

**Unit 2**

**Step 2: Measure**

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### Step 2: Measure

#### Objective:

*Separate pertinent from non-pertinent data.*

#### Description:

At first glance, STEP 2 may look similar to STEP 1. However, whereas the objective of STEP 1 is to recognize the relative importance of a particular problem, the objective of STEP 2 is to discover significant factors or features of that problem and select a significant data set from **within** it. Therefore, the problem (gap between the “actual” and “targeted” performance) must be **stratified** from various viewpoints to discover this significant data set.

#### Checkpoints:



**Data contained or directly linked to the indicator were stratified from various viewpoints (i.e., What, Where, When and Who) and a significant data set was chosen.**

The best viewpoint from which to stratify pertinent data will differ from problem to problem. However, in each problem, four important viewpoints should be considered to search for significance. Those viewpoints are What, Where, When and Who.

**What** (category, complexity, level, type, amount, degree, etc.)

**Where** (geographically, where the defect resides on the object and physical location setting)

**When** (calendar time such as, day of week, month, year, hours, minutes; stage, or when in the life cycle of a process)

**Who** (customer, player, victim, stakeholder, age, gender or other attributes about person(s)).

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### Step 2: Measure (Continued)

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**A target for improvement was established based on the stakeholders' need.**

The stakeholder referred to here is the same as in STEP 1, Checkpoint #1. Targets should be determined by questioning the stakeholder if possible, or management rather than by assumption. As in any translation of stakeholder needs and wants to measurable terms, "Win-Win" oriented negotiation may be necessary. Targets may also be established through benchmarking or competitive knowledge.

7 ✓

**The impact of the target on the indicator was determined.**

This checkpoint ensures the logical flow of information or linkage between STEPS 1 and 2. The target is set based on the desired improvement on the problem but a check must be made to ensure that the impact of that improvement on the theme indicator is understood. A statement should be made to indicate the impact meeting the target will have on the theme indicator.

8 ✓

**A problem statement that describes that “remaining data set” was developed.**

The problem statement can be simply worded as the “object with the defect” and the stratification adjectives that describe the data set remaining.

(e.g. “47 Unit 7 employee injuries occurred outside on Fridays”)

Note: OBJECT=Employee

DEFECT=Injuries

Adjectives (or Stratifications)= 47, Unit 7, Outside, Fridays

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### Step 2: Measure (Continued)

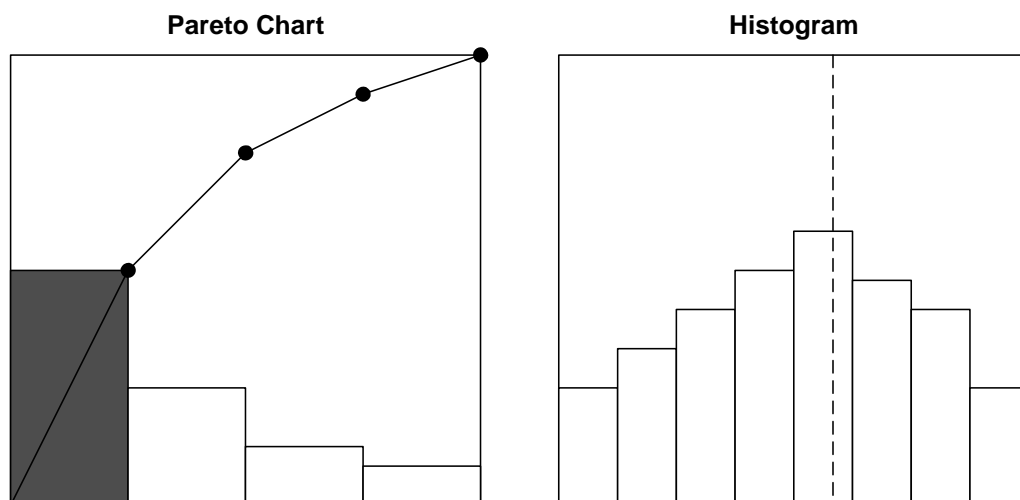
#### Recommended Tools and Techniques:

**Tools** commonly used with STEP 2 may include:

- Checksheet/Spreadsheet
- Histogram
- Graphs
  - Bar Graph
  - Line Graph
  - Pie Graph
- Pareto Chart

**Techniques** that may be helpful include:

- Problem Statement
- Process Flow Chart

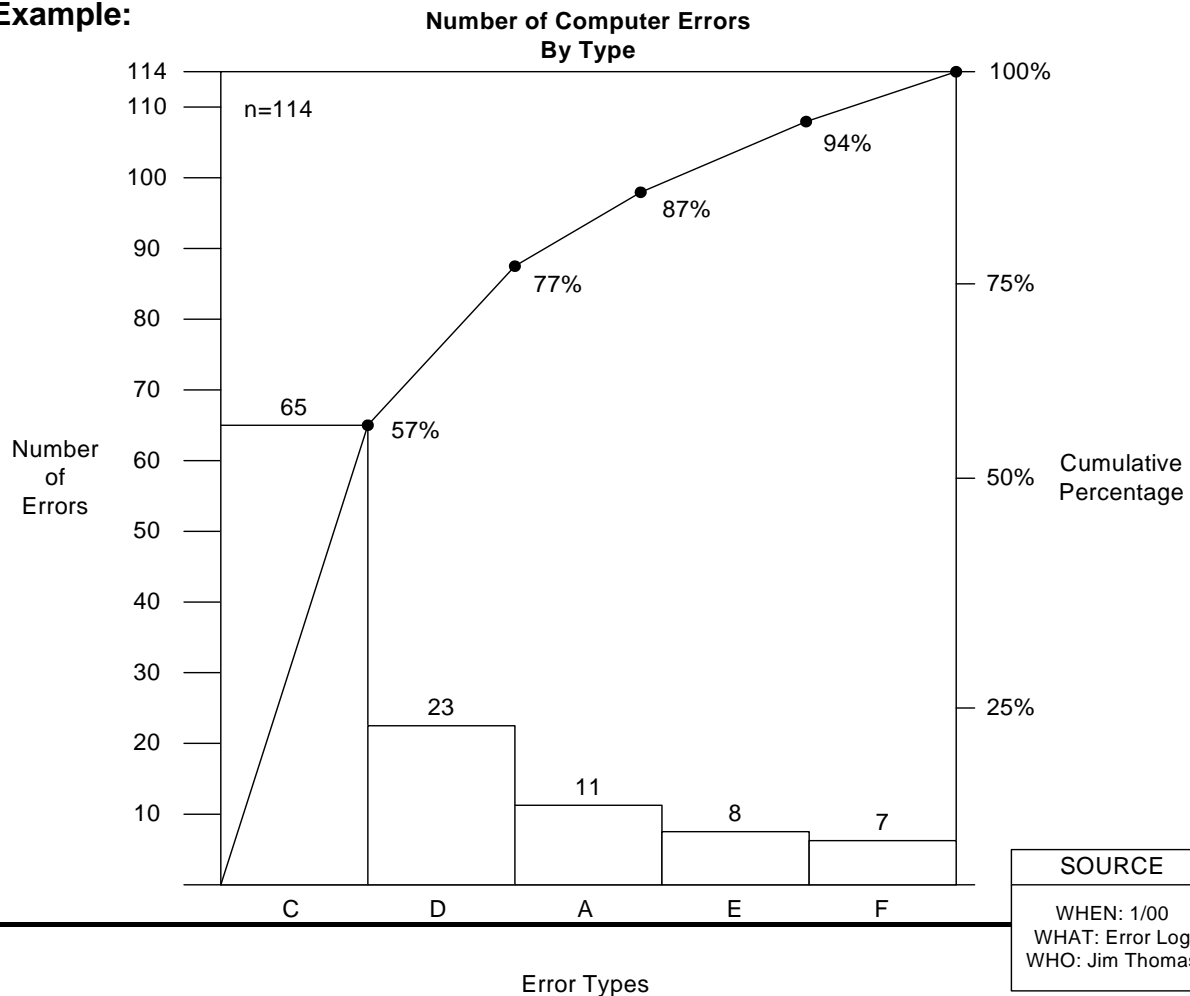


## Pareto Chart (Tool)

A **Pareto Chart** is a graphical Quality Control (Q.C.) tool used to rank data groups. This helps us to determine which data groups are pertinent (or significant). It distinguishes between the "significant few" and the "trivial many". The Pareto Chart is an excellent tool to organize and analyze data. It can be used in these ways:

- **To identify** the most serious or most frequently occurring data groups. It is based on the concept that 80% of the problems (or, at least a "large" percentage) result from 20% of the areas or groups.
- **To analyze** different groupings of data (by what, where, when or who).
- **To measure** the impact of countermeasures implemented to reduce a problem effect (**before** and **after** comparisons).

**Example:**

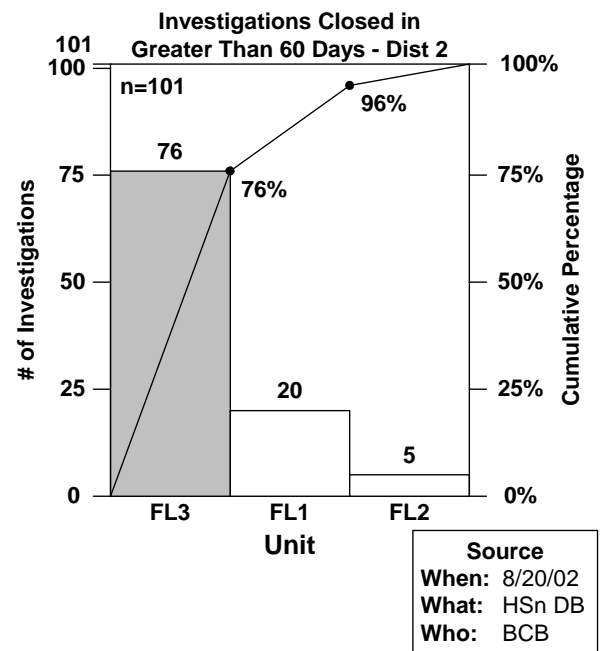


## Pareto Chart (Tool) (Continued)

1. **Draw a box.**
2. **Display the number of items** in the upper left corner as shown below (n=101).
3. **Label three (3) sides of the box** as follows:

A) Left side: Number of \_\_\_\_\_ (place the name of the data being stratified (e.g., # of Investigations). Construct a measurement scale on the left side starting with zero at the bottom and the “n” (e.g., 101) value at the top. Add additional appropriate scale values on the left side.

B) Bottom side: Label this with the name of the stratification group to be displayed (e.g., Unit). Divide the bottom side by the numbers of bars to be displayed. Draw each bar from left to right with bars descending from the biggest bars to the smallest bar with a height according to the left side measurement scale. Label each bar and display bar height values above each bar. If desired, many small bars can be lumped together and labeled as an “other” bar (see example on next page). **The “other” bar (if used) will always be the last bar on the right and should not have any data bar in it larger than the next to last bar on the right. Also, the “other” bar should not be taller than 1/3 of biggest bar.**



C) Right side: Label this side “Cumulative Percentage” and display measurement grid at 0%, 25%, 50%, 75% and 100%.

4. **Construct a “Cumulative Percentage” line.** The line starts in lower left corner at “zero” and connects labeled data points plotted at or directly above the upper right

corner of each bar and at a height equal to the cumulative percentage, calculated as follows:  $\% = (\text{bar heights of all bars to left data point}) \div (\text{the total } n) * 100$  (e.g., for FL1:  $(76+20) \div (101) * 100 = 96\%$ ).

**5. Add a source box.**

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### Pareto Exercise

#### Purpose

To construct a Pareto diagram

#### Agenda

- Team 1 will construct a Pareto diagram for plant failures from the Checksheet on the next page. The Pareto to be **by the five failure modes**.
- Team 2 will construct a Pareto diagram **by the six manufacturers of equipment** for the plant failures (without regard to cause) contained in the checksheet on the next page.
- Team 3 will construct a Pareto diagram **by the three plants** in which the plant failures occur (without regard to cause) contained in the checksheet on the next page.
- Each team should construct the Pareto chart and then reconvene to share the final result.
- All teams will answer:  
What do you suggest for further investigation?

#### Limit

- 15 minutes for teams
  - 10 minutes for entire class sharing
-



## Pareto Exercise (Continued)

The XYZ Power Company has been experiencing a problem with equipment failures. The company decided to do an analysis of the causes of these failures. Five Failure Modes were noted as occurring at least once.

A checksheet was constructed to record the cause of each failure by plant and by manufacturer. The five Failure Modes were as follows (with corresponding symbols to be used on the form for an occurrence):

**Failure Mode Causes:**

- X** - Incorrect mounting of connector hose
- O** - Premature “break point” for circuit breaker
- C** - Incorrect dial setting
- #** - Frayed wiring
- ★** - Defective component

The results of recording the causes of each failure over a period of time yielded the following:

**Failure Modes by Plant and Equipment Manufacturers**

MANFR PLANT	A	B	C	D	E	F
23	O O X C #	C O X O ★ X	O O O C O O O #	O # # O ★	O # ★ O C	O C O # O C
42	O # ★ C O	O # # # X	O O O O	C # ★ # O O	O O C X O O	O # ★ ★ O O

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<b>56</b>	○ ○ #	○ ★ ○	○ ○ ○	○ # ○	○ C #	○ C #
	○ ○ C	# ○ C	○	★	# ○ ○	○ ○ ○
	○	#	○ ★ ○		C	

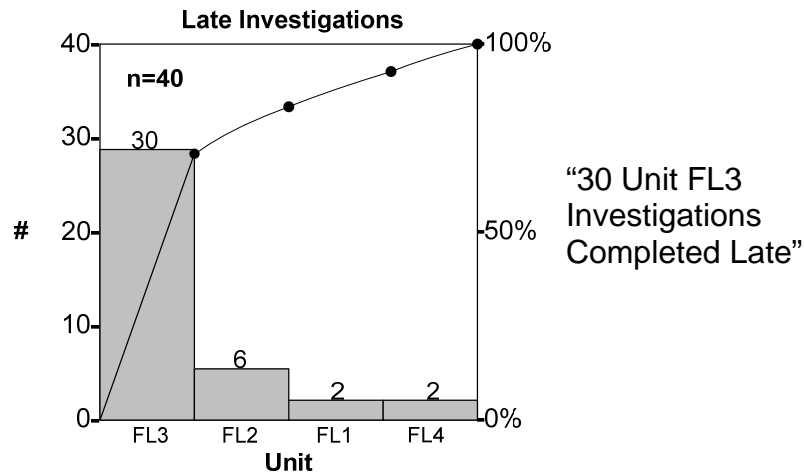
## Problem Statement (Technique)

A good **Problem Statement** is a simple statement of the data group that you are left with after stratifications are performed. Each stratification represents an adjective to be applied to the original problem’s “object with defect”. Adding the adjectives for each stratification to the original “object with the defect” will produce the appropriate Problem Statement.

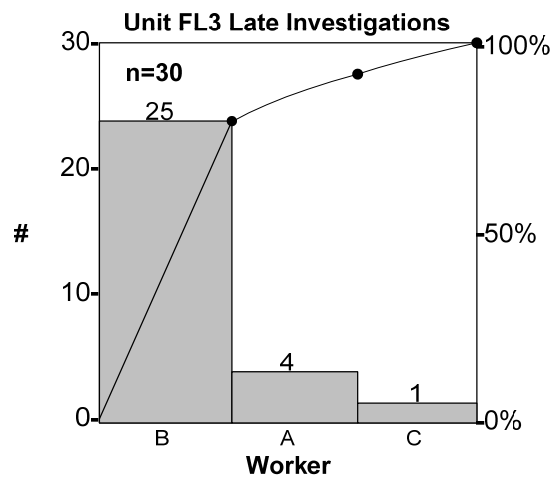
Example:

1. Problem: “Investigations Completed Late”  
Object
Defect

2. 1<sup>st</sup> Stratification



3. 2<sup>nd</sup> Stratification



Problem Statement:  
"25 Unit FL3  
Investigations were  
completed late by  
worker B"

### Targets Setting Methodologies

Targets (or goals) are set for most all indicators. Targets (or goals) should be set using the most appropriate “common sense” logic or methodology. Targets may be revised (and often are) over time as better methodologies or more accurate data becomes available and can be applied. Because targets may be revised at a later date, often teams are better served to quickly select an initial target (that can be revised later) based on an accepted methodology and move forward with data analysis. Generally accepted methodologies include the following six (6) items:

1. **Customer Valid Requirements** (Targets are often negotiated with customers to determine valid (or reasonable) requirements.)
2. **Benchmarking** (internal or external) Benchmarking can be internal to the organization (i.e. another unit, district) or external to the organization (but similar in some appropriate way).
3. **Historical Trends** (best previous performance or expected future performance).
4. **“What the data will allow”** (estimated number of defects or waste seen in the data under review. Also, what resources are available to apply).
5. **Management Wisdom** (Management often sets more aggressive targets to challenge staff).
6. **Yankee Spirit** (50% improvement) (Can be used when no other methodology can be readily or easily applied.)

Note: See “Target Setting Worksheet” form in Unit 7 page 6.

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