
- Popularized by Deming (Deming Cycle)
- Also known as Plan-Do-Study-Act (PDSA)



- PDCA serves as the framework; detailed steps are added.
- Tools are used to accomplish the steps.

INTRODUCTION

Plan-Do-Check-Act (PDCA) is a continuous improvement cycle developed by Walter Shewhart at Western Electric and popularized by Dr. W. Edwards Deming. The four phases -- plan, do, check and act -- incorporate careful planning with "doing" in small doses, and using feedback to standardize the most effective method.

Planning involves setting boundaries, deciding what data is needed, how it will be collected and what it means. This phase requires an analysis and selection of alternative improvements. **Do** consists of carrying out the planned change. **Checking** assesses the results of the change. **Act** places the most effective alternative as the standard mode of operation. Then, the cycle starts again with a new set of planned improvements.

This method is based on the assumption that staying in business long-term means continually learning how to serve customers and how to get the job done. Knowledge of processes or *how* to do something must then be guided by knowledge of customers' needs or *what* to do.

This workshop is designed to provide guidance through the improvement cycle. Assignments for each step reflect all aspects of any improvement effort: organizing people, creating a common map of the process and customer needs, using data to guide learning, examining a broad range of changes in the work system, and managing change.

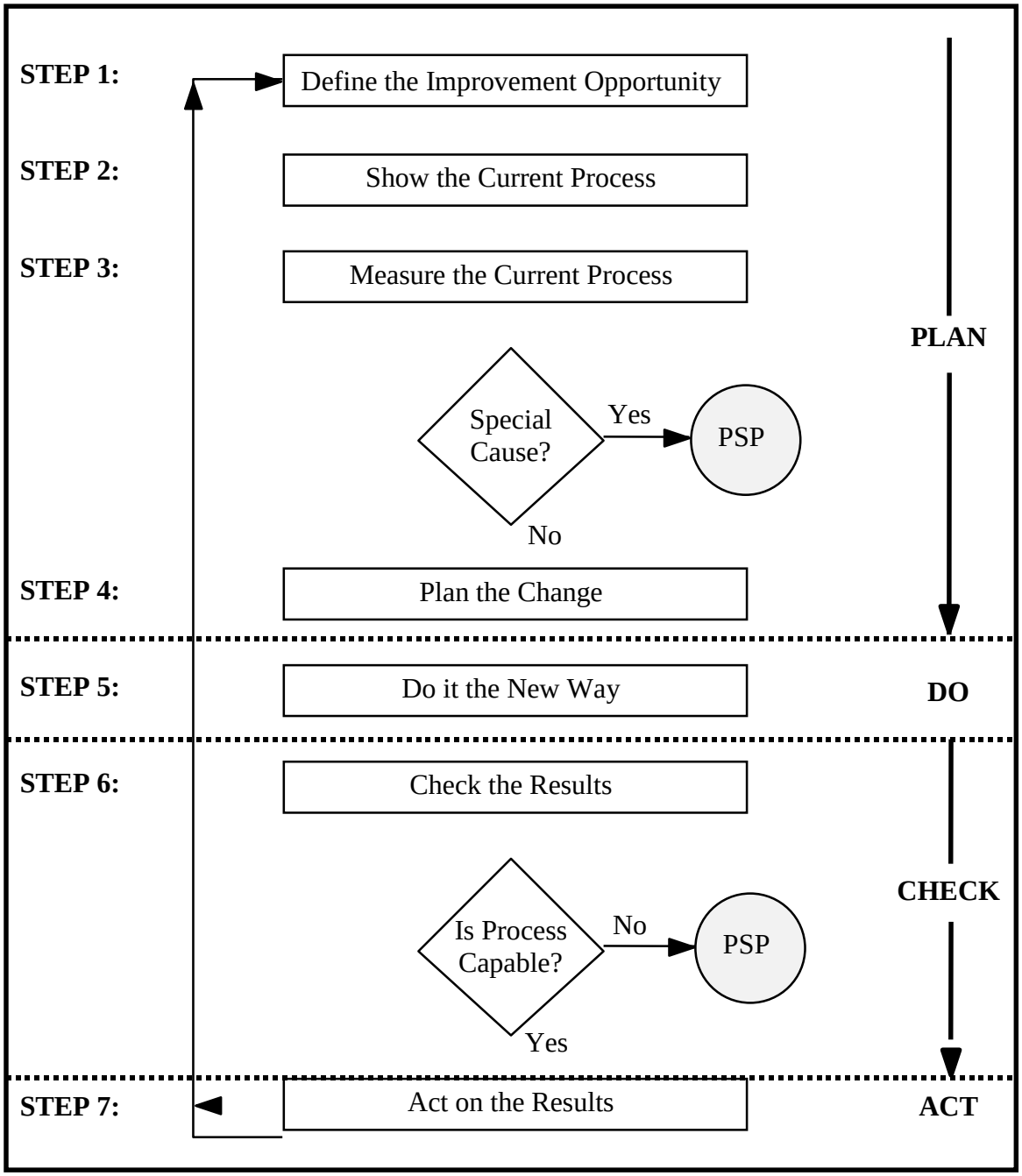
START-UP

Education in the improvement methods is best accomplished by practicing the methods on an important process because people need energy to carry them through the initial learning. The emphasis during the learning phase is on understanding the methods. Participants become energized by results.

Education and experience in process improvement create a common language, patience and discipline. Those with PDCA experience are more likely to appreciate the hard work required to continually improve a process and less likely to blame other departments for problems. In addition, they are more likely to share the responsibility of input quality with their suppliers. Knowing others have been working on improvement alleviates the fear of being the only department trying to improve.

Achieving a continuous improvement culture in a department does not occur quickly or easily. Once interlinking department members understand the philosophies and methods of process improvement, a multiple-departmental effort is more likely to succeed.

THE CONTINUOUS IMPROVEMENT FLOW CHART (PDCA)



THE CONTINUOUS IMPROVEMENT STEP BREAKDOWN

1 Define the improvement opportunity
- 1.1 Select a process
- 1.2 Identify customers and suppliers
- 1.3 Identify participants
- 1.4 Journalize the process

2 Show the current process
- 2.1 Describe the ideal output
- 2.2 Identify variances
- 2.3 Construct real and ideal I/O diagrams
- 2.4 Locate key causes

3 Measure the current process
- 3.1 Write investigation questions
- 3.2 Plan the data collection effort
- 3.3 Describe variation at check points
- 3.4 Describe variance control patterns

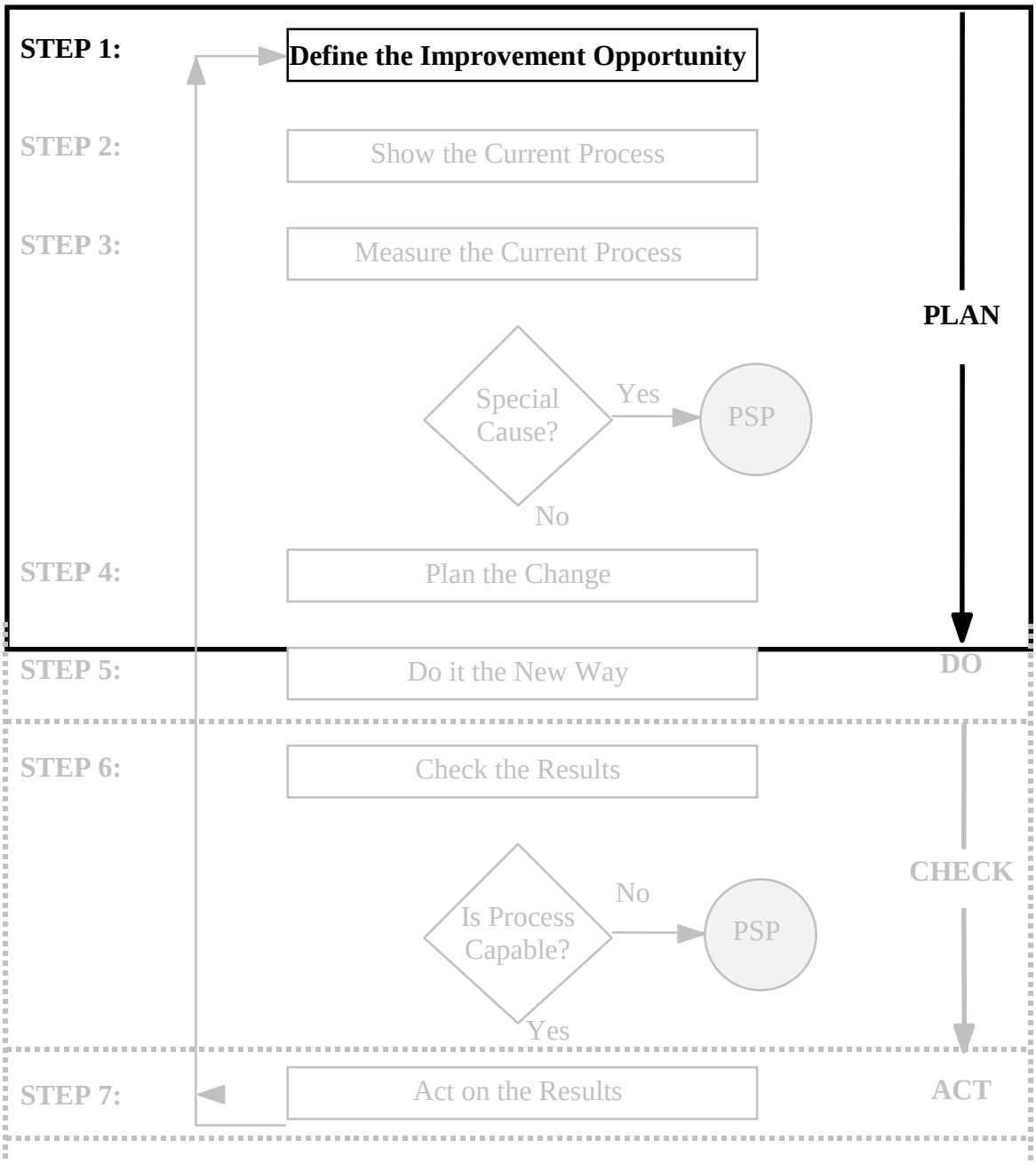
4 Plan the change
- 4.1 Develop reinforcing changes
- 4.2 Summarize changes
- 4.3 Develop sponsorship for change
- 4.4 Develop project plan

5 Do it the new way
- 5.1 Implement project plan
- 5.2 Monitor project plan

6 Check the results
- 6.1 Verify data collection methods
- 6.2 Study the impact of the change

7 Act on the results
- 7.1 Update documentation
- 7.2 Build on the improvements

STEP 1: DEFINE THE IMPROVEMENT OPPORTUNITY



OVERVIEW

What is the process? Where does it begin and end? Who are the customers and suppliers? Who will be directly and indirectly involved in the improvement effort?

The purpose of Step 1 is to set the boundaries of the process to be examined and to identify who will participate in the improvement effort.

Process

A set of activities that transform input into output. The intended output of a process is always more valuable than its input. It may be large or small depending on where you place your boundaries. For instance, billing a customer, receiving payment and accounting for the materials and labor that went into the process may be considered one process or three. The extent to which a process can be broken down is based on its level of aggregation.

Aggregation

One of the first issues people face when attempting to improve a process is determining the level of aggregation. How much of whole should be examined? Too much can cause one to miss the precise relationship between details; while too little can cause one to miss the purpose of the process.

Processes can be broken down, or disaggregated, by product or process step. For example, a business can be divided into product families or into its major functions, such as finance, sales and manufacturing. People familiar with how a process works (the **process owners**) must decide when and when not to aggregate processes. A rule of thumb is to aggregate processes that are controlled in pretty much the same way.

Sponsor

Someone who has the authority to legitimize the improvement effort. The role of a sponsor in a multi-departmental project is to:

- clearly define the need for change in the process,
- prepare people to examine their part of the process,
- provide time and resources to study the process, and
- see that feedback between departments is not personalized.

1.1 SELECT A PROCESS

Your first step is to identify the basic process that exists within the framework of your effort.

Process Selection Criteria

Strategic Issues	☐ **LOZIER** goals & objectives ☐ Annual operating plan ☐ Function of department objectives
Local	☐ Defective, late or unpredictable input ☐ Customer complaints about our product or service ☐ Too much rework ☐ An apparent waste of time and space ☐ Complicated procedures and policies that may be unnecessary ☐ Dependence -- one process may need to be improved before improvement in others pays off.
Learning	If you are starting the first PDCA effort in your department, you will want to consider which processes make it easy to learn the PDCA steps. ☐ Involvement of most department members as process owners. People learn the PDCA method best on a familiar process. ☐ Measurability of inputs and outputs of the process.

1. Determine how much you can break your effort into processes by product or sub-process. List these processes on the **Process Selection Worksheet**.
2. List the criteria you will use to select a process along the top of the matrix. See the description of the criteria above.
3. Choose a process by rating each one against each criterion. Use a ++ to indicate a strong relationship, a + to indicate some relationship, and leave it blank to indicate little or no relationship.
4. Count the number of pluses for each process. Select from among the three with the highest number of pluses.

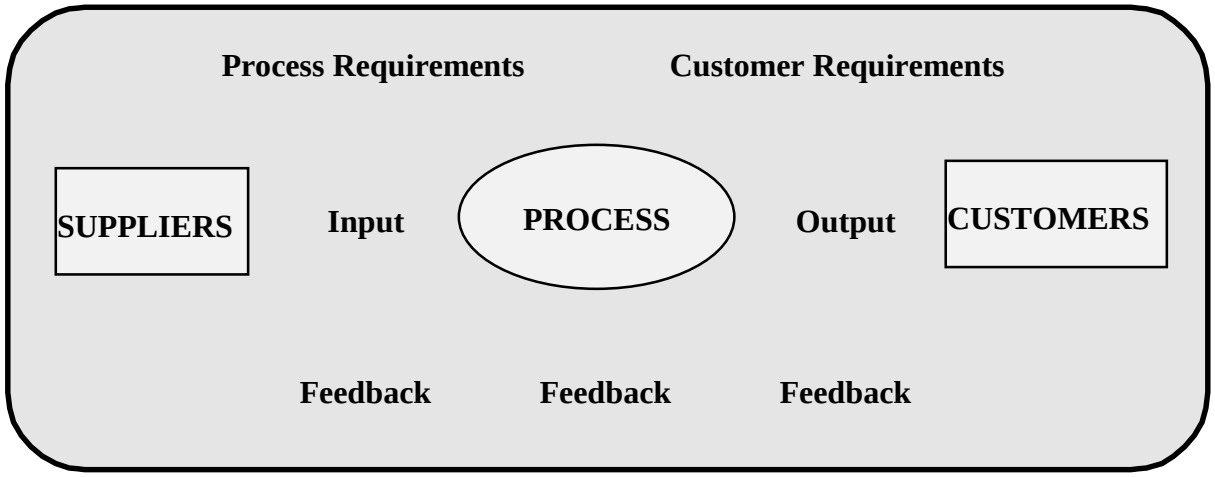
Process Selection Worksheet

Processes	Process Selection Criteria											Comments

1.2 IDENTIFY CUSTOMERS AND SUPPLIERS

A system that continually improves relies on feedback. A *reactive* system fixes problems in response to feedback. An *improving system* fixes the process in response to feedback.

Process	A process changes "raw" information or material (input) into more valuable information or material (output).
Suppliers	Input comes from suppliers. There are two kinds of input; basic input -- the input that will be changed to output, and *facilities* -- the skills, machines, documentation and other tools used to work in the process.
Customers	Every process has customers. Your customers are people who receive or use your products and services.



Customer and Supplier Relationships

Every process is a supplier of a subsequent process and the customer of a previous process. Although we more commonly think of customers as end-users -- people who pay for product -- viewing subsequent processes as customers reinforces our responsibility for quality.

1. Describe the process you are investigating on the **Customer Supplier Worksheet.** List the Improvement Objective if known.
2. List the customers and the output you provide them.
3. Identify your output and your suppliers. Although expertise, money, time and machines are "put into" the process, we are more concerned, at this point, with basic input, i.e., *material or information* being transformed by the process.

Customer-Supplier Worksheet

Process			**Improvement Objective**	
Suppliers: The sources of input.	**Input**		**Output**: Material or information designed to meet customer requirements.	**Customers**: Anyone who uses the output.
		→ ←		
		→ ←		
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1.3 IDENTIFY PARTICIPANTS

Setting the process boundaries lays the ground work for determining who will participate in the improvement effort. Participants in an improvement effort are made up of **process owners** and **stakeholders.**

Process Owners
The people who work in and control the process. A quality-driven culture relies on knowledge and commitment. Knowledge of customer needs and the process drives improvement. Commitment to serving customers makes the improvement continuous. When all people are viewed as knowledgeable contributors to a process, the identification of process owners becomes essential.

Stakeholders
Those who have a vested interest in a process, e.g., suppliers, customers, regulators and senior management. They may be either directly involved in an improvement effort or kept informed of key issues and progress.

Involving process owners and stakeholders

Unless there is only one process owner, most improvement efforts involve groups. The optimal size is between five and nine. But since there are usually more than nine process owners, involving everyone can be done using **representatives** or **steering committees**:

Representatives
One way of resolving an issue is to start with a small representative group. If the size of the improvement effort grows, new teams can be established so that all owners can participate directly in some part of the investigation. If representatives are used, the group must determine how it will keep other process owners informed and involved, if only indirectly.

Steering committees
When several teams operate in one area, coordination of the whole is difficult. Representatives from each team, often the team leaders or managers can form a process-wide steering committee to facilitate communication and cooperation.

1. List the names of those who work-in or control the process (process owners) as well as their role on the **Participants Worksheet**.
2. List the names of others with a vested interest under “Other Stakeholders.” Define their role.
3. Determine a method of communicating with non-active participants.

Participants Worksheet

Process Owners	Role or Job Title

Other Stakeholders	Role/Department

Place an asterisk (*) by all direct (active) participants.

1.4 JOURNALIZE THE PROCESS

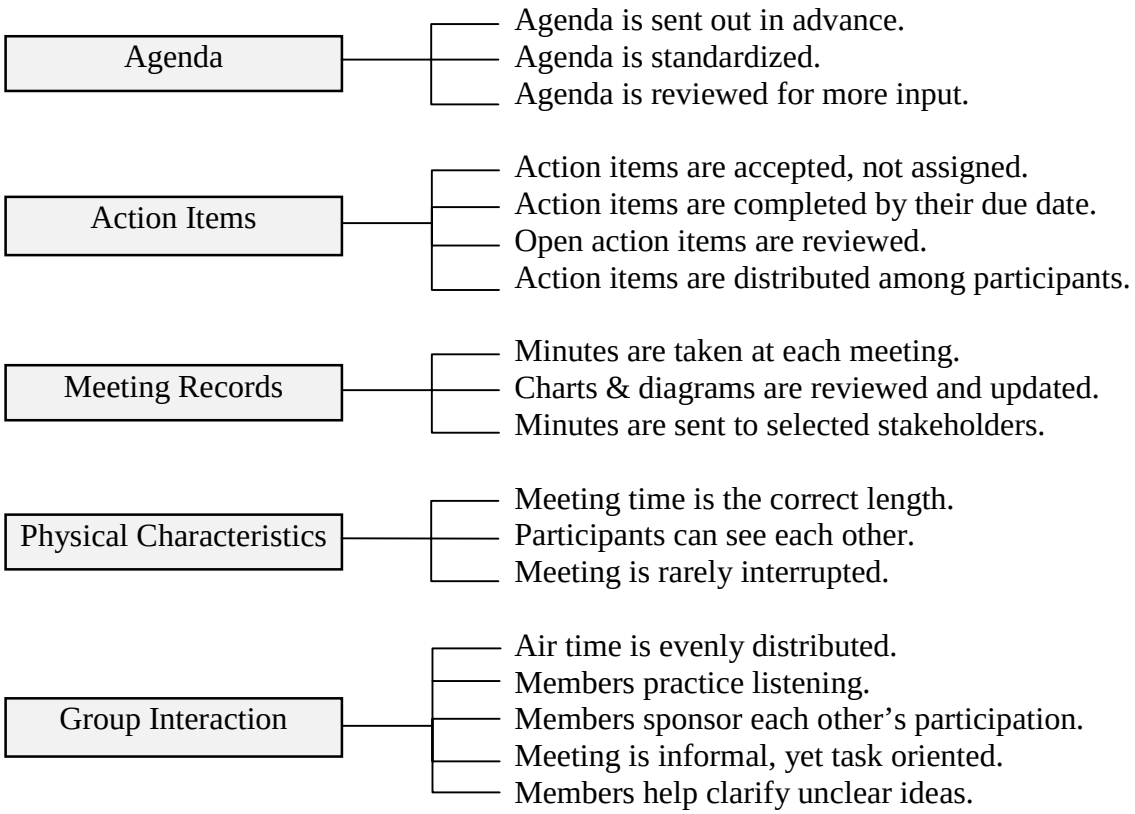
Meetings

Managers and supervisors will lead meetings as participants learn and continue through all the steps. The group's ability to meet efficiently will be an important factor in the team's success. Follow these guidelines for effective meetings:

- Incorporate PDCA functions into existing staff meetings rather than scheduling "another" meeting;
- Meet briefly and informally with participants to analysis new data;
- Allow teams to meet 1 - 1½ hours once a week to work through the steps of the cycle;
- Use the last 10' of a meeting to evaluate the group's performance in the meeting based on the standards the group set for themselves.

Effective Meeting Criteria:

Use these criteria as a starting point for developing an effective *Meetings Checklist*. Use the checklist at the end of the meeting to guide the evaluation of your meetings.



Displays

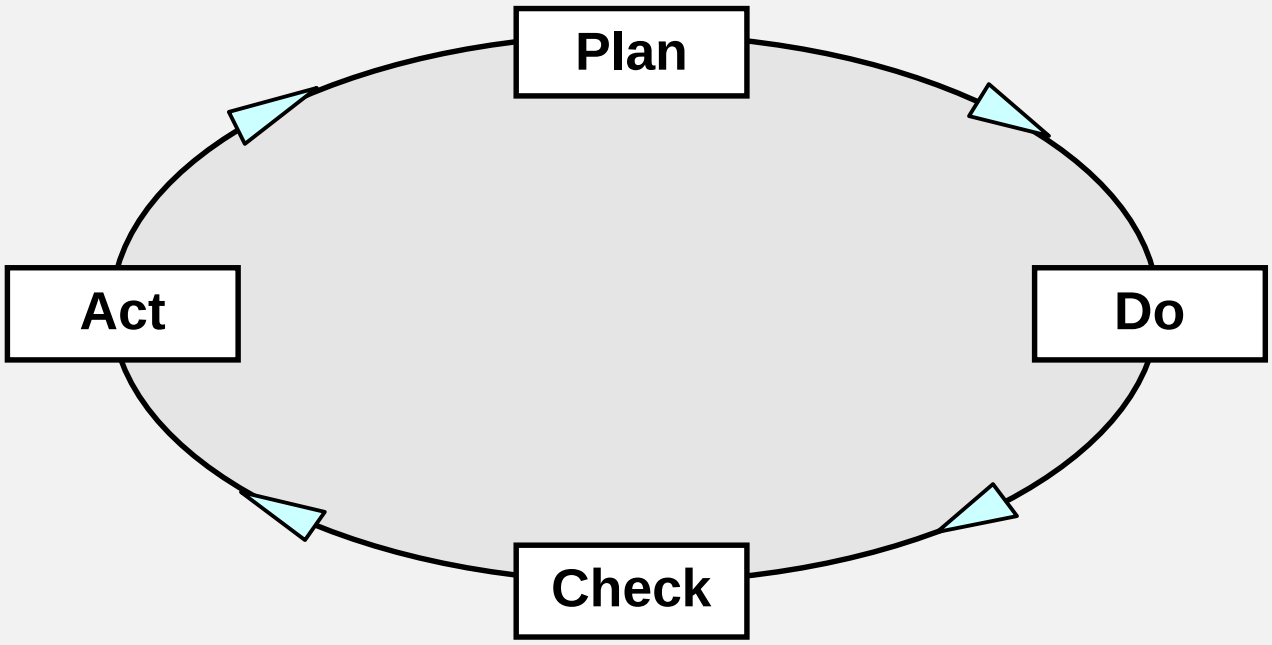
Graphically displaying information is a common thread throughout the PDCA cycle. Making 3 or 4 easy to understand charts or graphs to display in your work area keeps the project in front of process owners and serves as a simple, quick communication tool for stakeholders. It also helps meeting productivity by keeping the info fresh.

Storyboards

Every improvement project must be documented. A Storyboard is one method of documentation. It provides a set of repeatable steps that an individual or group can follow. A Storyboard is particularly important in the learning phase of PDCA since it helps insure that all phases of the cycle are completed. Lozier's Improvement Storyboard can be found in Appendix C.

1. Form a group of four to five process owners.
2. Choose from your list of improvement projects one small, well defined project that you can work on together, making sure that it meets objectives.
3. Develop a **meeting checklist**.
4. Determine a place to **display** 3-4 easy to understand charts or graphs.
5. Fill in the known information on the first page of the **Storyboard**.

HINT: Use your Storyboard as a folder to house your information. Then, after completing all seven steps, all your info is in one location so you can complete the Storyboard with ease.



1. Define the Improvement Opportunity:
   A. Problem Statement:

   B. Desired State Statement:

Plan

Leader:

Team Members:

Date Started:

Date Completed:

Control #:

- ☐ A plan for communicating with stakeholders and process owners who are not participating has been completed.
- ☐ A meeting plan for routine participants has been identified, as well as a plan for recording and distributing meeting minutes.
- ☐ A place to display improvement documents is designated.

NOTES ON STEP 1

1 Always let operators aggregate process. Always have a sponsor before starting a PDCA cycle.

- 1.1 Don't skip. Always do no matter how sure you are of having a specific problem process
- 1.2 May be easier to do one part number at a time on the Customer-Supplier Worksheet if the "process" is multi-partial, and then combine all parts onto one Customer-Supplier Worksheet.
- 1.3 Keep teams under nine people or there may be difficulty keeping everyone involved.
- 1.4 Don't worry about neatness at this point. There will be changes throughout the entire process. Use the Storyboard as a worksheet until after Step 7, then copy the final information to a new form.

MODULE 2:

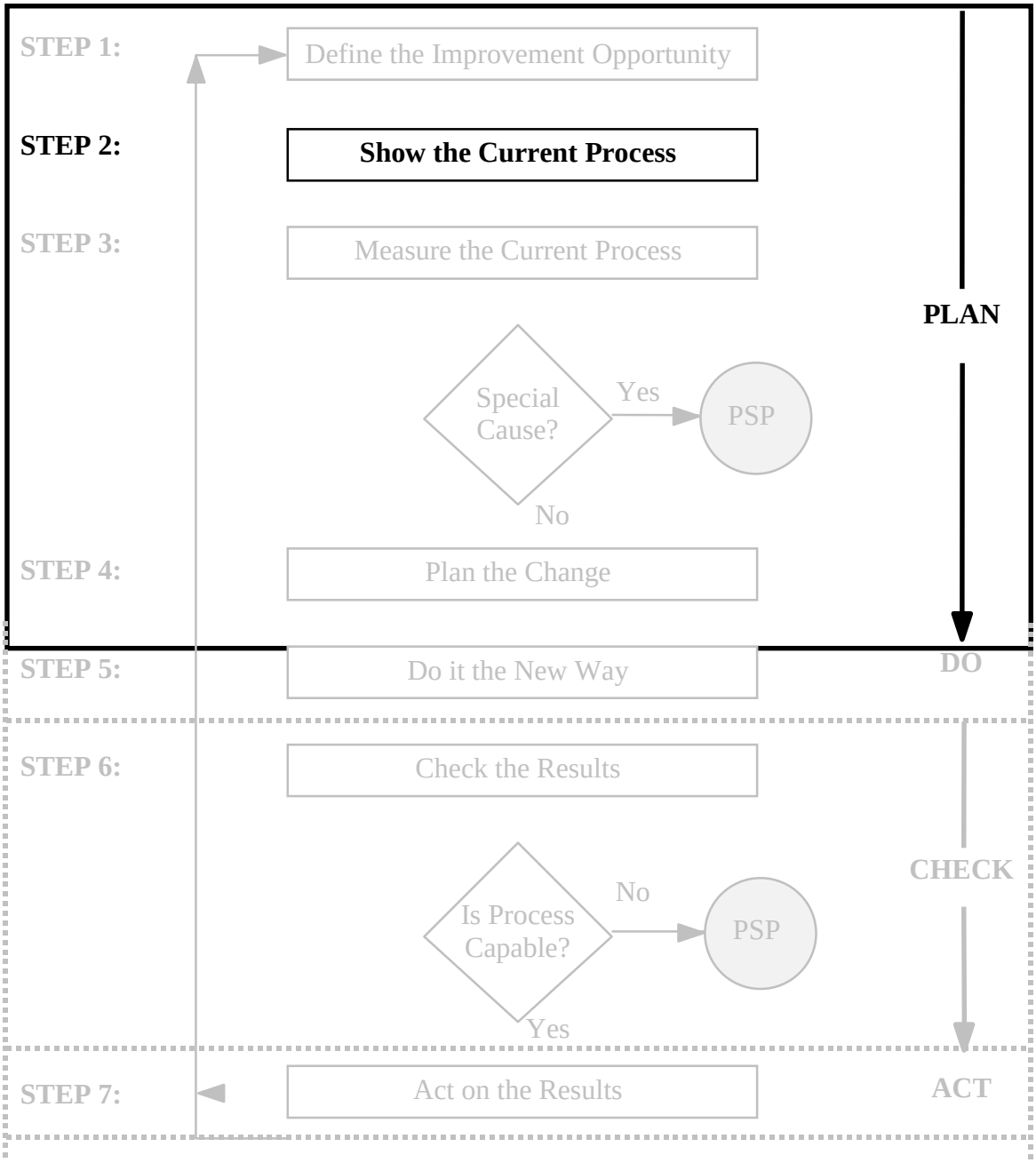
Describing the Current Process

Objectives

Upon completion of this module, participants will be able to:

- Describe the scope of the improvement project.
- Create an input/output diagram of a given process and the ideal process as described by its users and customers utilizing standard flowchart symbols.
- Determine the key causes or variances that if improved would have the greatest impact.

STEP 2: SHOW THE CURRENT PROCESS



OVERVIEW

Providing a product or service of consistent quality requires understanding the customers wants and knowing how to deliver them. It also requires understanding the critical control points in the process. Step two has several purposes:

1. to describe the intended quality of the product,
2. to identify waste in the process,
3. to create a common understanding of what makes the process work, and
4. to focus participants on improvements that are important to customers.

Process description starts with a flowchart or "map" of the process, breaking it down into its major stages. The flow chart, also called an input-output (I/O) diagram, depicts input flowing through the process. It helps participants decide what information must be collected, where it should be collected, and who should see it to better control the process

2.1 DESCRIBE THE IDEAL OUTPUT

The ideal output of a process meets all customers' needs for that product or service now and in the future. The aim of the "ideal" flow is to eliminate variation and waste.

Customers use many criteria to judge the value of a product or service. The four major categories are:

1. Product characteristics
2. Relationship
3. Cost
4. Delivery

Traditionally, quality has been associated with product characteristics, but as we work to continually improve we find that waste in process, such as scrap or long lead times, defines quality as well.

The tree chart on the following page describes a general set of Output Needs Categories based on the above criteria. Use them as a starting point for thinking about what your customers require.

Customer Need Categories

Product Characteristics	Performance	How well does it perform?
	Features	What bells and whistles does it have?
	Reliability	How often does it succeed?
	Conformance	Does it do what it says it does?
	Durability	How long does it last?
	Serviceability	How easy is it to fix?
	Aesthetics	How does it look, sound, etc.?
	Flexibility	Can I have it my way?
Relationship	Service	Is it easy to do business with them?
	Information	What is written about the company/field?
	Reputation	What is their track record?
Cost		What is the price? life-cycle cost?
Delivery	Reliability	Will I get it on time?
	Capacity	Can I get as many as I want?
	Lead time	How long will it take to get one?

Understanding Customer Needs

Customers vary in their ability to describe what they need or want. The needs that can be verbalized are *explicit needs*. For example, people want and expect gas in a rental car.

Needs that are every bit as strong, but unspoken, are *implicit needs*. For example, people want an inexpensive, comfortable rental car from an easily accessible location near an airport that has an express check-in and check-out.

1. Describe the specific **Product or Service** you are examining **Customer Needs Worksheet**.
2. List the **Customers** of the product or service in column ❶.
3. List the implicit needs of which you are aware in column ❷.
4. Survey customers to answer the following questions
   - ❷ What do you need or want (from this product or service)?
   - ❸ Which needs are most **important**? The least? (rate 1-5)
   - ❹ How well do we meet each of these needs (**performance**)? (rate 1-5)
5. Subtract customers' performance rating (❹) from their importance rating (❸). Needs with positive numbers are improvement targets.
6. Translate those needs into **key output variances** -- variances in the product or service you provide the customer.

Customer Needs Worksheet

Product or Service

Customers ❶	Needs ❷	Imp to Cust ❸	Perception of Performance ❹ Cust	❺ You	Score ❸-❹

Ratings

1 2 3 4 5

not important/low performance — very important/high performance

Key Output Variances

2.2 IDENTIFY VARIANCES

A **Variance** is any deviation from an ideal input or output. The greater the deviation, the greater the loss to the company and the customer. Variances, if not controlled, cause more variances down-stream in the process. The longer a variance is uncontrolled, the more waste, complexity and excess cost it generates.

Key Output Variances
Key output variances are the differences between your processes and your customer's most critical needs.

Upstream Variances
Upstream variances are deviations from ideal inputs and outputs that cause key output variances. Identify upstream variances only at major points in the process, or where two or more departments are involved (input points).

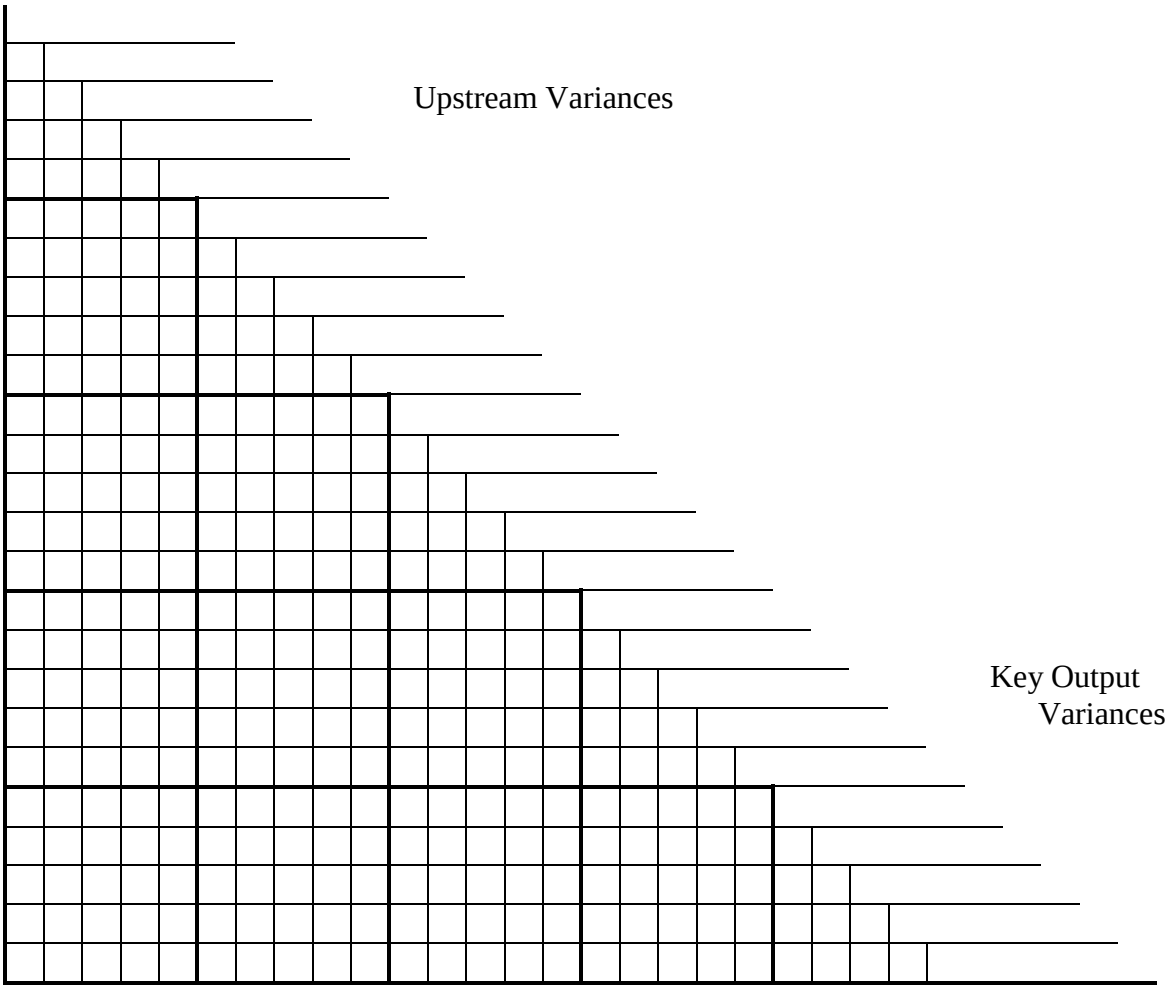
What to Control?
Control costs money. Variance control that does not improve customer value -- "more bang for the buck" -- is waste in the form of over-control. Controlling and reducing all variation is not only impossible, it is undesirable. If you understand your customer and your product well enough, you will know what has to be controlled to make your product effective. Anchoring the improvement effort on key output variances reduces the likelihood of over-control.

Variance Matrix
The variance matrix helps determine which upstream variances have the most impact on other variances and on key output variances. Use it when the relationships between variances *should be clarified*, such as when an effort involves several departments.

1. List the variances along the diagonal part of the matrix on the **Variance Matrix Worksheet**.
2. Place an "X" in any cell where one variance cause the other.
3. Identify key upstream variances (those that cause the most variances downstream or most impact the key output variances) with an asterisk (*).

Variance Matrix Worksheet

Use only when the relationship between variances needs to be clarified. This is usually the case if the improvement effort involves several departments.



You can describe the ideal product by identifying **Key Output Variances** or by **Surveying** customers (the surveying method was used in 2.1). Identifying key output variances is faster and uses customer feedback that *should* be received in the normal course of doing business:

1. For each output listed on the Customer-Supplier Worksheet, make a list of how it can vary from being perfect.
2. Use your knowledge of what is most important to your customers to select the output variances that most need to be reduced. These are the **key output variances.** Write these in the box at the bottom of the **Customer Needs Worksheet**

Customer Needs Ratings

		Importance	
		Low	High
Performance	High	Reduction Targets	Maintenance Targets
	Low	Non-Targets	Improvement Targets or **Key Output Variances**

Eight ways to better understand the customers' needs:

1. Be your customer; record your needs and wants.
2. Observe customers as they use your product.
3. Observe how customers change your product.
4. Set up routine communication with customers.
5. Learn about your customer's customer to anticipate future needs.
6. Involve your customer in your planning cycle.
7. Analyze product failures and complaints.
8. Test product modifications with pilot customers.

2.3 CONSTRUCT REAL AND IDEAL I/O DIAGRAMS

The Input/Output diagram is an effective method of describing a process because:

1. Customers and Suppliers are clearly identified.
2. The names given to inputs change as they exit a process. The change in name emphasizes the transformation that occurs in a process step. It helps orient participants to the purpose of a process step.
3. Waste due to defects and delays (uncontrolled variation) are made visible.

A **Real I/O Diagram** depicts the actual process. It shows value-added and non-value-added steps; participants have a consistent definition of waste in the process.

R
E
A
L

1. Select the primary input from the Customer-Supplier Worksheet and represent it with an arrow on the **Input/Output Diagram Worksheet**. Add a box representing the supplier.
2. Represent the first process step with a circle. Label its output arrow.
3. Continue with all steps including those considered waste until you have identified the primary output and its customers.

An **Ideal I/O Diagram** depicts the process as it would look if everything worked perfectly; it demands that participants think through, as a team, how the process should work. Continuous improvement requires an ideal goal, even though the goal may never be reached.

I
D
E
A
L

1. Select the primary input from the Customer-Supplier Worksheet and represent it with an arrow on the **Input/Output Diagram Worksheet**. Add a box representing the supplier.
2. If the input were perfect, what would be the first process step? Represent it with a circle and label its output arrow.
3. Assume the first process step and its output was perfect. What would be the second step? Represent it with a circle as you did in the first step.
4. Continue until you have identified the primary output and its customers. Trace other process steps with their inputs and outputs until all major process steps are shown.

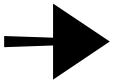
Either diagram can serve as a working map for attaching key output variances, upstream variances and check points. The “real” diagram is used to document the actual process on the Storyboard.

Flowcharts Symbols

A description of the real process encompasses all major stages, including storage, inspection and rework. Shading the symbols contrasts the ideal diagram making the waste in the real process more visible.

The rectangle represents either a supplier or customer -- someone outside the process. Label every rectangle with the name of the customer or supplier.

The circle represents a process step. Like the process over all, each stage transforms an input into an output to be used by the next stage. The first word in the circle should be a verb: inform members, assemble board, record preferences, hang shelves, etc.



The arrow is like a pipeline sending input and output between suppliers, process stages, and customers. Each arrow should be labeled with a noun naming the input or the output.

The shaded triangle stands for storage of inventory or pieces waiting to be processed (not applicable to all processes).

The shaded diamond represents an approval step of any kind, often labeled inspect or test. Every diamond has at least two outputs: approved material and defective material. If the defect cannot be reworked, the input must be scrapped. You may also want to show the test list or inspection criteria as an input to this step.

The shaded circle is a step that would not be necessary under ideal conditions. It adds no value to the original input. The most common example is rework. Most diamonds (inspection points) have corresponding rework processes. Showing rework as a separate step, as opposed to sending defects back to the original process stage, makes the rework more visible on the diagram.

An Input/Output diagram, at its highest level, contains only a circle which represents the whole process. Conceivably, every step of each activity could be listed and drawn. But, the most useful diagram lies at a level somewhere between the two.

Input/Output Diagram Worksheet

Process Description:
(Real or **Ideal)**

Date:

Prepared By:

Key

□ = customer/supplier

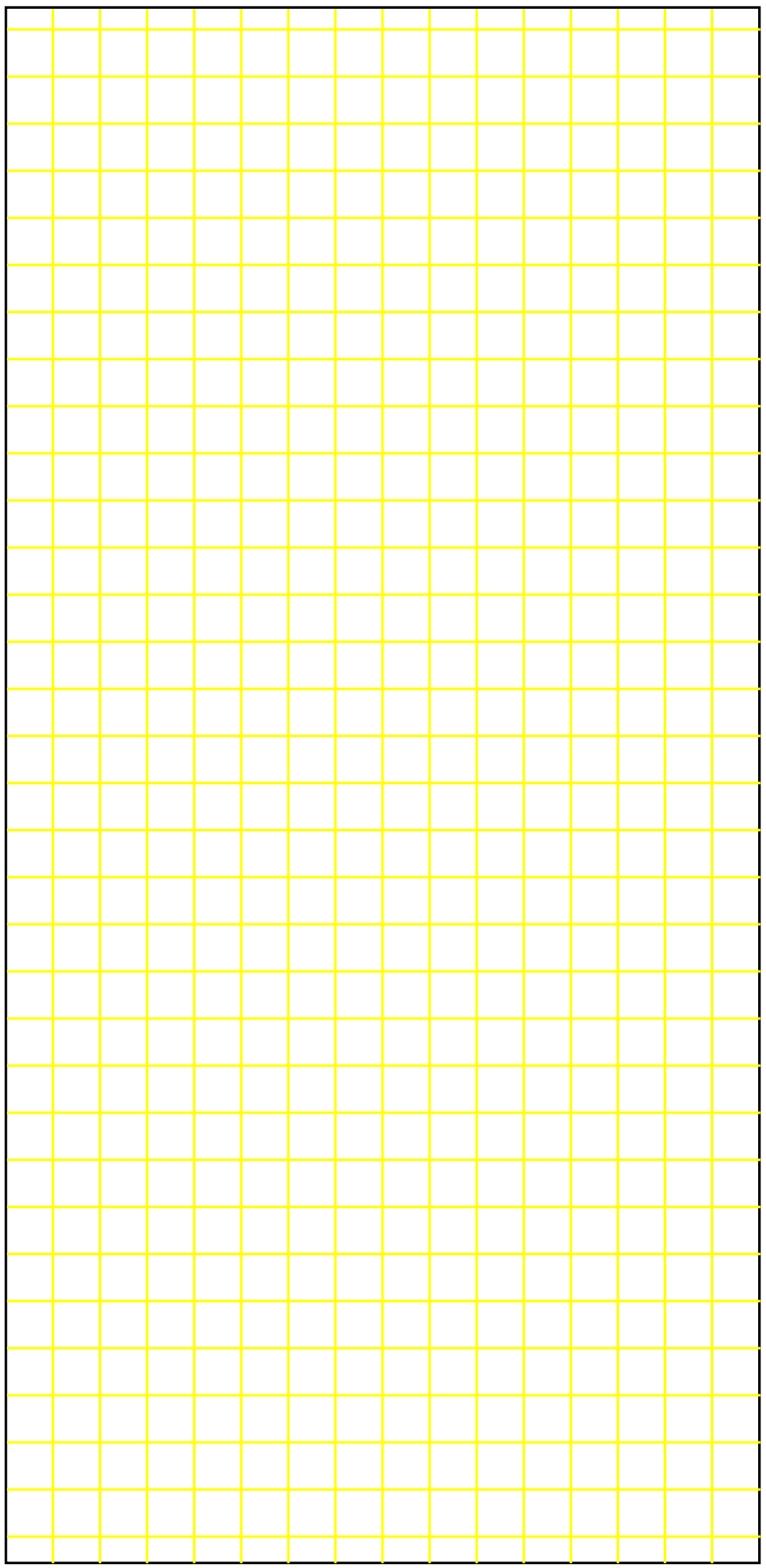
○ = process stage

→ = Input/Output

▼ = delay/inventory

✦ = inspect/test

● = rework



2.4 LOCATE KEY CAUSES

Joseph Juran popularized the Pareto Principle -- the notion that 80% of the variation in some condition are determined by 20% of the causes. People can use data and their knowledge of the processes to determine which causes require the most attention.

Examples of causes built into the system

An improving system consists of four interrelated categories: management, systems, processes and tools. The performance level of a process is influenced by the complex network of causes that are built into these areas (common causes). Performance capability can be improved by reducing or eliminating some of these common causes:

Management Systems

- ☐ Direction
  - Unclear department mission or purpose
  - Unclear work priorities
  - Stated priorities do not match real ones
- ☐ Communication
  - Lack of info. on company-wide changes
  - Lack of comm. w/customers & suppliers
  - Poor communication within the dept.
- ☐ Lack of follow-up on objectives & plans
- ☐ Rewards
  - Recognition
- ☐ Selection
  - Unclear job requirements
  - Inconsistent performance appraisals
- ☐ Individual development
  - Not emphasized
  - Little or no coaching
  - Poor training
- ☐ Organization design
  - Uneven distribution of responsibility
  - Dept. boundaries interfere w/ comm.
  - Over-specialized jobs

Process

- ☐ Poor process design
  - Incapable process
  - Improper sequence
  - Unbalanced capacity
  - Wasted materials, time or space
- ☐ Poor physical working conditions
- ☐ Unacceptable variation in matls. or info.

Tools

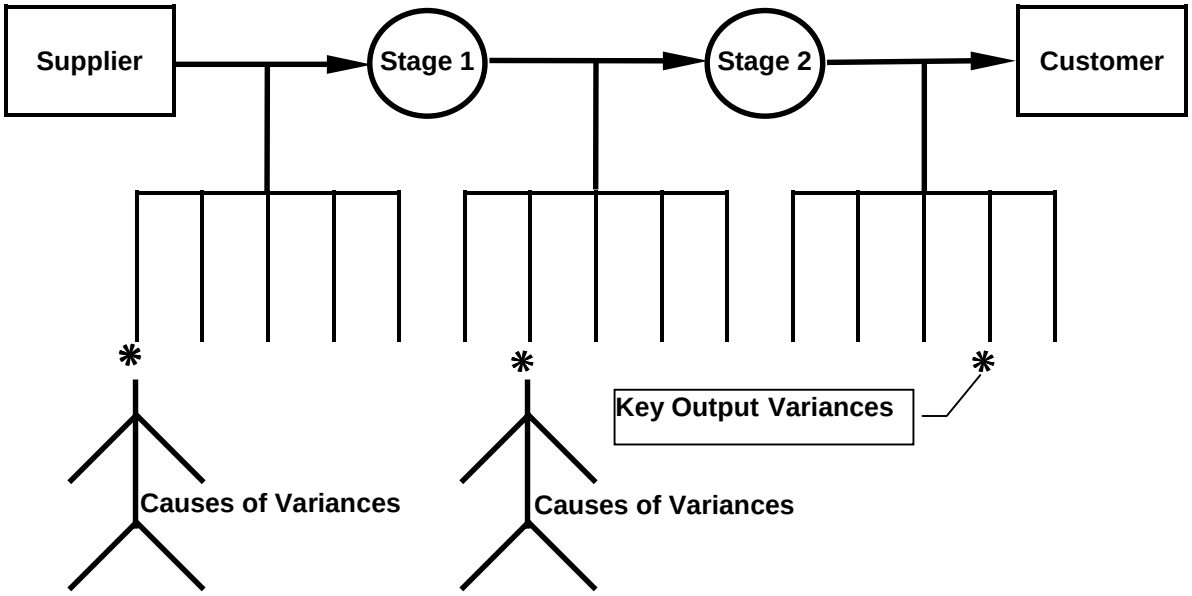
- ☐ Inadequate tools
  - Incapable of process demands
  - Poorly maintained
  - Slow

Manpower

- ☐ Human Error
  - No one is perfect, but human error can be reduced by reducing dependence on people's attention or by making it easier for people to attend to the task at hand. In the long run, human error is affected most by management systems.

Identify Check Points

By using data and the knowledge of process owners, you have determined the key upstream variances (or vital few causes) that must be controlled if the output is going to improve.



Examine your key variances or causes closer by completing the Key Variance Control Table. Analyze communication patterns that control variances *after* you have described and stabilized your process.

1. List all the key variances or causes in column one of the **Key Variance Control Table.**
2. Answer the question at the top of the column for each key variance or cause. Use only the first two columns to locate your data collection points. The others will be used to analyze team work and communication.
3. Select the key variances or causes you intend to monitor. Note that this is a Check point by placing an asterisk (*) in the "Where it is observed" column.
4. Place a corresponding asterisk (*) on your input-output diagram.

Key Variance Control Worksheet

Key Variance or Cause	Where it occurs	Where it's observed	Who observes it	Who tries to control it	How do they try to control it

CHECKLIST FOR STEP 2

- ☐ Customer input was used to describe the ideal product or service.
- ☐ Customer input helped determine Key Output Variances.
- ☐ Participants have a working map of the real process.
- ☐ Participants have a common understanding of an ideal process.
- ☐ Known causes of key variances are documented.
- ☐ Check points at which to collect data are identified.

NOTES ON STEP 2

2.1 On Customer-Needs Worksheet:
2.1.1 Put supplier in upper right-hand corner,
2.1.2 Ask customer to fill out "need" portion,
2.1.3 Photocopy,
2.1.4 Give original to customer. Ask him/her to fill out "Importance" and "Perception" columns,
2.1.5 Give photocopy to supplier. Ask him/her to fill out "Importance" and "Perception" columns,
2.1.6 Combine scores from customer and supplier. Compare.
2.2
2.3
2.4

MODULE 3:

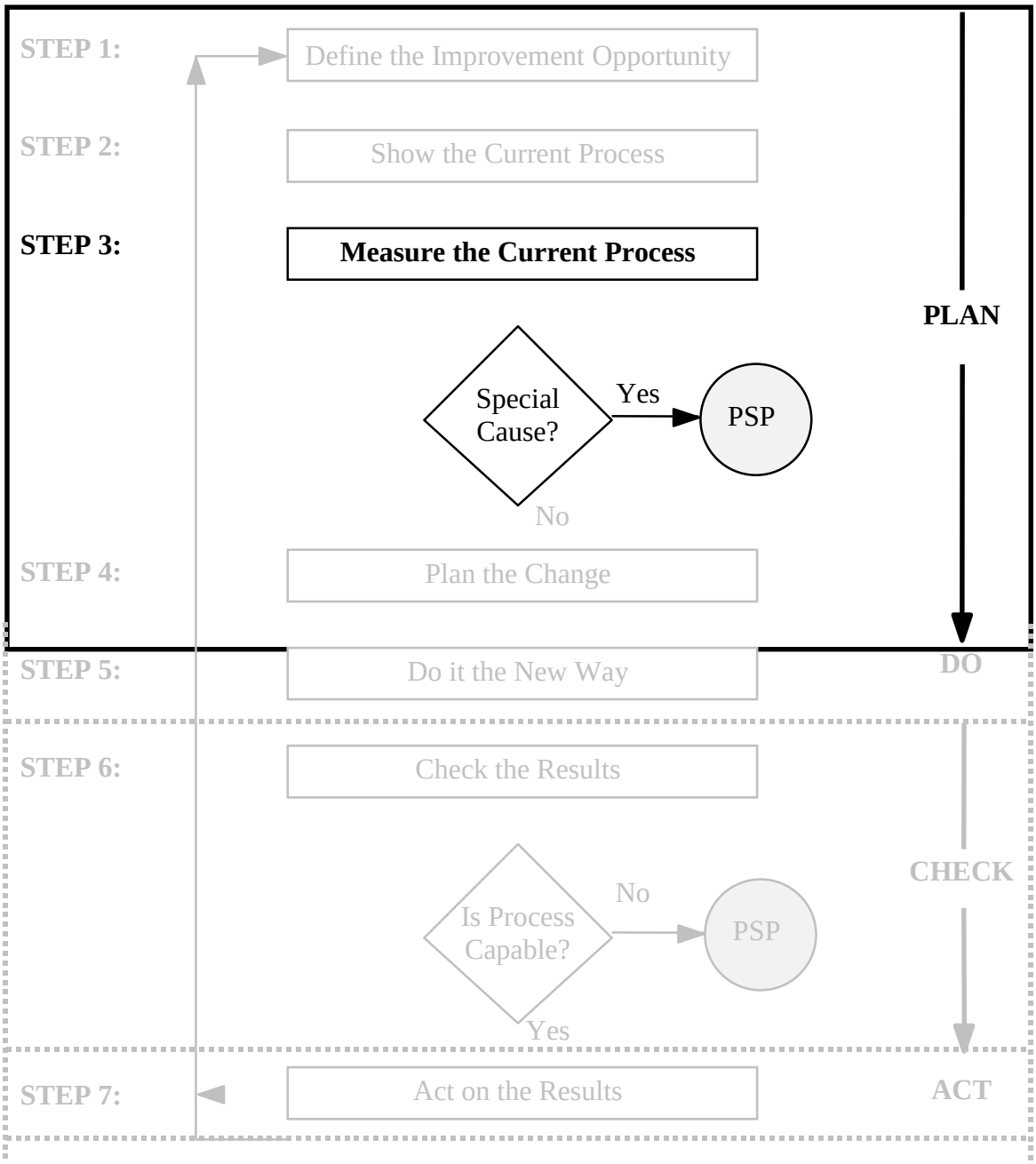
Analyzing the Current Process

Objectives

Upon completion of this module, participants will be able to:

- Determine what data needs to be collected, who should gather it, from where and when.
- Use basic tools to collect data and analyze common causes of a variation.
- Deduce from data analysis the need for problem solving (if required) to stabilize the process prior to continuing the improvement process.

STEP 3: MEASURE THE CURRENT PROCESS



OVERVIEW

After you describe the current process and examine key variances, you need to develop and implement methods to measure those variances. The resulting data will expose the **Root Cause.**

3.1 WRITE INVESTIGATION QUESTIONS

Regardless of where data is collected, the basic investigation questions will be the same:

1 What is the defect rate? *Attribute Data (pass/fail)*
What is the measurement? *Measurement Data (numerical value based on physical measure)*

For attribute data, the actual question may be, "What is the defect rate of incoming forms (or orders or materials)?"

For measurement data, the question could be, "How much time does it take to process each piece?" or "What is the thickness of the bars at each end?"

2 Is the variation consistent?

To reduce variation, you first need to understand whether or not the variation appears consistent or stable. You will be using statistical tools to help you define consistency.

If the variation appears consistent, it is probably caused by something built in to your process. If extreme variation occurs occasionally, it may be due to causes apart from your process. You will have to make the process consistent by preventing special causes before attempting to remove the built-in or common causes of variation.

3 Is the process capable?

When a process is consistent, its capability or natural tolerance can be determined. The tools for describing capability will vary with data type. This is because capability for attribute data is defined by the average number of defects per sample, while capability for measurement data depends on the degree of variation in the measurement.

1. Develop an investigation question for each data collection point (✳) on the Key Variance Control Worksheet.
2. Write each question on the **Data Collection Worksheet**.

3.2 PLAN THE DATA COLLECTION EFFORT

List the Data Elements

Data is collected to track process changes over time (hence the use of run charts and control charts), but it is also used to better understand causes of variation.

1. Consider the variances you want to investigate (Step 2.4). Then ask yourself, "What specific attribute and/or measurement data would help me understand why the variance is occurring." e.g., # backorders/day, length of weld
2. List your answers with the appropriate Investigation Question under "What data elements are to be collected?" on the **Data Collection Worksheet**
3. Provide criteria or measurement methods to several people and ask them to make judgments or measurements to insure that it is *operational defined*, i.e., everyone that does or will use the data understands its function.

Consistently collecting good data is one of the most difficult parts of the PDCA cycle. Expect your data collection forms and methods to change you gather more information.

Guidelines for Data Collection Methods

Complex or cumbersome methods will often lead to inconsistent data accuracy. Use the following info to control the consistency of data gathered from multiple collectors:

1. Make the data collectors the data analysts to ensure long-term use.
2. Avoid collecting too much data to prevent burn-out.
3. Have all data collectors trained by one person.
4. During training, test the consistency of the collectors' judgments.
5. Print data collection instructions on data collection form.
6. Encourage the collectors to monitor their own accuracy.

Use and communicate the data. If data is not being used, stop collecting it.

1. Complete a **Data Collection Worksheet** segment for each investigation question. See Appendix A, "Tools for Collecting Information" for examples on how to record data.
2. Discuss how and when data will be communicated with people other than the process owners.
3. Complete a **Data Communication Worksheet** segment for each checkpoint.
4. Collect the data.
5. Communicate its results.

Data Collection Worksheet

Investigation Question:				
What data elements are to be collected?	**By whom?**	**Where?**	**How recorded?**	**When?**

Investigation Question:				
What data elements are to be collected?	**By whom?**	**Where?**	**How recorded?**	**When?**

Investigation Question:				
What data elements are to be collected?	**By whom?**	**Where?**	**How recorded?**	**When?**

Data Communication Worksheet

Check Point	Who can use this data for process improvement?	Format needed?	How often will data be communicated?

Check Point	Who can use this data for process improvement?	Format needed?	How often will data be communicated?

Check Point	Who can use this data for process improvement?	Format needed?	How often will data be communicated?

3.3 DESCRIBE VARIATION AT CHECK POINTS

In Step 2.4 you determined your variance check points, and in Step 3.2 you collected the data on those identified variances. Now it's time to analyze those variances and determine the **Root Cause** using basic tools *:

1 Tools that track processes over time:
- 1.1 Run charts to observe trends or patterns
- 1.2 Control charts to monitor, control and improve performance

2 Tools to analyze and display data to make the variation more visible:
- 2.1 Cause & Effect diagrams to identify and explore all of the possible causes related to a condition to discover the root cause
- 2.2 Pareto charts to break down the most frequent or costly defect categories until a course of action is apparent
- 2.3 Histograms to summarize data that has been collected over a period of time, and graphically present frequency distribution in bar form

1. Use any of the above tools -- and any others up to 4 -- to analyze your data.
2. Describe the **Root Cause** on your Storyboard.
3. Display the data in the area you designated in Step 1.

3.4 DESCRIBE VARIANCE CONTROL PATTERNS

Before considering system changes, consider how people are trying to control key variances and causes. The most significant variances exist because the present system is not designed to control them; or they *are* being controlled, but at too high a cost.

Uncontrolled variances can sometimes be traced to complicated control procedures that require too many hand-offs and transactions. The lack of control is usually not the fault of the individual who first observes the variance, nor are the people upstream to blame.

1. List (in detail) the activities and delays on the **Variance Control Analysis Worksheet** that usually take place from the time the variance occurs to the time it is controlled. Circle "A" if it's an activity and "D" if it's a delay.
2. Identify who performs the activity (name or role) or where the delay occurs.
3. Determine the amount of time required to perform the activity or the typical delay time. If the time is insignificant, enter "I."
4. Count the number of entries on your list. Add up the total time.

* See Appendix A for tool descriptions and how to's

Variance Control Analysis Worksheet

Key Variance (or Root Cause)			
	Activity or Delay Description	**Who or Where**	**Time**
1 A D			
2 A D			
3 A D			
4 A D			
5 A D			
6 A D			
7 A D			
8 A D			
9 A D			

CHECKLIST FOR STEP 3

- ☐ Investigation questions are written for each check point.
- ☐ Participants have identified data elements to be collected while the process is in operation OR to monitor changes in the process over time.
- ☐ The data collected will enable participants to add to their knowledge base.
- ☐ Participants have developed a plan to maintain consistent data collection.
- ☐ Plans to communicate the data being collected have been made with the involvement of those who will receive the data.
- ☐ The vital few causes of variances at each checkpoint are being monitored over time.
- ☐ Data at each checkpoint is being studied so that causes will be better understood.
- ☐ Process owners know how to respond to special causes.
- ☐ Control patterns for key variances and causes have been described.

NOTES ON STEP 3

3.1 Keep data collection as simple as possible... “Keep it simple stupid.”
3.2
3.3 Make various Pareto Charts using all available data for that part of the process, e.g., units, dollars, returns, part numbers, department, person, machine, etc.
3.4

MODULE 4:

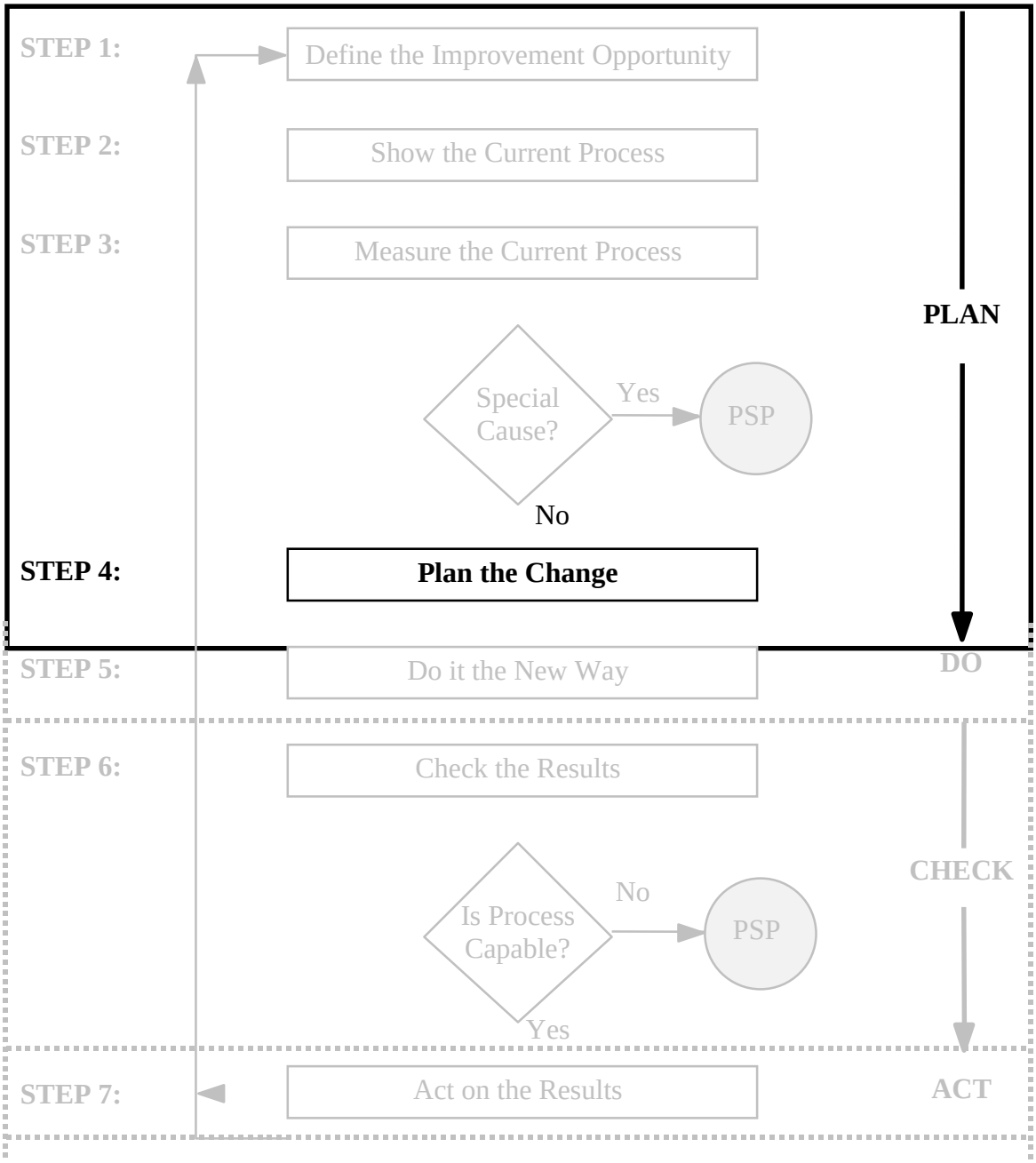
Planning and Implementing the Change

Objectives

Upon completion of this module, participants will be able to:

- Identify the “waves” a proposed change could make and devise a plan to control the ripples.
- Summarize a given planned change with evidence, assumptions, and ways of meeting customer demands and strategic objectives.
- Develop sponsorship for change.
- Develop and implement a project plan using basic tools.

STEP 4: PLAN A CHANGE



OVERVIEW

Data can highlight the inner workings of a process, but people must interpret the data and develop action plans. After measuring the current process, you have determined the **Root Cause** and have probably already *Identified* a *Change* that would reduce or eliminate the common cause/s acting on your process. Hold that thought ... Step 4 is designed to prevent thinking in terms of a single change because common causes are usually an interrelated network of causes. Participants must look for ways to make changes mutually reinforcing before they can determine their **Proposed Change**.

Controlling Special Causes

If the data analysis in Step 3 revealed an unstable, out-of-control process, the first step in improving the process is to remove the cause of the instability -- the special cause. Careful data collection and prompt data analysis will often lead to an identification of the unique event that led to the instability.

4.1 DEVELOP REINFORCING CHANGES

An improving system consists of four interrelated categories (as discussed in Step 2.4): management, systems, process, tools. Any time a change is implemented, its affects can be observed in the other categories. The components of each category are listed below:

Management Systems

- Direction
  Setting objectives and making plans
- Communications
  What people need to know and how they know it
- Follow-up
  The way progress is measured and monitored
- Rewards
  The connection between action and consequences
- Selection
  The way people become members of the organization
- Individual development
  The way people continuously improve
- Organizational design
  The way work is divided among people

Process

- Sequence of steps
- Waste
- Input quality (supplier relationship)

Tools

New tools are often result from technological developments that render the previous ones obsolete. The benefits of new tools will be optimized if they are considered part of a system of people management and systems.

- Automation
- Management information

People

- Knowledge level
- Skill level
- Skill breadth
- Responsibility level

The *waves* (variances) your identified change will create must be known and controlled before planning your change can begin:

1. List the **Identified Change** needed to control the *key variance or cause* on the **Change Alternatives Worksheet** .
2. Check the component the change could affect under its *change category.*

Variance Control Alternatives

There are strategies you can use to control these waves of change. Below are five general variance control strategies to choose from depending on the capability of the process (listed by degree of control):

- **Stop the variance**.
  The most powerful strategy to stop variance is to design the process to prevent it. For example, using computers instead of paper to record data makes it possible to edit the information before completing the transaction; or making mating parts asymmetrical to prevent them from being assembled incorrectly.

- **Decrease the likelihood of the variance.**
  Some variances occur because the process makes it easy for them to occur. To reduce the likelihood of incorrect information being entered onto forms, redesign the form to make the format easier to understand and the information more easily understood. Instructions on the form can also reduce the probability of variation.

- **Eliminate the variance when it is detected.**
  When a variance cannot be prevented, the best control mechanism may be early detection. Moving variance detection upstream may require new detection methods as well as an education system for people working upstream that gives them the ability and the responsibility to control the variance.

- **Control the degree of variation.**
  Sometimes it is unnecessary to control variation beyond a certain point. In manufacturing, using go/no-go gages assumes that the variation within set limit is insignificant. In administration, only high-cost variances may be selected for control.

- **Reduce dependence on variance control.**
  A completely different strategy is to make the system insensitive to variation in one or more components of the system. By examining how parts fit together, alternative product designs can be evaluated for their sensitivity to component variation.

Change Alternatives Worksheet

Identified Change	
Affected Areas of Change	
Management Systems ☐ Direction ☐ Communication ☐ Follow-up ☐ Rewards ☐ Selection ☐ Individual development ☐ Organizational design ☐ Other	**People** ☐ Knowledge level ☐ Skill level ☐ Skill breadth ☐ Responsibility level ☐ Other
Tools ☐ Automation ☐ Management information ☐ Other	**Processes** ☐ Sequence of steps ☐ Waste ☐ Input quality ☐ Other

Identified Change	
Affected Areas of Change	
Management Systems ☐ Direction ☐ Communication ☐ Follow-up ☐ Rewards ☐ Selection ☐ Individual development ☐ Organizational design ☐ Other	**People** ☐ Knowledge level ☐ Skill level ☐ Skill breadth ☐ Responsibility level ☐ Other
Tools ☐ Automation ☐ Management information ☐ Other	**Processes** ☐ Sequence of steps ☐ Waste ☐ Input quality ☐ Other

4.2 SUMMARIZE CHANGES

Now that you know the waves your *identified change* will make, as well as methods that can control their ripples, you can describe the change you want to implement. This is the one you will propose to your sponsors (supporters). On your Storyboard, it is called a **Proposed Change**. It is made up of specific *elements* that control the rippling effect of a change. Each of these **key elements** should:

1. control the variance/s without causing others;
2. fit with each other;
3. improve the process's long term effectiveness and adaptability; and
4. increase the process owners' commitment to continuous improvement.

1. Describe the **Proposed Change** on the **Change Summary Worksheet**.
2. Summarize its **Key elements**.
3. List the measurable and non-measurable **Expected outcomes** of the change. (See key output variances being monitored)
4. Summarize your **Supporting** data (**evidence**), then list the key **assumptions** supporting the change that will make the change successful.
5. Summarize the internal and external **Customer expectations met** by the change. Include the end user expectations met. (see Step 2.1)
6. Describe the **Strategic objectives met** by implementing the change.

4.3 DEVELOP SPONSORSHIP FOR CHANGE

A sponsor is someone who leads and provides resources for implementing the change. Sponsors extend from the highest level person who must approve the change, through the management hierarchy to all process owners who will be implementing the change.

Participants must identify, evaluate and educate sponsors who will implement the change. If the proposed changes will affect other processes, the effects must be understood and supported by process owners and management teams in those areas.

1. Sketch the management hierarchy between the process owners and the highest level sponsor that may be required.
2. If the change will affect other processes, add the hierarchy of those areas to your sketch.
3. Evaluate the sponsors you have identified using the Requirements for Effective Sponsors Checklist on the next page.
4. Complete the **Implementing Change Worksheet**.
5. Include *Sponsor Education* in your Project Plan.

Change Summary Worksheet

Proposed Change

Key Elements

Expected outcomes

Supporting evidence and assumptions

Customer expectations met

Strategic objectives met

Requirements of Effective Sponsors

Use the checklist below to evaluate the sponsors you have identified.

Understanding

- ☐ Understands the need for and the importance of the change.
- ☐ Understands some of the methods that will bring about the change.
- ☐ Understands the scope of the change.
- ☐ Understands the impact of the change on process owners.
- ☐ Understands the impact of the change on his/her role.

Words

- ☐ Articulates the importance of the change publicly & privately.
- ☐ Clearly describes the intended outcomes of the change.

Actions

Modeling the Change

- ☐ Modifies his/her own behavior to be consistent with the change.
- ☐ Communicates by word and action that the new system is replacing the old.

Managing the Change

- ☐ Incorporates change implications into department plans.
- ☐ Provides resources to support the change.
- ☐ Regularly checks on progress.
- ☐ Uses support for the change as a criterion for rewarding people.

4.4 DEVELOP PROJECT PLAN

Improvements that require the cooperation of several people or departments must be well organized. The *project* must be *managed.* Although project management is a course in itself, using a planning tool such as a Gantt chart assists project organization (See Appendix A, "Tools for Planning Action").

1. Determine the type of tool that would work best for "Planning Action."
2. Lists the tasks that need to be performed to reach the desired state described in the change summary.
3. If there are a large number of tasks, identify immediate milestones that must be reached.
4. Identify who will perform each task. If the tasks are to be performed by a group, identify who will be responsible for seeing the task is complete.
5. Identify when the task will start and when the task will be complete.

Implementing Change Worksheet

1. Can the change be implemented by process owners alone?

— Whose sponsorship is required?

— What evidence will sponsors need to support the change?

2. Can the change be implemented without additional resources?

— If yes, go to #3.

— If no, what resources will be needed?

3a. Will the change affect other processes?

— Process

— Owners

— Effect

3b. What will be done to control the effects on other processes?

CHECKLIST FOR STEP 4 ☑

- ☐ Alternatives to the selected set of changes were considered.
- ☐ Changes in the relationship among people, management systems, processes and tools have been considered.
- ☐ The need for change has been documented.
- ☐ Measures or indicators of improvement have been identified.
- ☐ Sponsorship is adequate for the changes to be successful.
  or
- ☐ There is a plan for developing sponsorship for the changes.
- ☐ Tasks, responsibilities and completion dates for implementing the set of changes are identified.

NOTES ON STEP 4

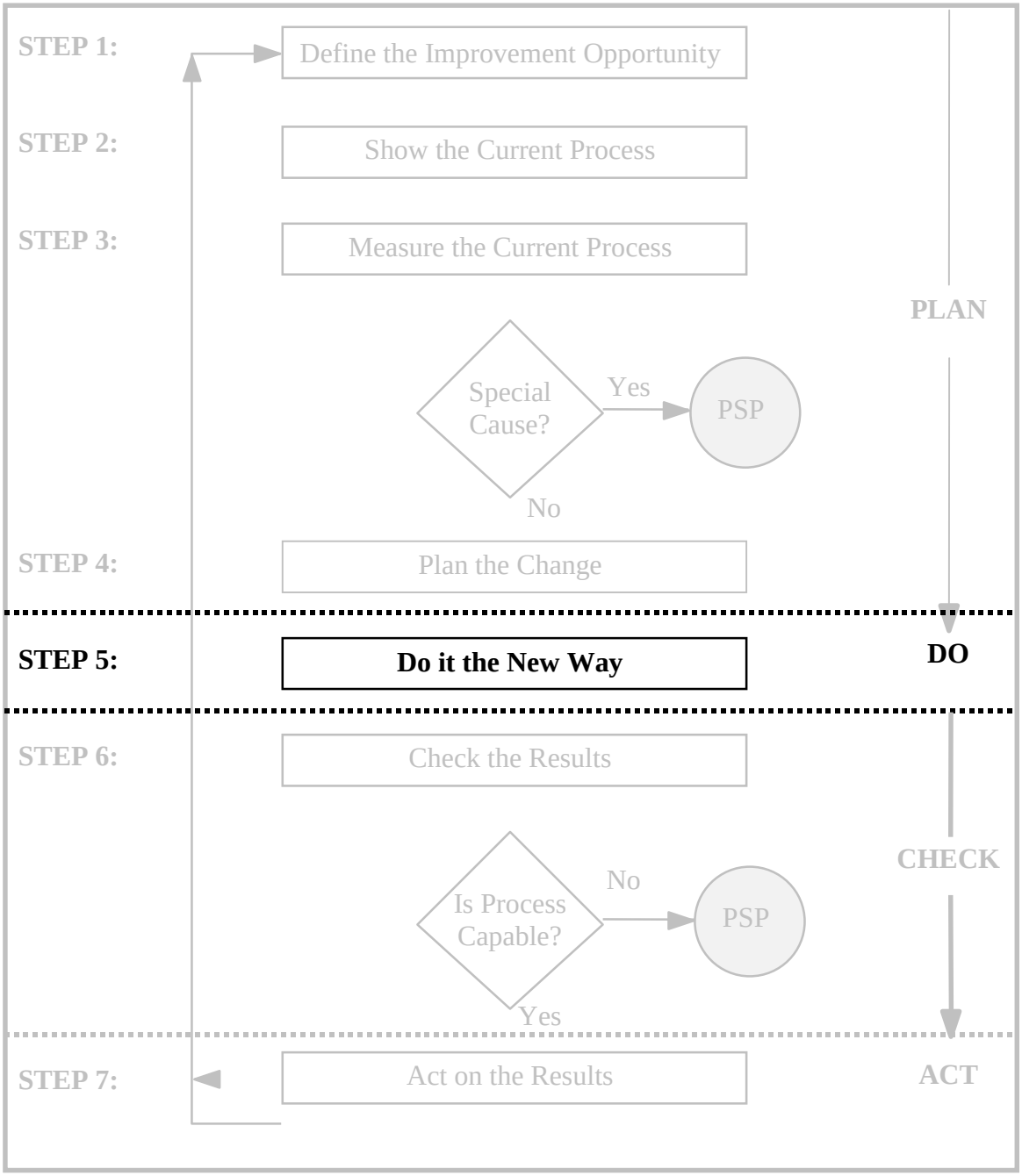
4.1 Do a Change Alternatives Worksheet for each proposed idea to correct a given problem. After filling out the sheets, try the one idea or suggestion that looks best.

4.2

4.3

4.4 Before developing a project plan, it may be helpful to construct a force-field analysis to examine the forces acting on your proposed change.

STEP 5: DO IT THE NEW WAY



OVERVIEW

Process changes can be as simple as altering a machine setting, changing a company policy or redesigning jobs. Even though a change will lead to improvements on paper, the way the changes are implemented can affect their impact.

The purpose of Step 5 is:
- to implement the change as planned, and
- to assure the change is going as planned

5.1 IMPLEMENT PROJECT PLAN

Implement the plan you developed in Step 4, preferably on a small scale at first, particularly if it's a costly or risky solution.

Communicate the "Who's, What's Where's and When's" of the implementation to all process owners and stakeholders. Follow the communication plan developed in Step 1.3 to communicate with non-participants. Enlist sponsors to assist with leading the effort or enlisting other resources if required.

5.2 MONITOR PROJECT PLAN

The best plans can go wrong without proper nurturing. Take the time to make sure that the plan you developed is on schedule:

1. Are the listed tasks being completed in the appropriate way?
2. Are milestones being reached?
3. Is data being collected according to plan?
4. Are those responsible for seeing the task through monitoring the plan's progress satisfactorily?
5. Is everything on schedule?

If the answer was no to any of these questions, are corrective measures being taken?

Continually revisit the implementation, asking the above questions, to insure the plan is being implemented properly.

CHECKLIST FOR STEP 5

- ☐ The plan is on schedule
  or
- ☐ Corrective action is in place.

NOTES ON STEP 5

MODULE 5:

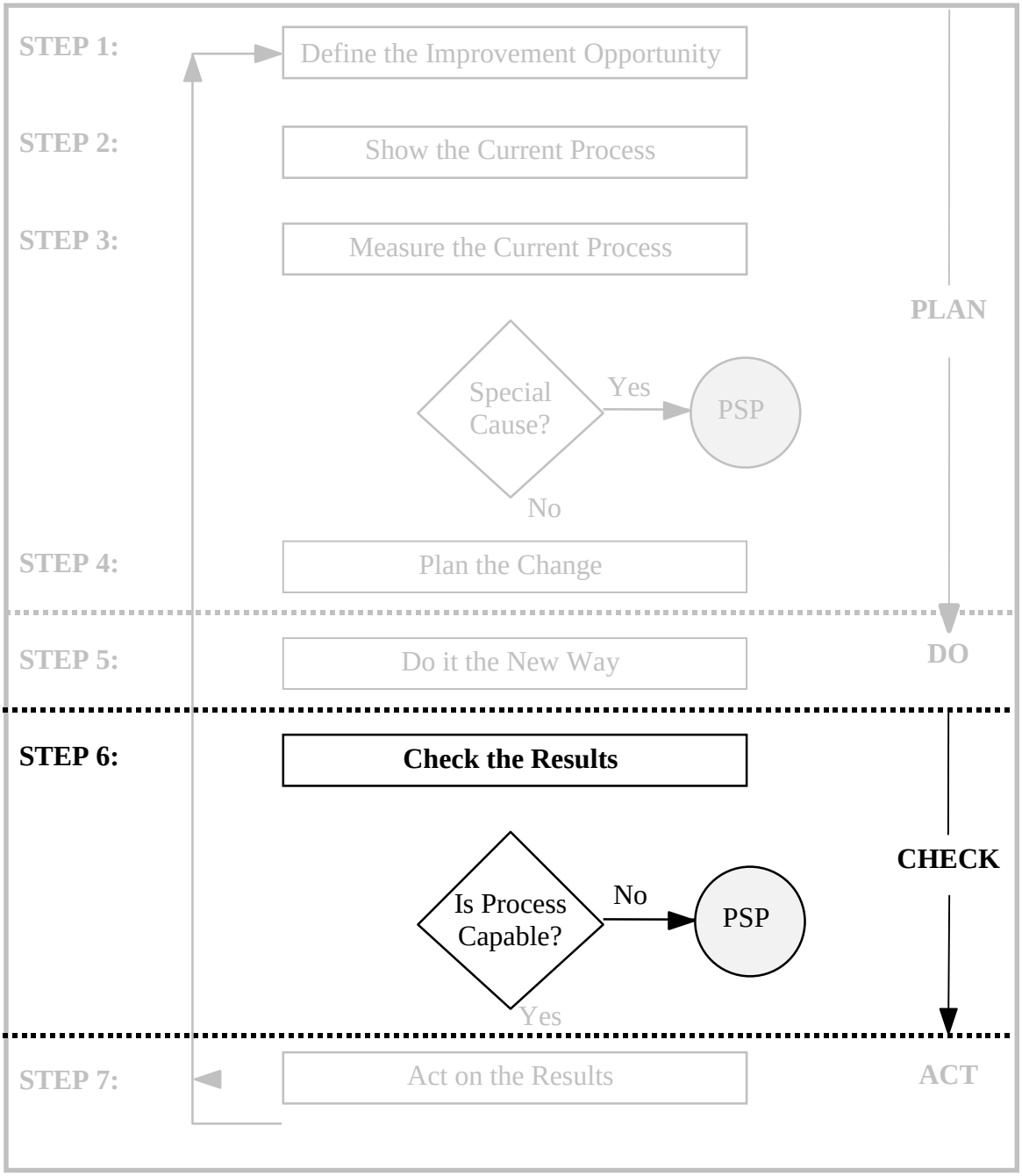
Validating the Change

Objectives

Upon completion of this module, participants will be able to:

- Determine the capability of a process to support a given change.
- Tell the story of the improvement with data, diagrams and other forms of analysis.
- Identify the terms a newly instituted improvement requires to maintain it.

STEP 6: CHECK THE RESULTS



OVERVIEW

Preparation for Step 6 -- deciding what, how, where and when to check -- was completed in Steps 1 to 5. The purpose of *checking* is to follow up on what you have planned to accomplish

6.1 VERIFY DATA COLLECTION METHODS

Before analyzing the results of the project plan, verify the validity of the data you have collected. This should not be a problem if data collection methods:

1. Were established with the aid of the gatherer
2. Are being analyzed by a user of the data

6.2 STUDY THE IMPACT OF THE CHANGES

After establishing the validity of the new data, use the **Implementation Check Worksheet** on the next page to insure that the change is having the intended effect/s.

If after completing the worksheet you determine that the implementation is NOT having the effect predicted, you must revisit your data or your implementation plan. You may find after analyzing the final data that you cannot accept the change as planned. It may have to be modified or even rejected.

The process may not even be capable of realizing the planned objective. If this is the case, the change cannot be implemented within this process. Problem Solving must be used instead.

Implementation Check Worksheet

Yes	No	Question
☐	☐	Are the changes having the intended effects?
☐	☐	Are there any side effects we didn't anticipate? If yes:
		What is the impact on process owners? _____
		What is the impact on suppliers? _____
		What is the impact on customers? _____
☐	☐	Can we trust the data?

What is causing the improvement or lack of improvement? _____

What is the role of management in sustaining the improvement? _____

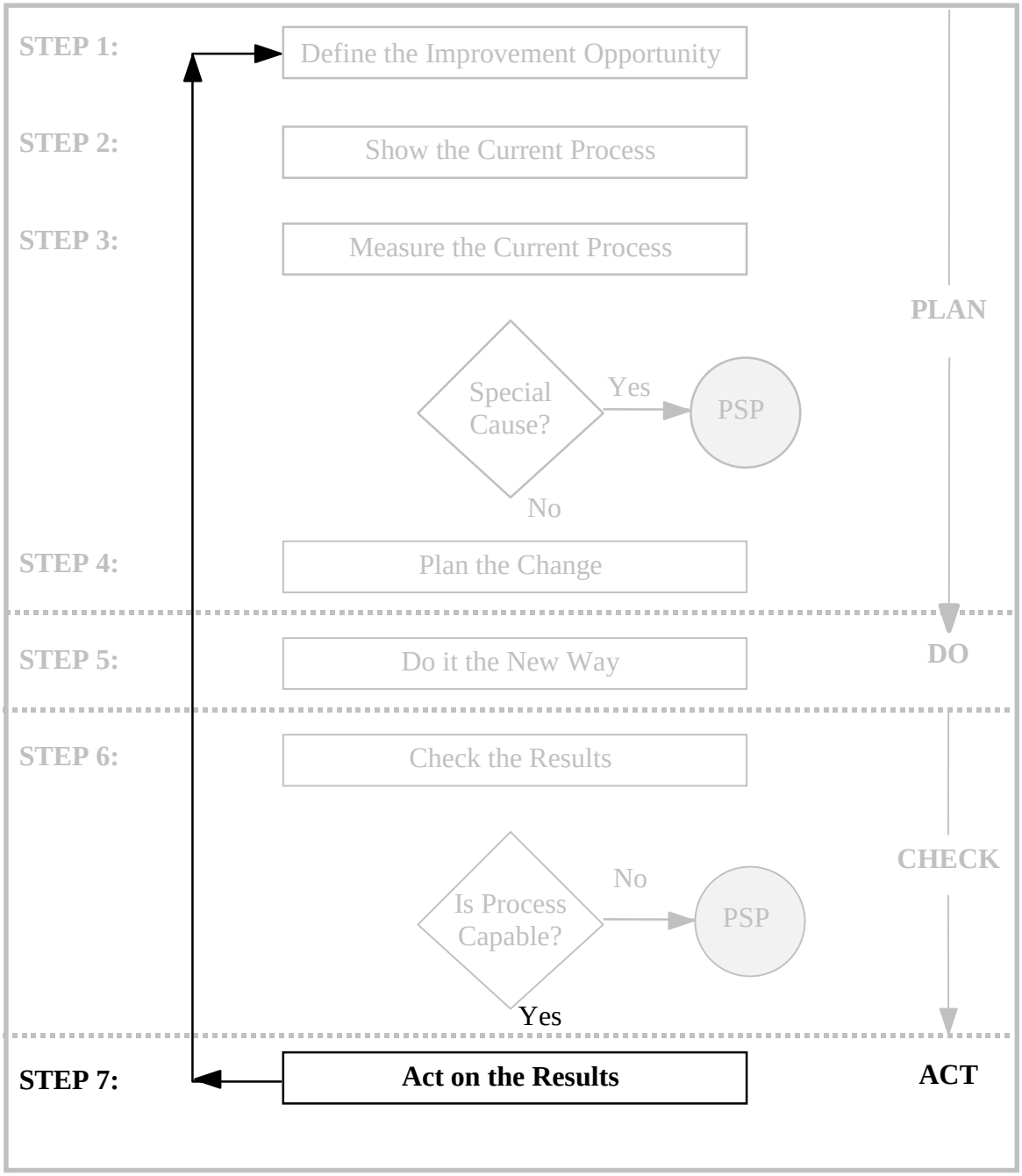
Positive responses to all of the above questions indicate improvement. Negative responses to any of these questions must be acted on by the participants.

CHECKLIST FOR STEP 6

- ☐ Data validity is routinely being verified.
- ☐ The impact of system changes on customers and process owners is being studied.
- ☐ The improvement measures and indicators are adequate.

NOTES ON STEP 6

STEP 7: ACT ON THE RESULTS



OVERVIEW

Your data may or may not have had the planned effect. This is not unusual. If it didn't, it's back to Step 1 to rethink the improvement. Why didn't the change work as planned? Did we miss something? Go back and reanalyze your data and try again.

Improved results, even those substantiated with valid data, do not guarantee that an improvement will be integrated into the normal process. The greater the scope of the change, the greater the resistance to making it a way of life.

This step addresses the problems of building in process improvements that affect more than the technical system.

7.1 UPDATE DOCUMENTATION

One purpose of analyzing data is to gain insight about cause-effect relationships in the process. What is learned through data analysis can be captured in the cause-effect models. Learning is then documented for all process-owners, as well as for people who may become process owners in the future. Displaying the improvement project keeps the learning in front of people associated with the process.

In Step 1, you started an Improvement Storyboard to document all seven steps. Storyboards, when completed, become documentation of an improvement effort, which is a requirement of any quality management system, such as ISO 9000, or quality based award, such as the Malcolm Baldrige National Quality Award.

1. Update the charts and graphs you have been displaying to reflect the knowledge gained by implementing the change.
2. Complete the Storyboard started in Step 1.

7.2 BUILD ON THE IMPROVEMENTS

Just because a change leads to improvement does not guarantee that it will remain part of the system. Improvements that affect the roles, relationships, and structure of an organization have a high impact on people. Therefore, these improvements require careful nurturing to remain in tact.

Stability of Improvements

Research on improvements that have lasted revealed these eight factors that contribute to the stability of improvements:

1. **Participation by process owners**

1. **A strong sponsor**
   Someone who has influence in the organization and is able to articulate the key issues is involved in making the change successful.

1. **Training**
   The necessary methods and skills to implement the change are provided to the appropriate people.

1. **Alignment of formal and informal rewards with the improvement.**

1. **Specific improvement targets**

Key output variances

1. **Absence of external crisis**
   Problems that must be dealt with immediately can threaten the resources required to support the change.

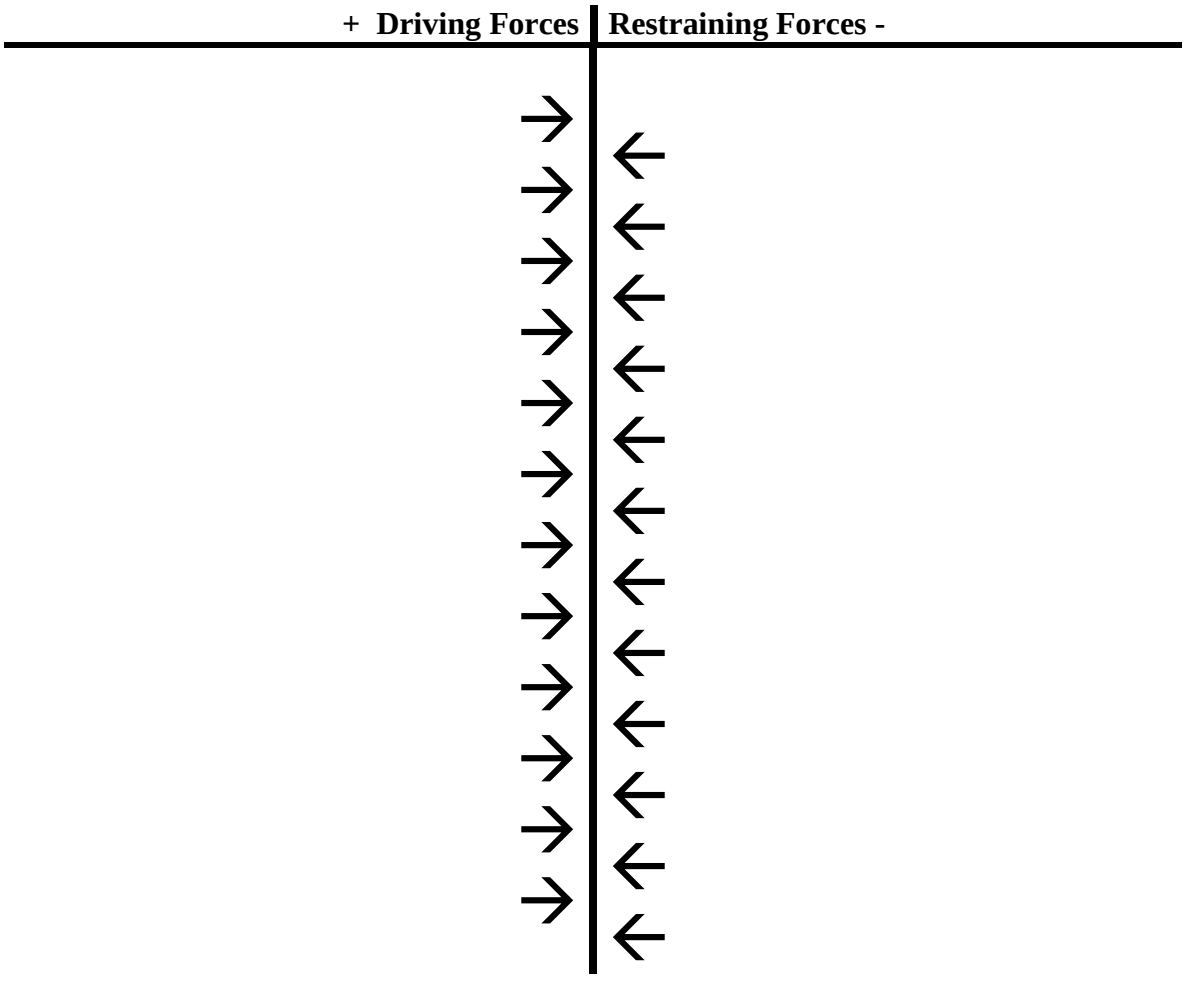
1. **An informal work culture that is basically supportive of the improvement**

1. **Systemic improvement**
   Implementing multiple improvements that reinforce each other.

1. Describe the intended improvement or desired state in the space at the top of the **Improvement Stability Worksheet**.
2. Rate the stability of the improvement as you see it today by circling one of the seven numbers.
3. In the left column, list all the important forces making the improvement a way of life. In the right column, list all the barriers.
4. Rank the listed forces on both sides in order of importance.
5. Rate the forces with regard to clarity, i.e., how much data you have to support the fact that is a force.
6. Investigate important forces that are unclear. Update your force field as needed.

Improvement Stability Worksheet

Improvement (or Desired State)						
Unstable The improvement is very dependent on a few sponsors. There is considerable resistant to it.						**Stable** The improvement has become a way of life; it is part of the normal routine for all.
1	2	3	4	5	6	7

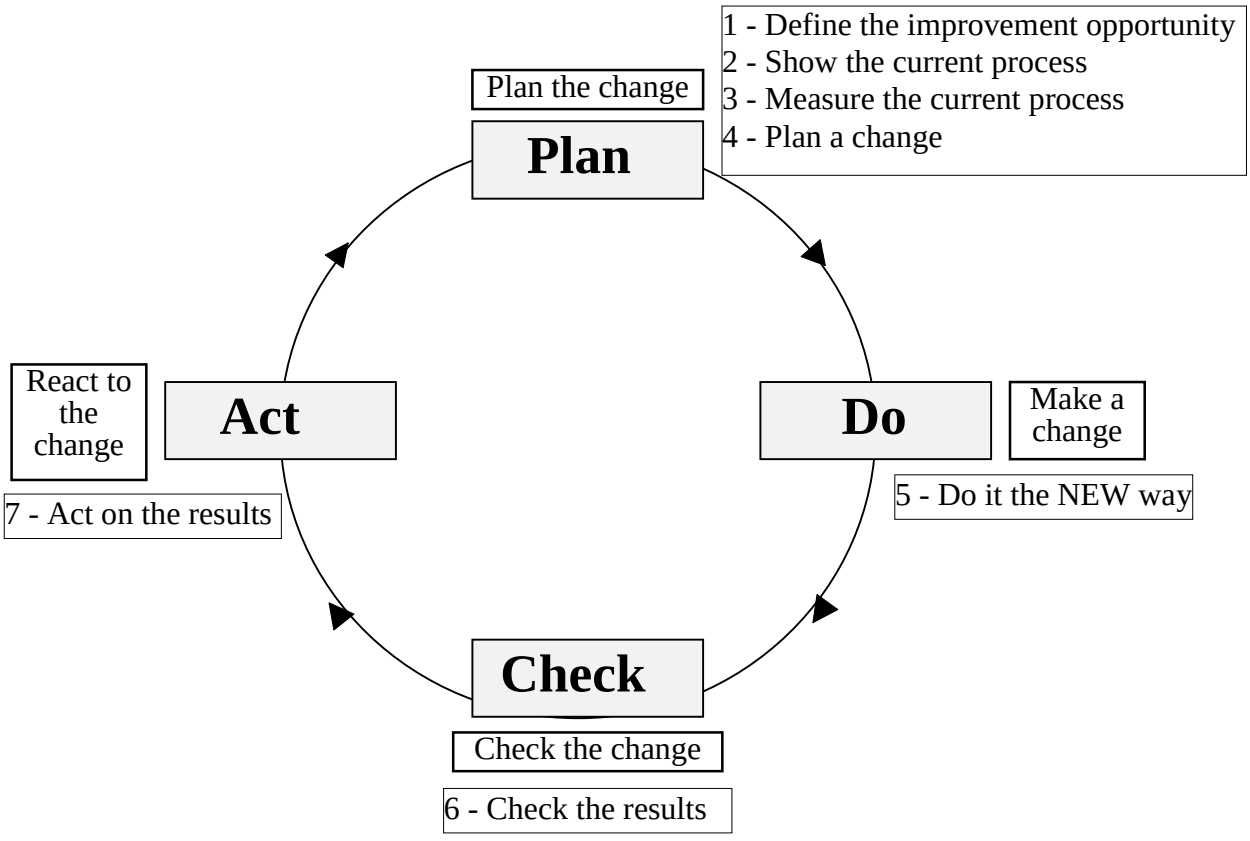


CONTINUE THE PDCA CYCLE

PDCA is a way of describing the continuous improvement cycle. Although the steps are numbered from one to seven, PDCA is a never ending cycle in an organization devoted to quality. Sometimes an investigation cycles between steps several times before implementing a change. At other times, the data collection methods may need several rounds of trial and error before they are effective.

The first application of the seven steps to a process lays the groundwork for future breakthroughs. In subsequent cycles, decisions made in the first round will be re-examined.

CONTINUOUS IMPROVEMENT IS THE SIGN OF A WORLD CLASS COMPANY.



CHECKLIST FOR STEP 7

- ☐ Documentation is updated.
- ☐ The stability of improvements has been evaluated and plans are in place to secure gains.

NOTES ON STEP 7

MODULE 6:

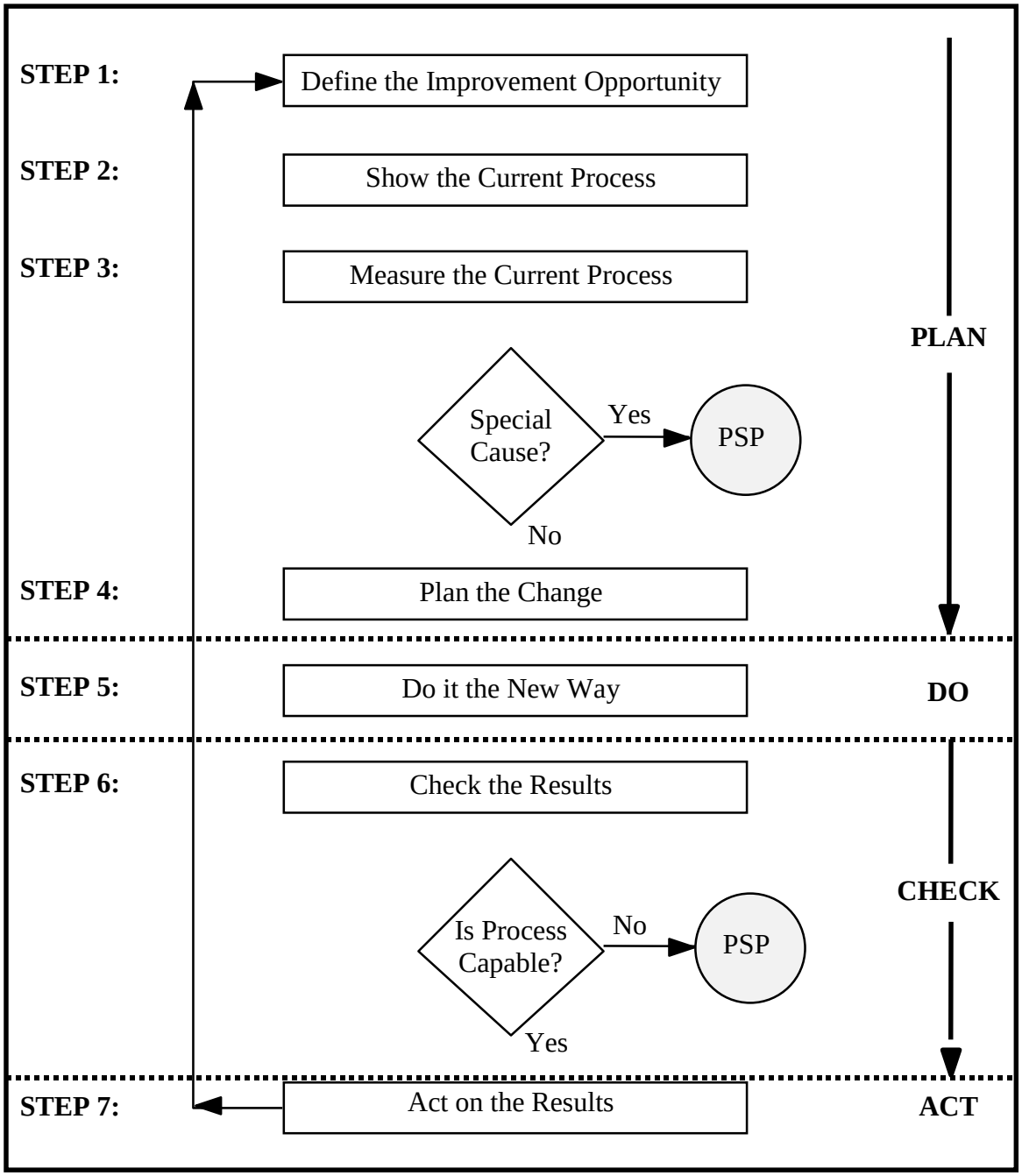
Continuing the Improvement Process

Objective

Upon completion of this module, participants will be able to:

- Identify the purposes of documenting improvement projects.
- Implement a corrective action system for the Scottsboro operation.

THE CONTINUOUS IMPROVEMENT FLOW CHART (PDCA)



OVERVIEW

After you have completed all seven steps of the PDCA process, it is simply a matter of ensuring that all documentation is complete, and implementing Scottsboro's corrective action system.

HOW TO

1. **Make sure all seven steps are complete and checked off.**
   Review all checklists. Is every box checked off? If not, revisit that step to ensure satisfactory completion.

2. **Organize supporting information and data**
   Compile the worksheets, data, analyses, etc. that your group has used throughout this improvement process. Make sure all info is complete.

3. **Complete final version of the Storyboard**
   Type (or word process) the final information in the appropriate locations on a fresh Storyboard. Make an 11X17 copy.

4. **Implement corrective action procedure**
   This procedure insures that the improvement effort is documented for future use, and that the people who need access to the info have it.

PRACTICE PDCA

Practicing PDCA is the best way of making it a way of life. Even though it may be a difficult and confusing at first, it becomes easier and faster the more times you do it. The best way to learn it is to teach it to others. You don't have to be an expert, you simply need to choose a process that you and others want (and need) to change and then go for it. And remember, resources are available everywhere: people, workshop manuals, "The Memory Jogger," etc. will all help you walk through the PDCA cycle

"Knowing how to measure our processes in all areas and using a structured improvement process gives us the tools we need to improve. And as we strive to be a market leader, we must continue to improve to stay competitive."

Just remember, the more you practice, the better you'll become, and the better Lozier will become.