

***Miami-Dade County***

***Lean Six Sigma (LSS)***

***Yellow Belt Training***

# Yellow Belt Training Agenda

- 9:00 am
- Introductions/ Kick-off / Training Objectives
  - Yellow Belt and Lean Six Sigma Overview
  - DMAIC Problem Solving Process
  - Tools: Line graphs and spreadsheet

10:15 **Break**

- 10:30
- Technique: Flowchart
  - Tool: Histogram
  - Tool: Pareto (**exercises**)

Noon **Lunch**

- 1:15 pm
- Tools: Single Case Bore and Fishbone
  - Technique: Brainstorming
  - Technique: Countermeasures (**exercise**)

2:30 pm **Break**

- 2:45 pm
- Case Study (**Green Belt Team**)
  - Lessons Learned/Certificates/Survey

- 4 pm
- Adjourn

# Yellow Belt Training Objectives

- 1. To understand Lean Six Sigma (LSS) principles, components and “Belt” expertise levels for staff.**
- 2. To understand how Lean Six Sigma (LSS) will be used to facilitate operational improvements.**
- 3. To understand key Lean Six Sigma (LSS) analytical tools and techniques used in performance improvement**
- 4. To review a Green Belt Improvement Team’s project addressing a significant problem**

# Mission and Vision Statements

## **Miami-Dade County Mission Statement**

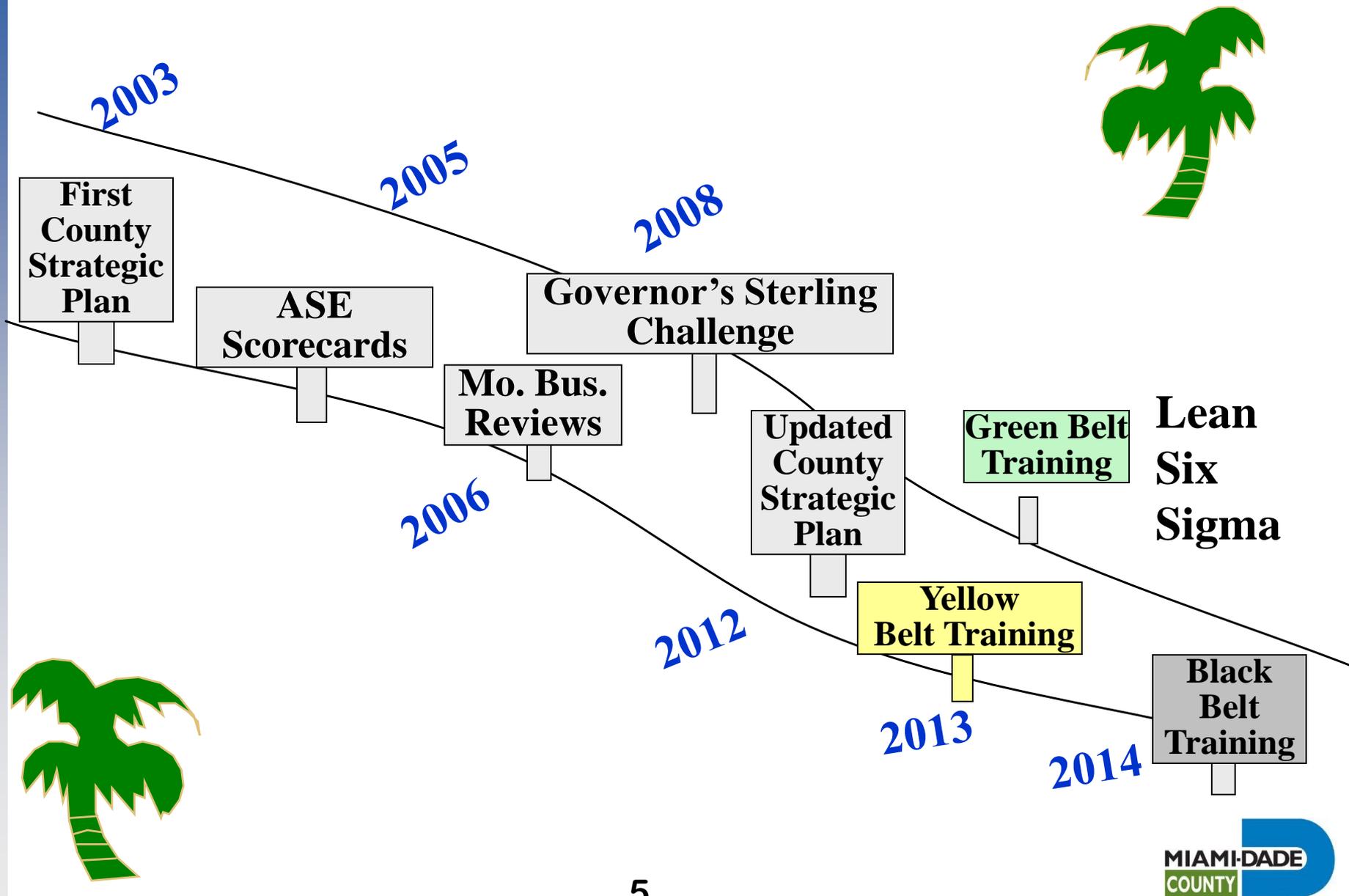
*Delivering excellent public services that address our communities needs and enhance our quality of life*

## **Miami-Dade County Vision Statement**

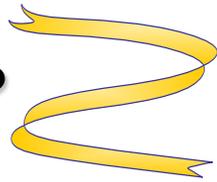
*Delivering Excellence Every Day*

**Your Departmental Mission and Vision Statements.....**

# History of Performance Excellence



## What is Lean Six Sigma **Yellow Belt** Training?



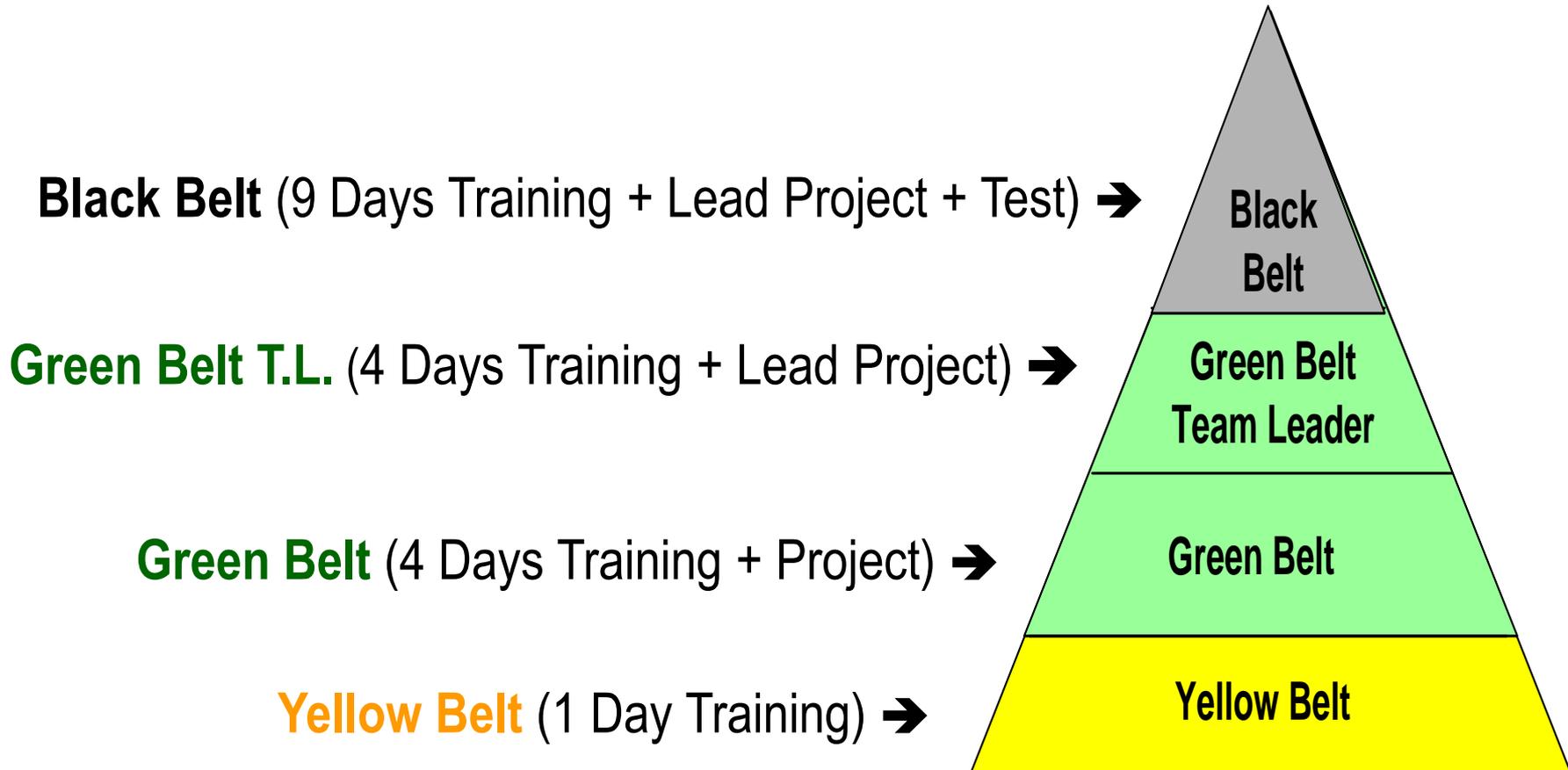
It is the *initial statistical and analytical tools training* needed by employees to successfully apply Lean Six Sigma methodology within an organization to continuously improve operations.

## Why are we holding this training?

Demonstrated by several **Green Belt** Project Teams, Lean Six Sigma offers employees the next level of skills to help us become more effective and efficient in delivering our services to our customers in times of fiscal constraint.

# Lean Six Sigma Belt Levels

## Lean Six Sigma Belt Certifications (and Requirements)



# Lean Six Sigma (LSS) Training Plan

Miami-Dade County initiated Lean Six Sigma training in July 2012. Lean Six Sigma capability established within 18 months

**WHAT: Develop Lean Six Sigma Capability in Workforce**

HOW	WHO	WHEN																							
		2012						2013												2014					
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb				
1. Hold Green Belt Class <i>(involve other County employees)</i>	Empls	WAVE I			WAVE II			WAVE III			WAVE IV			WAVE V											
2. Hold Yellow Belt Training	All Empls							Train Employees																	
3. Train selected Certified Green Belts as GB Team Leaders	Green Belts									Green Belt Team Leader															
4. Train a selected Green Belt Team Leaders as Black Belts	Green Belt T.L.												Black Belt Training												

COUNTER AS OF MARCH 31, 2014



Miami-Dade County Lean Six Sigma Website

<http://www.miamidade.gov/managementandbudget/lean-six-sigma.asp>

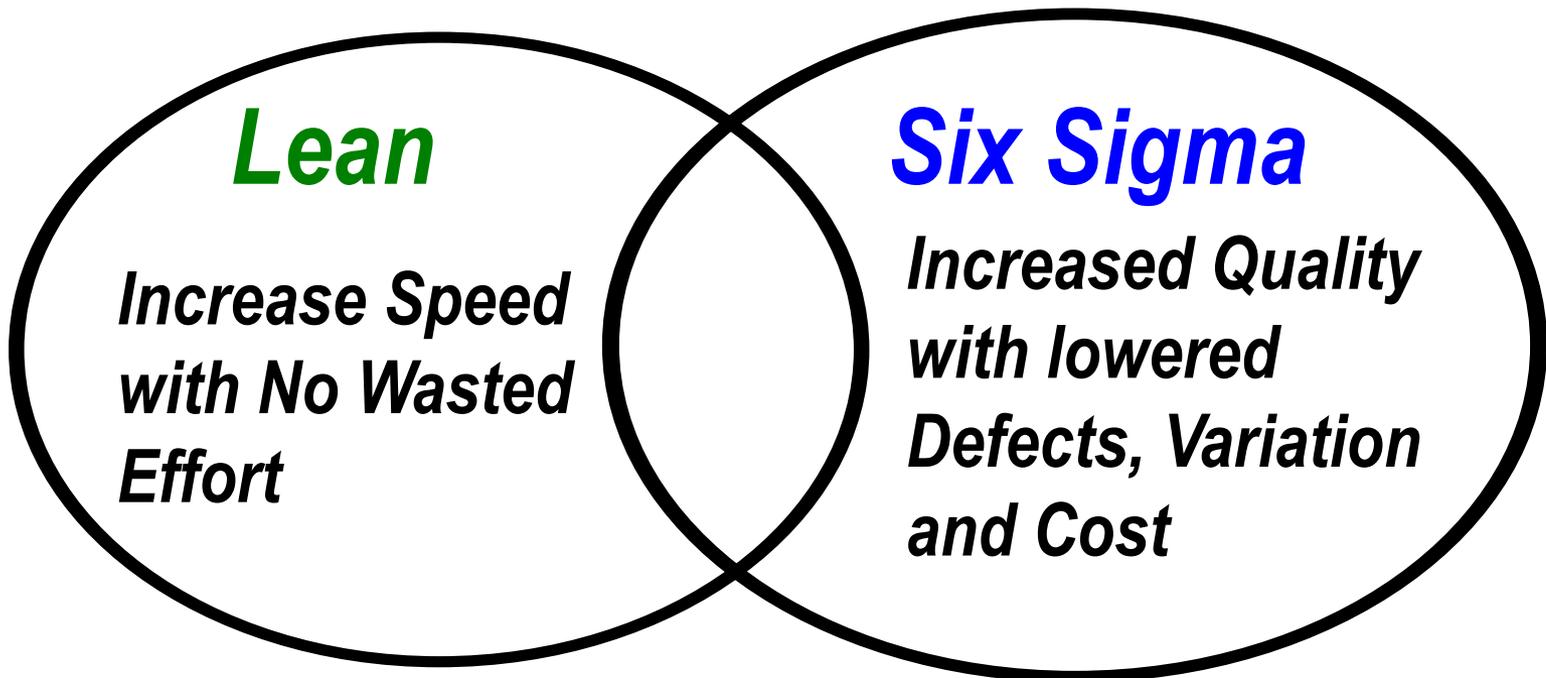
## Why do we need Lean Six Sigma?

**Lean Six Sigma** is a proven methodology that will help us improve our work in order to consistently ensure...

- ◆ Our products and services meet (or exceed) customers' needs
- ◆ Our processes are cost-effective
- ◆ Employees are well-trained and motivated
- ◆ Government regulations are met

# Lean Six Sigma Overview *(2 approaches in one)*

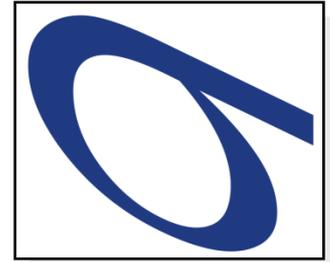
**Lean** primarily focuses on *Increasing Outputs*, for example, increasing process Speed while eliminating unnecessary Inventory and Waste.



**Six Sigma** primarily focuses on *Improving Outcomes*, for example, eliminating Defects (**DMAIC**) and reducing unwanted Variation (**Process Management**)

## What is Sigma?

**Sigma** ...is a Greek letter that represents a measure of process output variation (also known as standard deviation)



**Sigma Level** ...Is a measure of performance. It measures how much of the process output falls within the customers' requirements. The higher the sigma level, the more of the process outputs meet customers' requirements ( i.e. fewer defects in process outputs).

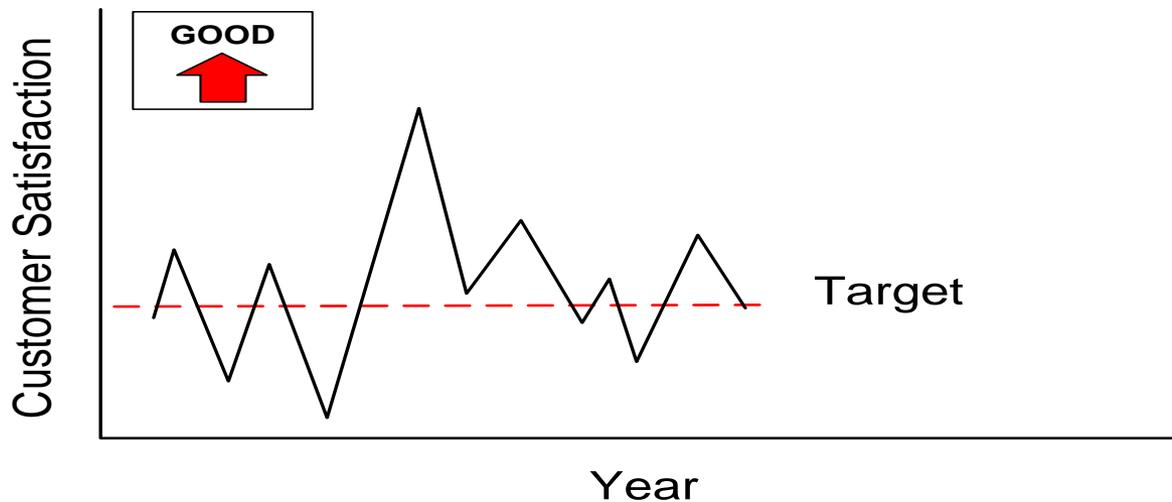
**Six Sigma Level** ... refers to near perfection representing only 3.4 process output defects per 1 million opportunities.

## What is Lean Six Sigma?

It provides **Customer Satisfaction** through the total involvement of **ALL** employees...

## Or put in a graphic way...

...It makes **Line Graphs** move in the direction you want them to go.



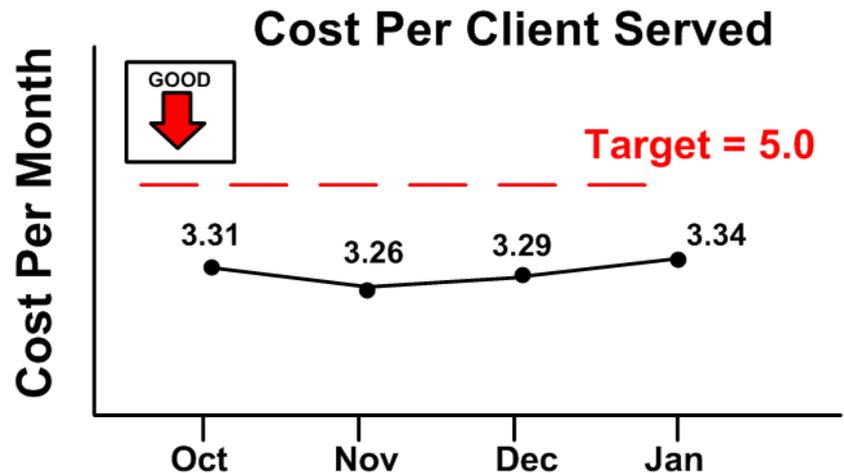
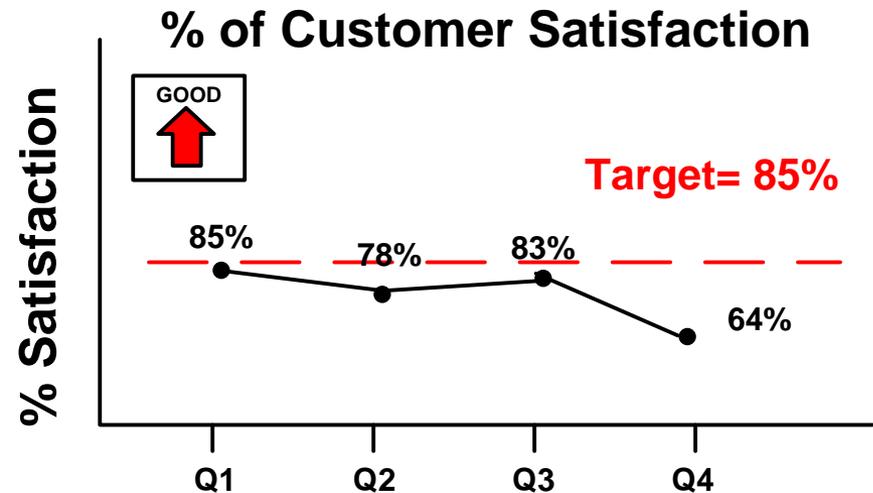
Line graphs help us understand our performance

# Lean Six Sigma Overview

We know we're Successful when...

- Our **Customers** tell us that they are satisfied with our services.
- Our **Costs** for doing business are the lowest possible.

**Example**

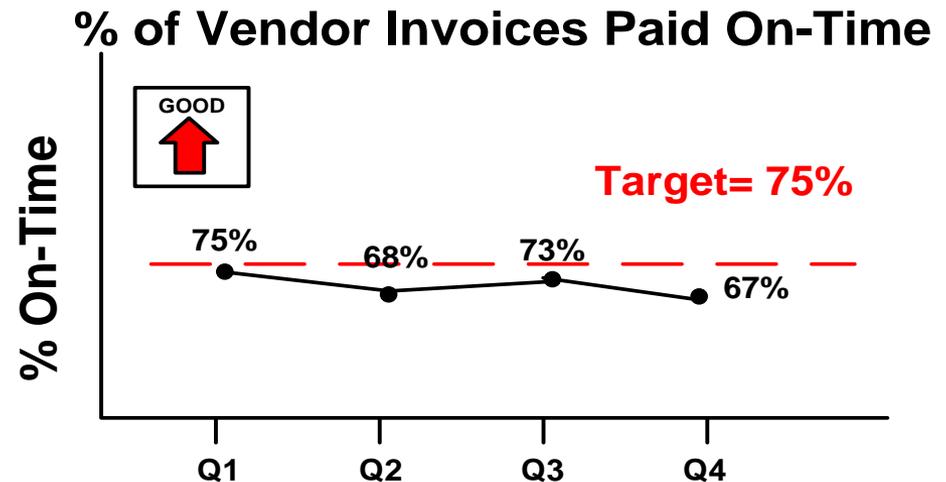
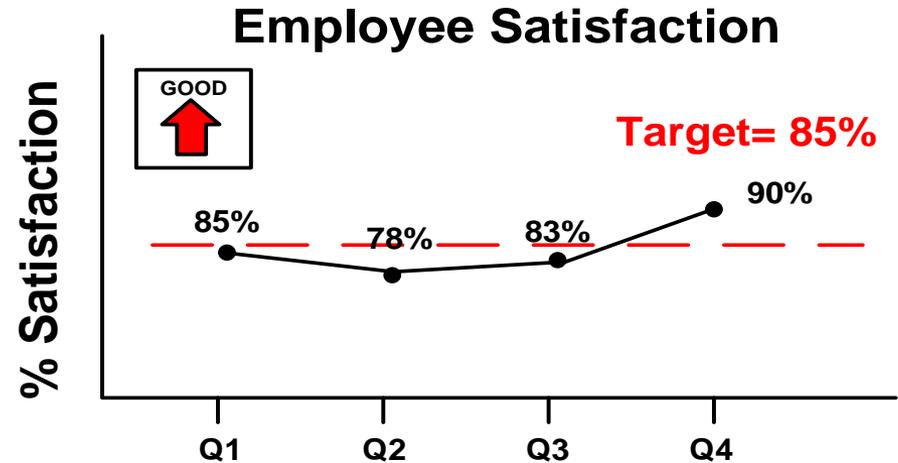


# Lean Six Sigma Overview

**Example**

We know we're Successful when...

- Our **Employees** are Satisfied.
- Our **Services** are Delivered On-Time.



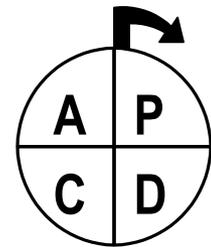
So, how do we make line graphs move?

# Lean Six Sigma - Principles

**1. Manage with Facts** - All employees should base decisions on objective data, not instinct or "gut feel" whenever possible. Also, managers must ensure that a disciplined system is in place to manage with the data or facts.

**2. PDCA (Plan-Do-Check-Act)** - The continuous improvement cycle consists of four stages:

- **P**lan the work,
- **D**o the plan,
- **C**heck the results of the worked plan, and
- **A**ct to apply lessons and improve the results of the plan.



**3. Respect for People** - Everyone must listen to all ideas and promote the creativity, self-motivation, and the limitless potential of others. Treat others as you would like to be treated and respect the ability of others to produce ideas and contribute to the organization. Think and act as a team player. If the team wins - the individual wins.

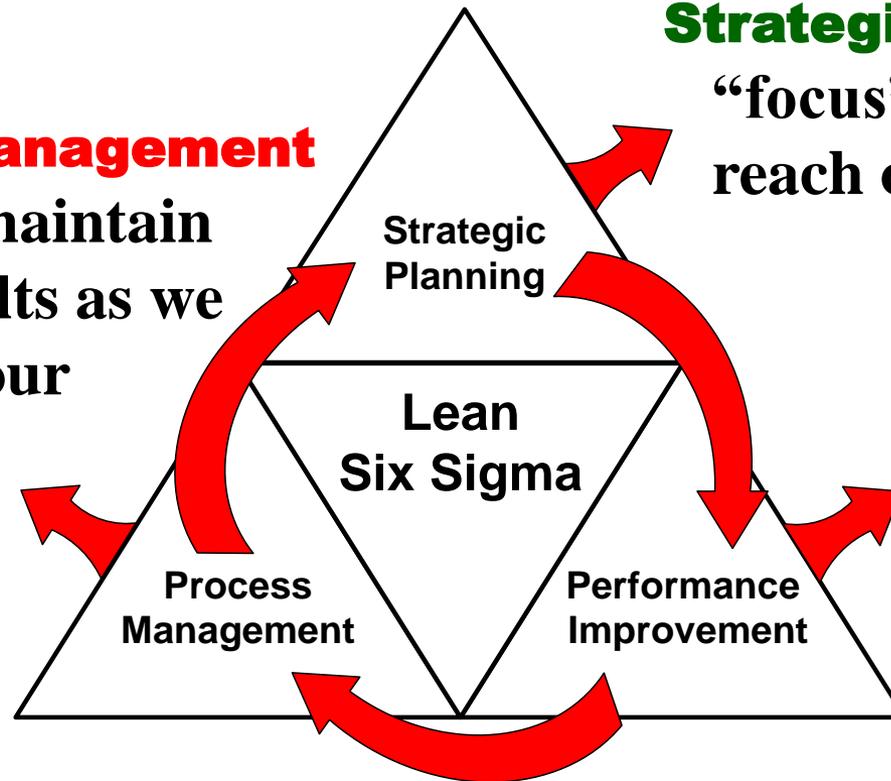
**4. Focus on Customer** - Not only must we satisfy the needs and expectations of customers, we should strive to anticipate those needs. The prevailing attitude must be that the customer and other stakeholders come first.

# Lean Six Sigma Components

Moving line graphs requires efforts in three areas...

## Process Management

helps us maintain good results as we perform our **Mission.**



**Strategic Planning** helps us “focus” on key projects to reach our **Vision.**

**Performance Improvement** helps us fix work problems and improve our **Performance.**

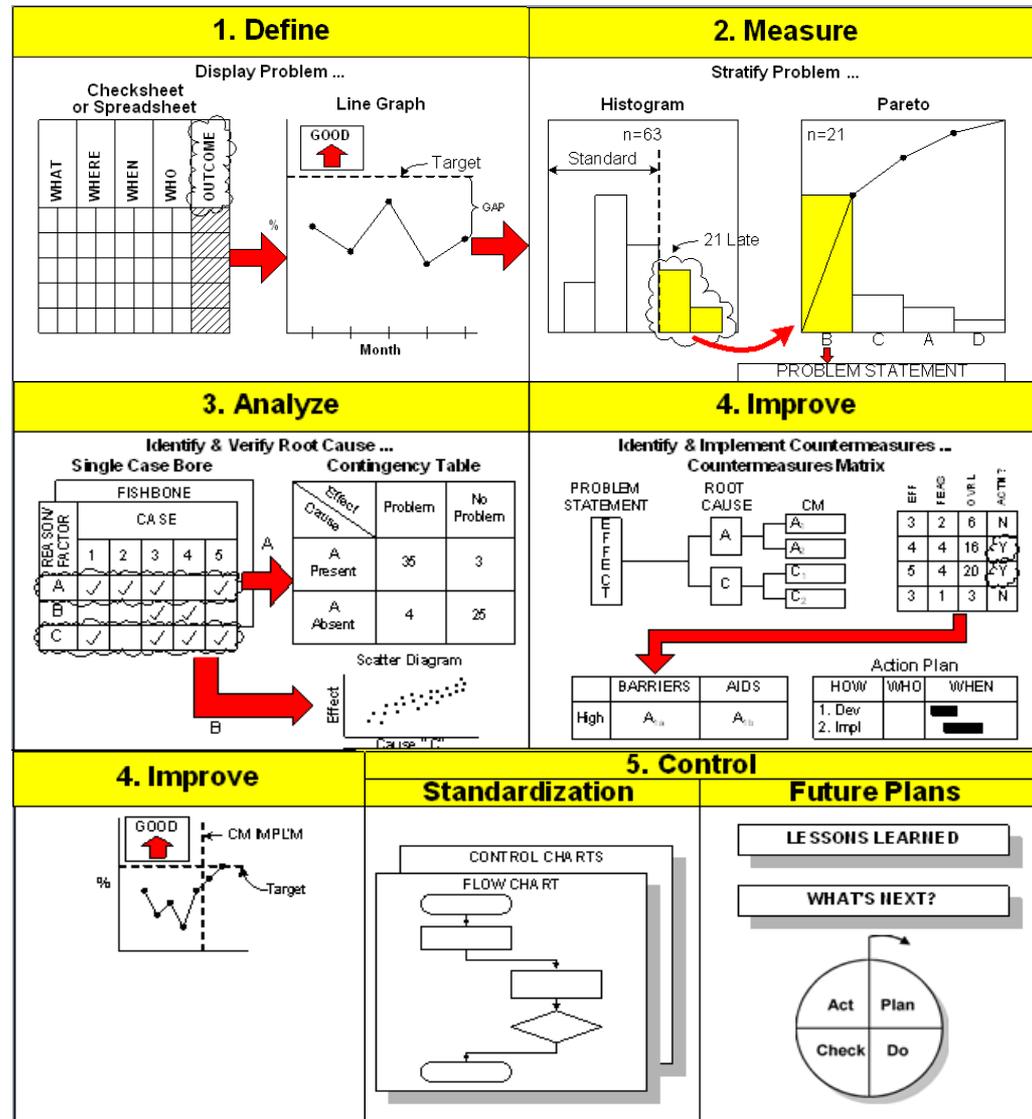
We will focus on the **Performance Improvement** Component for this Yellow Belt Training.

# LSS Component: Performance Improvement

Green Belt teams will utilize the Six Sigma 5 step problem solving DMAIC process:

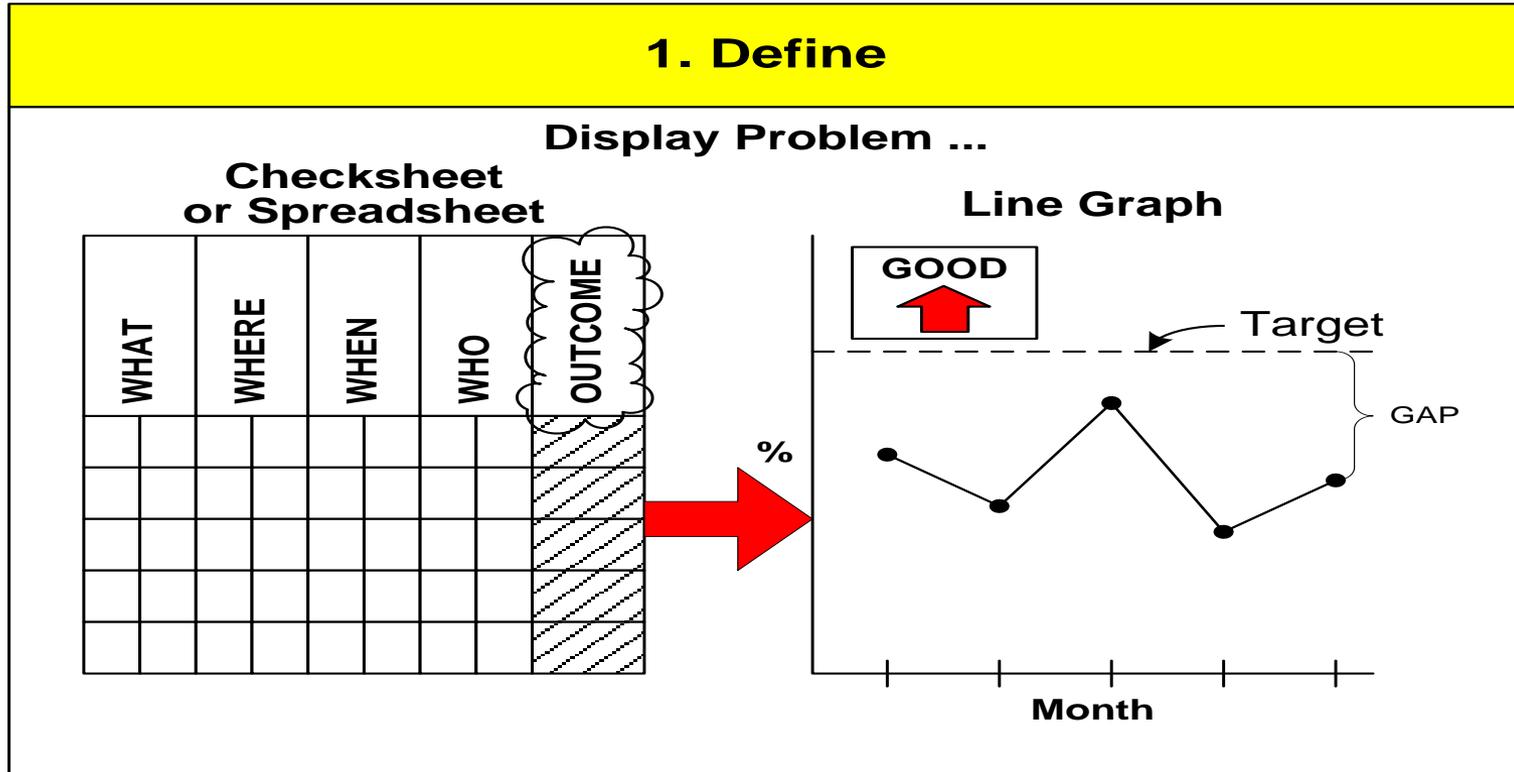
## DMAIC 5 Steps

- 1) Define
- 2) Measure
- 3) Analyze
- 4) Improve
- 5) Control



# DMAIC Process Step 1: Define

The objective of step 1 is to “Demonstrate the importance of improvement needs in measurable terms.”



Lets look more closely at the Spreadsheet and Line Graph tools.

# LSS Tool : Spreadsheet

**Spreadsheets** capture demographic data (e.g. **When, What, Where and Who**) related to a process or problem.

## Construction Related Vendor Payments

A Line #	DEMOGRAPHICS									
	WHEN				WHAT	WHERE		WHO		
	B	C	D	E	F	G	H	I	J	K
Invoice Received Date	Day of Week	Paid Date	Day of Week	Days to Pay	Work Type	Work Location (N,S,E,W)	Invoice Delivery Location	Project Manager	CCMS Liason	
1	12/7/2012	Friday	4/12/2013	Friday	126	Resurfacing	E	MLK	Paul	Gonzalo
2	9/5/2012	Wednesday	11/23/2012	Friday	79	Sidewalks	W	MLK	Paul	Jason
3	6/8/2012	Friday	10/12/2012	Friday	126	Signals	S	MLK	Susan	Gonzalo
4	4/13/2012	Friday	7/5/2012	Thursday	83	Sidewalks	S	MLK	Paul	Gonzalo

### For “When” columns consider:

- Calendar time (date, time, day of week)
- When in the Life Cycle
- When in the Process
- Duration (# of seconds, weeks, days, etc.)

### For “What” columns consider:

- Type, Category
- Complexity, Severity
- Priority
- Cost Level
- Group, Amount

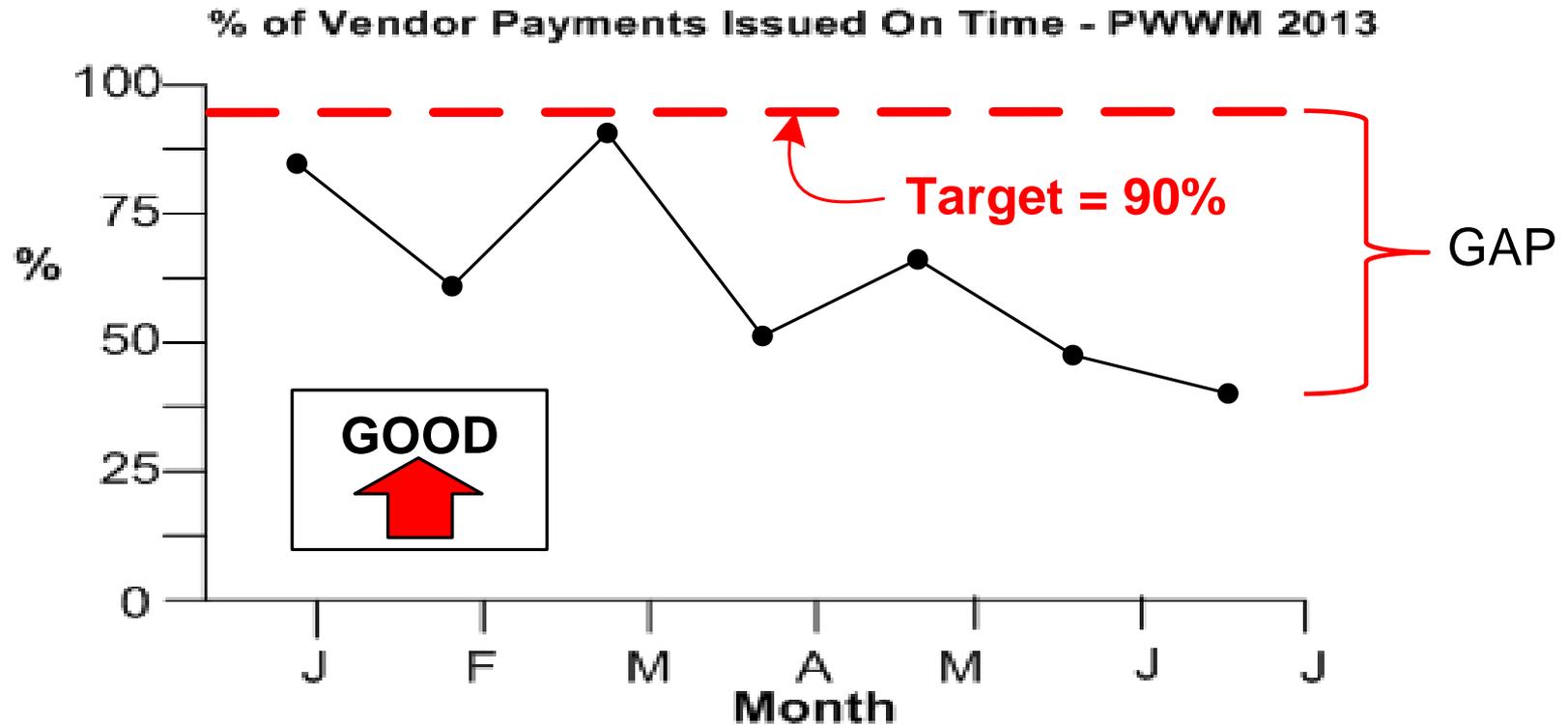
### For “Where” columns consider:

- Location (County, city, address, district, etc.)
- Type of Location (inside, outside, facility, etc.)
- Where is Defect in the Object

### For “Who” columns consider:

- Customer
- Worker/Supervisor
- Employee Name
- Employee Position, Classification, Experience
- Gender, Race, Age

# LSS Tool: Line Graph



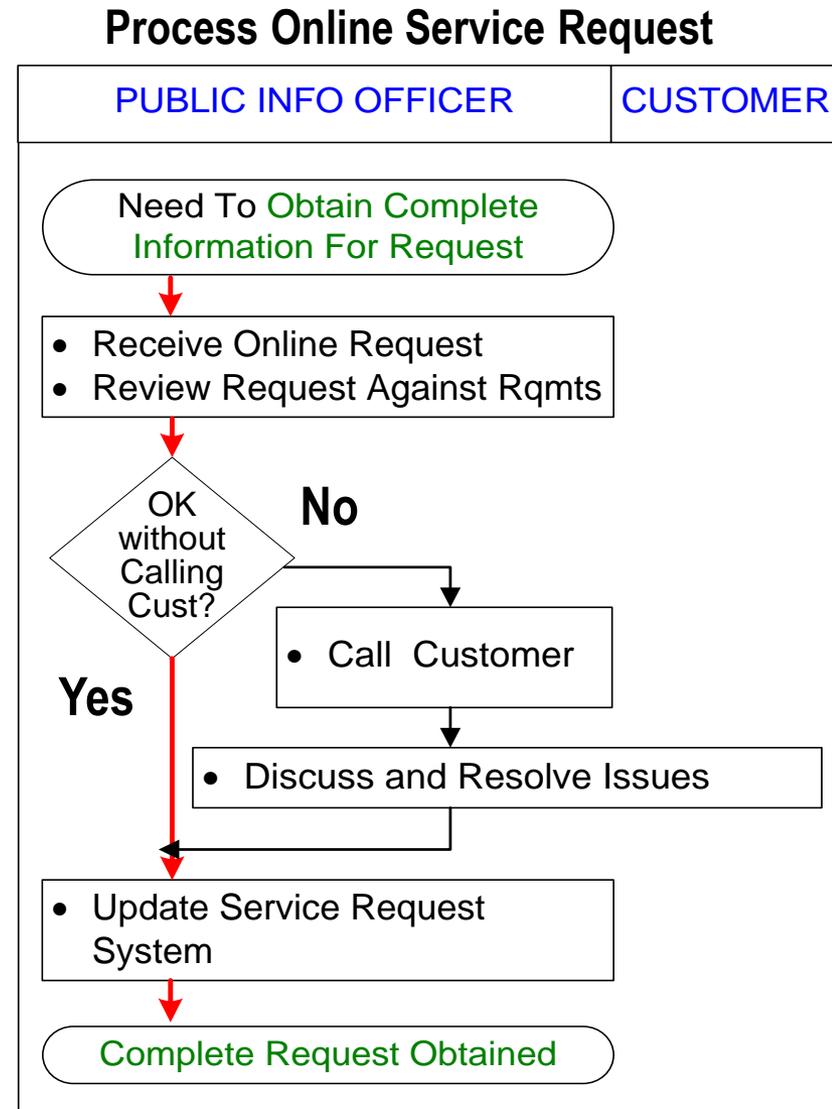
**A well designed outcome Line Graph indicator has ...**

- Clear labels showing what is being measured and when
- Data points connected by a line
- Target info., a “Good Direction Arrow” and a labeling of the gap in performance between the Target and actual data

# LSS Technique: Process Flowchart

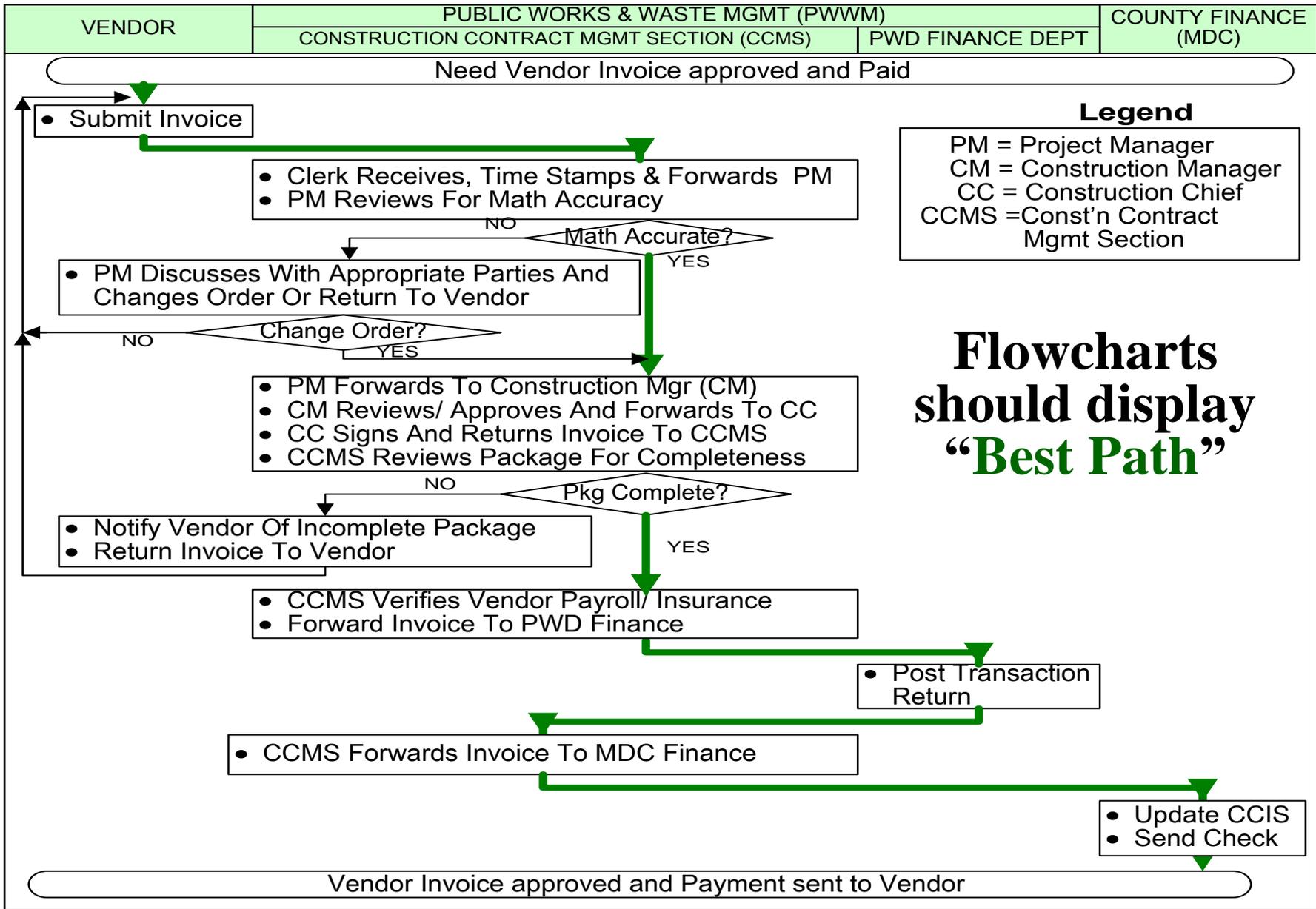
Process flowcharts describe activities needed to provide services and ...

- ◆ identify **workers** involved.
- ◆ start with a need for a *desired outcome*.
- ◆ end with the *desired outcome* being achieved.
- ◆ describe the “**best path**” for workers to follow to achieve the *desired outcome*.
- ◆ describe other activities that may be required to achieve the *desired outcome*.
- ◆ Keep in mind shapes have specific meanings. Will make reading flow chart *easier*.



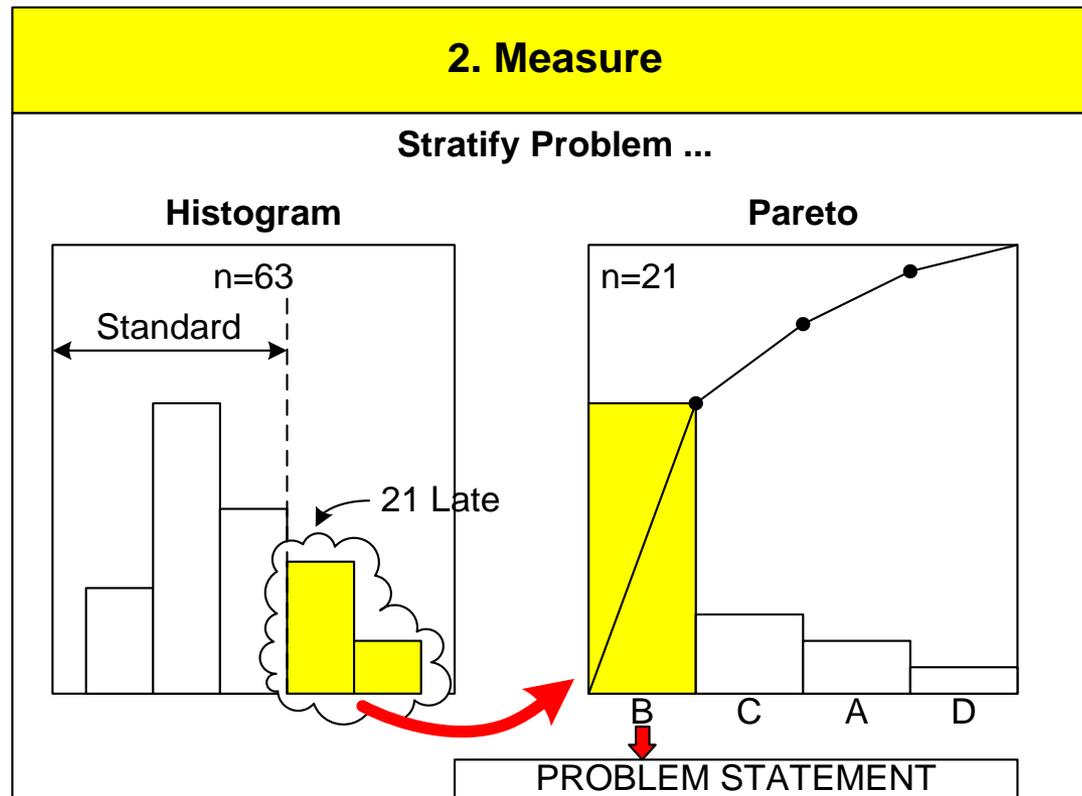
# LSS Technique: Process Flowchart Example

## Pay Vendor Invoices



# DMAIC Process Step 2: Measure

The objective of step 2 is to “Investigate the features of the indicator, stratify the problem and set a target for improvement.”

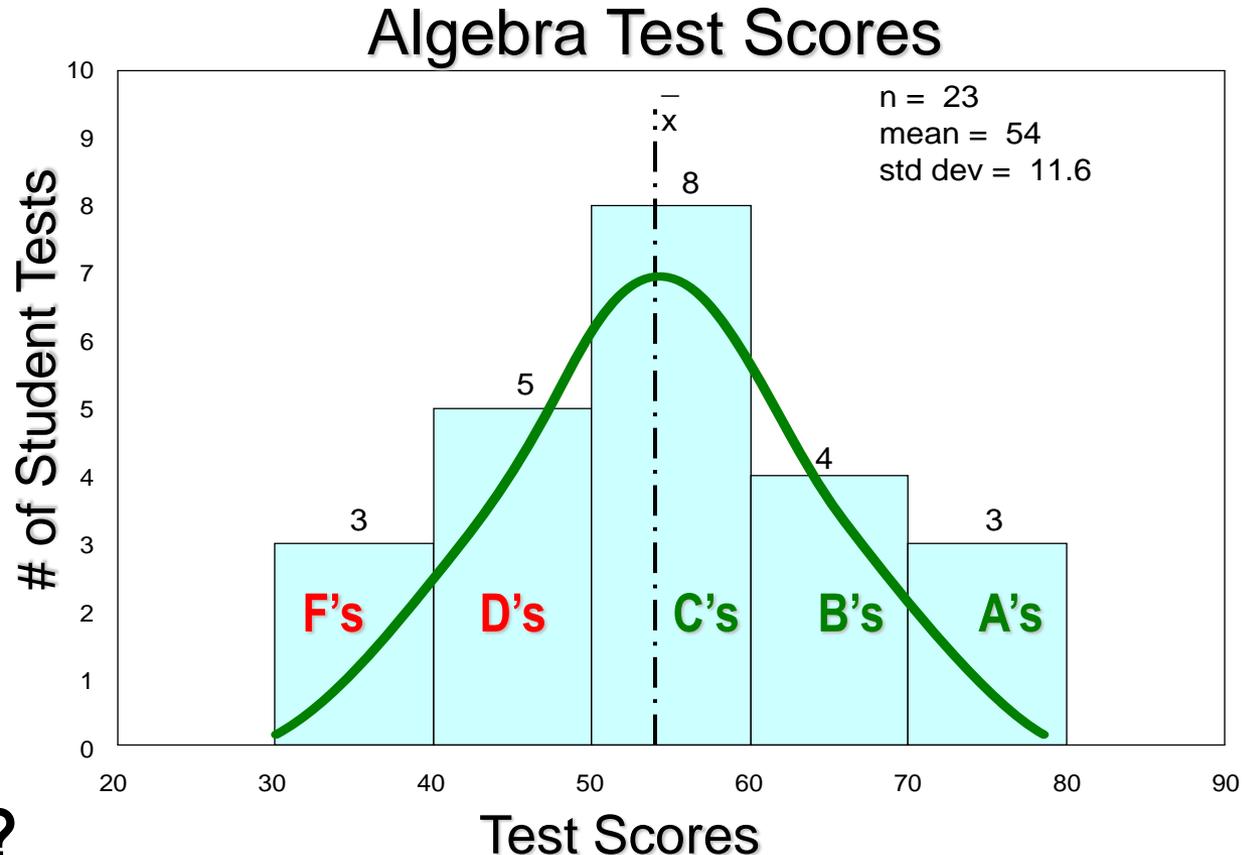


Lets look more closely at the Histogram and Pareto tools.

# LSS Tool : Histogram School Example

## What is it?

It is a distribution (bell shape curve) of process outputs displaying the spread of outputs around an average (e.g. school test scores, vendor payments, etc.)



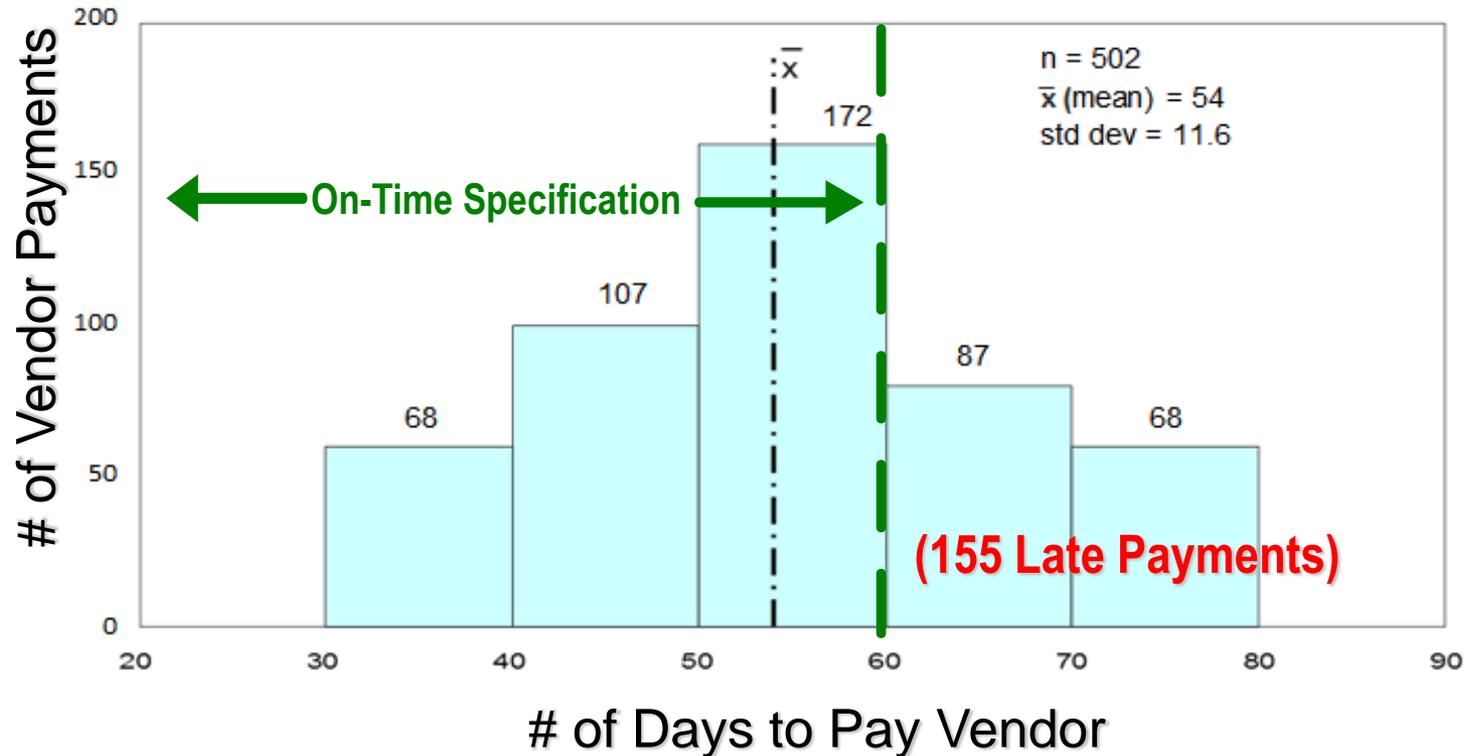
## When is it used?

1. To measure “Process Performance” (e.g. Average Score= 54)
2. To stratify (or separate) process “**Bad Outputs**” from “**Good Outputs**”

# LSS Tool : Histogram PWWM Example

What does this Histogram tell us about the Vendor Payment Process?

## Vendor Payments

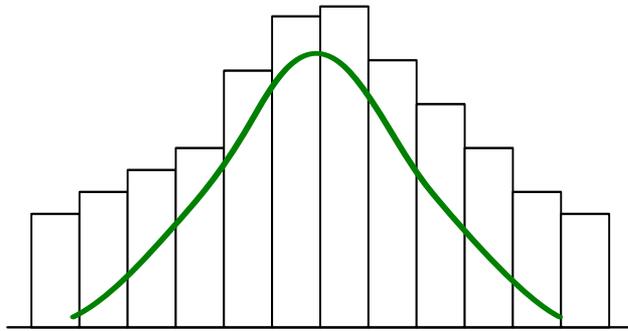


1. What is the “Process Performance”?

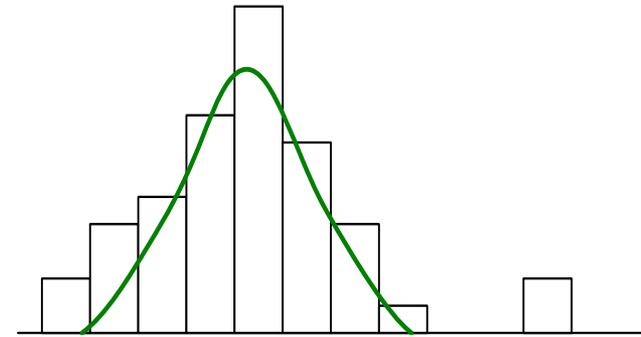
*Process averages 54 days and produces 70% of payments (347 of 502) on-Time*

2. What outputs would you separate out? **(155 Late Payments)**

# LSS Tool: Histogram (*Distribution Types*)

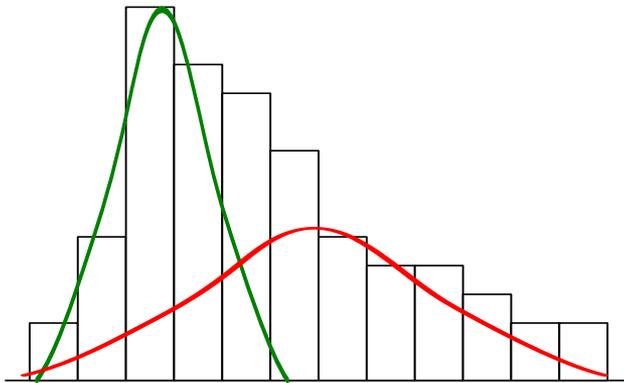


**Normal** (process outputs vary evenly around an average)

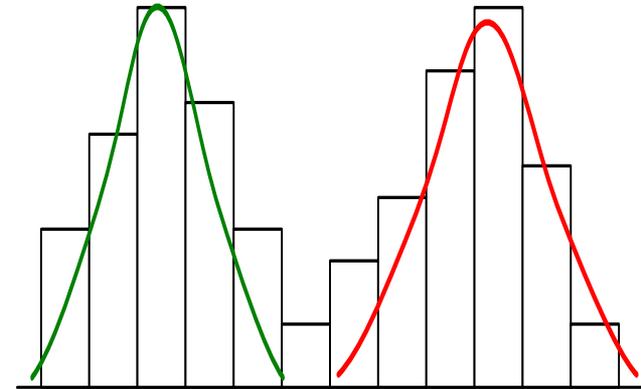


**Outlier** (investigate output that may not be normally part of process)

Can you see the Normal distributions below?



**Skewed** (2 normal distributions are mixed...separate them before analysis)



**Bi-Modal** (2 distributions, select one to analyze 1st)

# Histogram (Human Histogram Exercise)

**Purpose:** To practice constructing a histogram

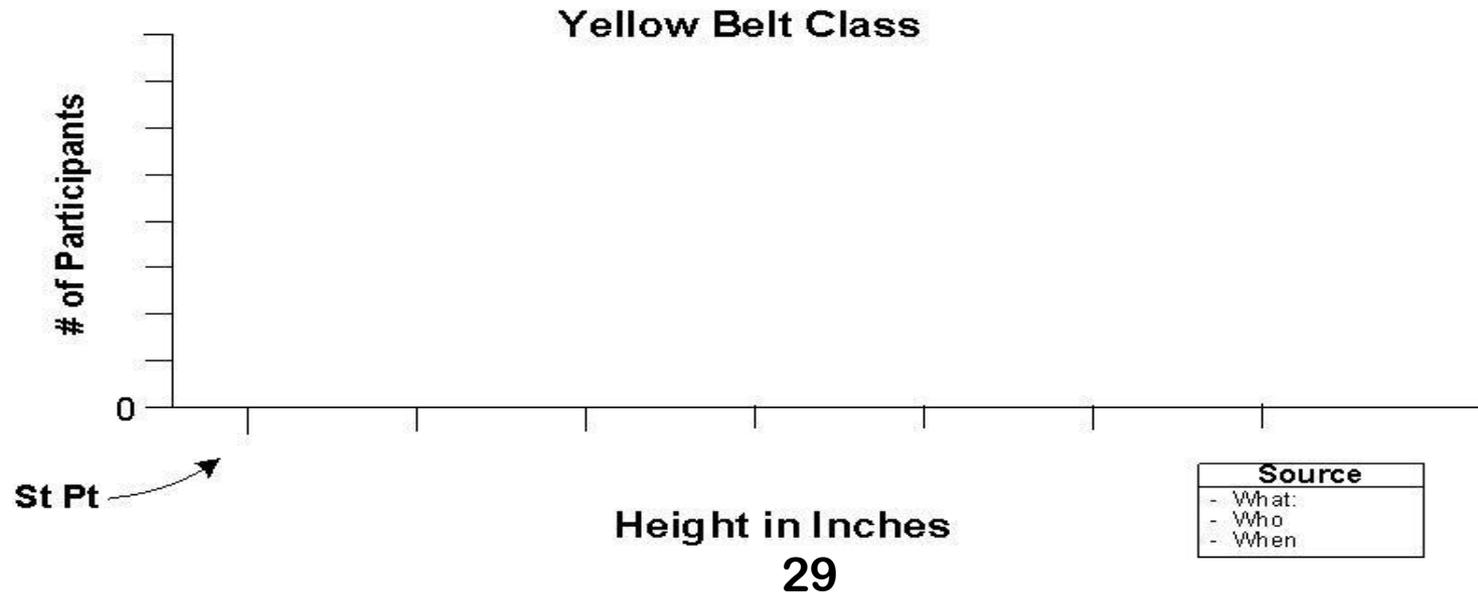
- Agenda:**
1. On a sheet of paper write your height in “inches” (round up to nearest inch)
  2. Follow instructor’s directions and the histogram construction process  
*(Follow-along using guide on next slide)*
  3. What is the central tendency of the distribution (mean or average, median, mode and modal class)

**Limit:** In teams (or full group): 20 Minutes

# Histogram (Histogram Exercise)

## Histogram Construction Procedure

1. Select data
2. Sort data low to high:
3.  $n =$
4.  $\text{Range} = (\text{maximum data point}) - (\text{minimum data point}) =$
5.  $\text{Class} = K = \text{square root of } n =$  (Round up for # of bars)
6.  $\text{Width} = W = \text{range} / K$  (Round up for width of each bar)
7.  $\text{Starting point} = (\text{minimum data point}) - 1/2 =$
8.  $\text{Mean} = (\text{sum all data points}) / n =$

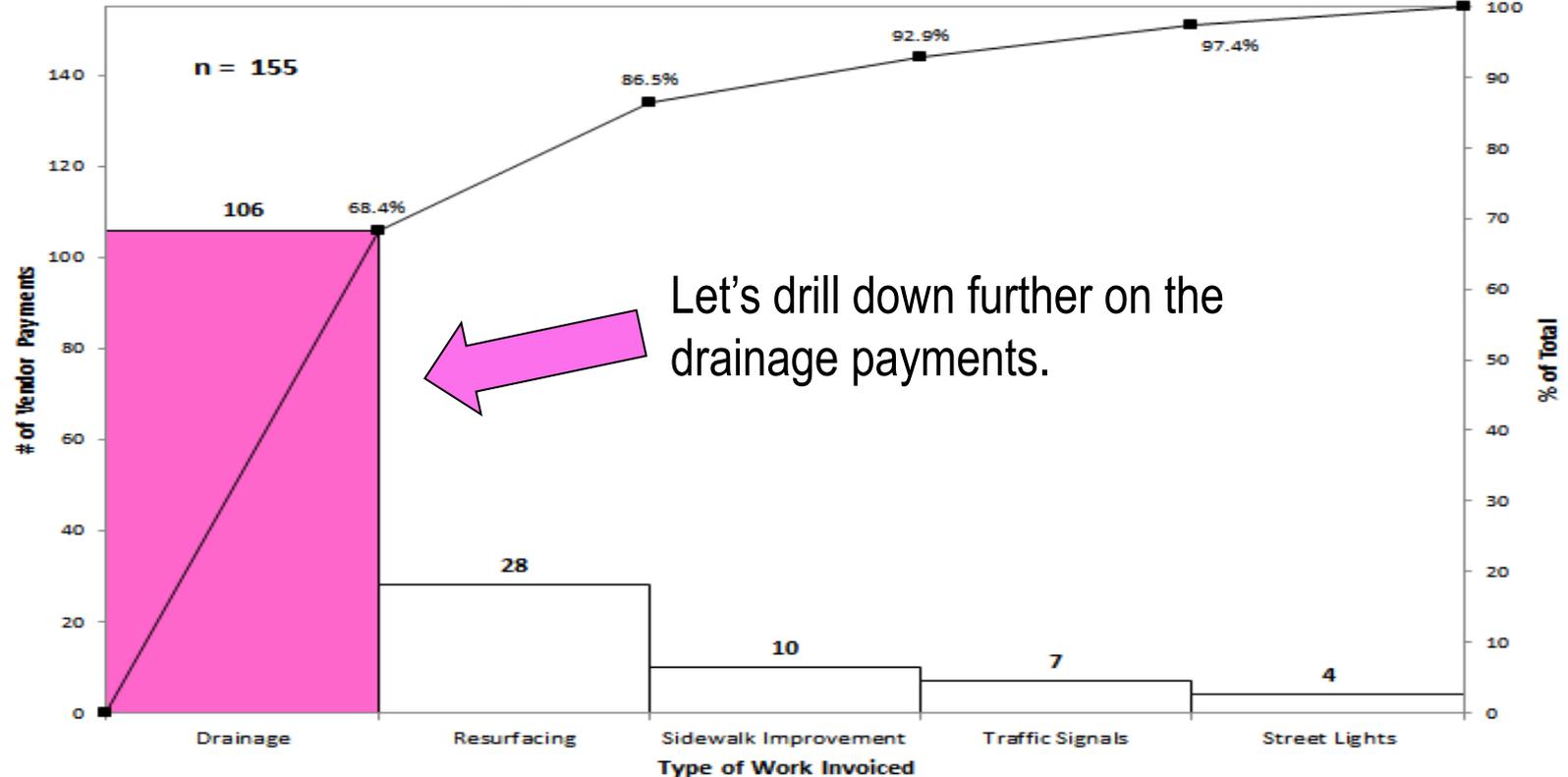


## How the Pareto Diagram was Born

- 1897 . . . Italian Economist, Vilfredo Pareto, presented a formula showing that the distribution of income is uneven (i.e., the largest share of the world's income is held by small number of people).
- 1907 . . . U.S. Economist, M. C. Lorenz, expressed a similar theory in a diagram.
- Later . . . Quality Control expert, Dr. J. M. Juran, applied Lorenz's diagram method to classify problems of quality into "vital few" versus the "trivial many".

# LSS Tool: Pareto

## Late Payments to Vendors - 2013



### Paretos...

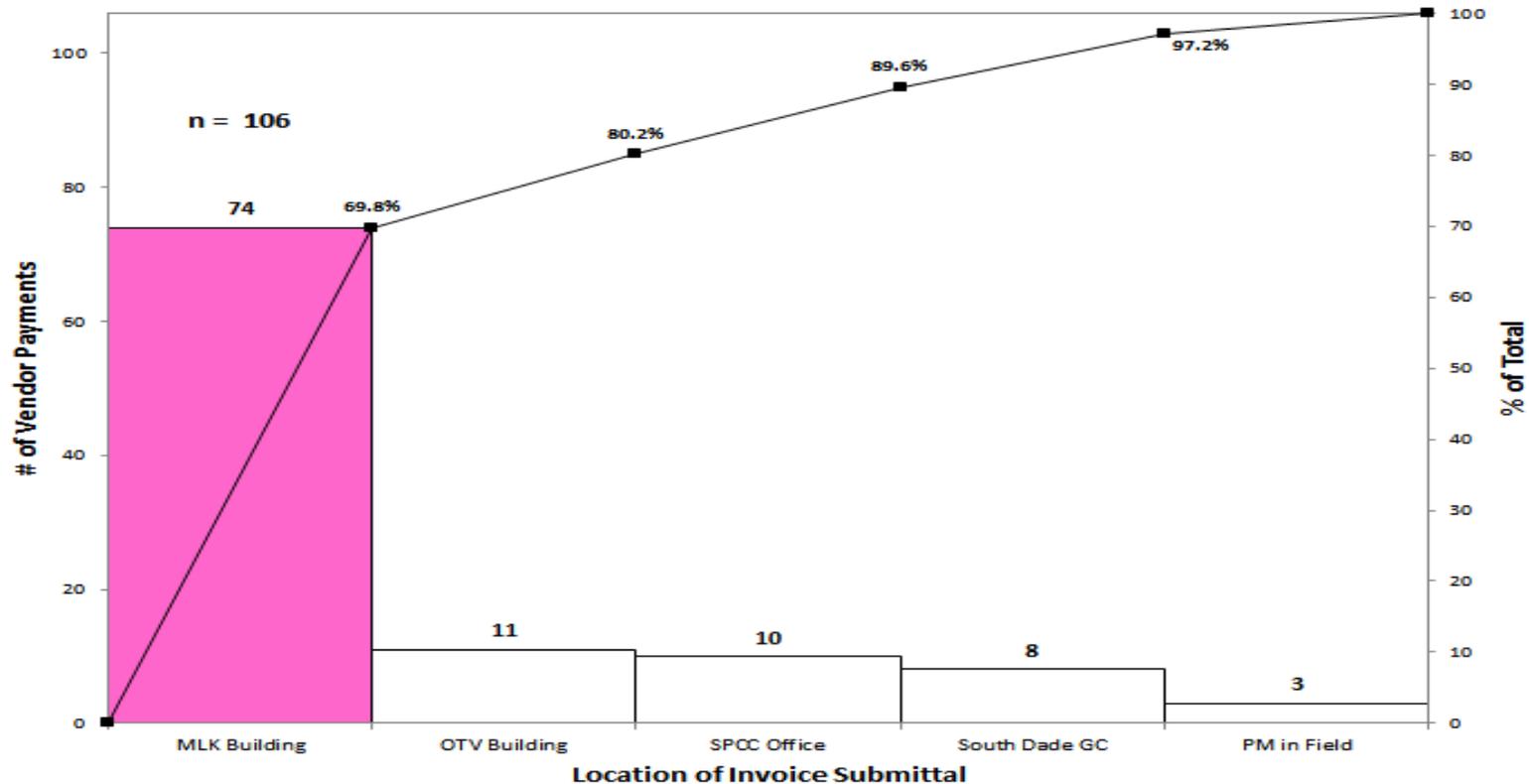
- Summarize groups of items in order from highest to lowest
- Separate the “significant few” group(s) from the “trivial many” (i.e. 80-20 Rule...80% of pain is caused by 20% of groups)
- Assist problem solvers in “drilling down” from What, Where, When and Who viewpoints searching for a “large bar” or “young mountain”.

# The Pareto – Construction Procedure

- 1) Draw a box.
- 2) Display the number of items (e.g. n=343).
- 3) Title the PARETO with the answer to the Question, "What is n?"...(i.e. What are the 343?)
- 4) Label the sides of the box:
  - a. Left side: Number of \_\_\_\_\_ Construct a measurement scale on the left side starting with zero at the bottom and the "n" (e.g., 343) value at the top. Add additional appropriate scale values on the left side.
  - b. Bottom side: Label with the name of the What, Where, When or Who data group to be displayed (e.g., Type of Work Invoiced). Draw each bar at the appropriate height descending from the left starting with the biggest bar. Label each bar and display bar height values above each bar.
  - c. Right side: Label this side "Cumulative Percentage" and display measurement grids at 0%, 25%, 50%, 75% and 100%.
  - d. Construct a "Cumulative Percentage" line: 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.,  $(76+20) \div (101) * 100 = 96\%$ ).
- 5) Add a source box.

# LSS Tool: Pareto – Second Drill Down

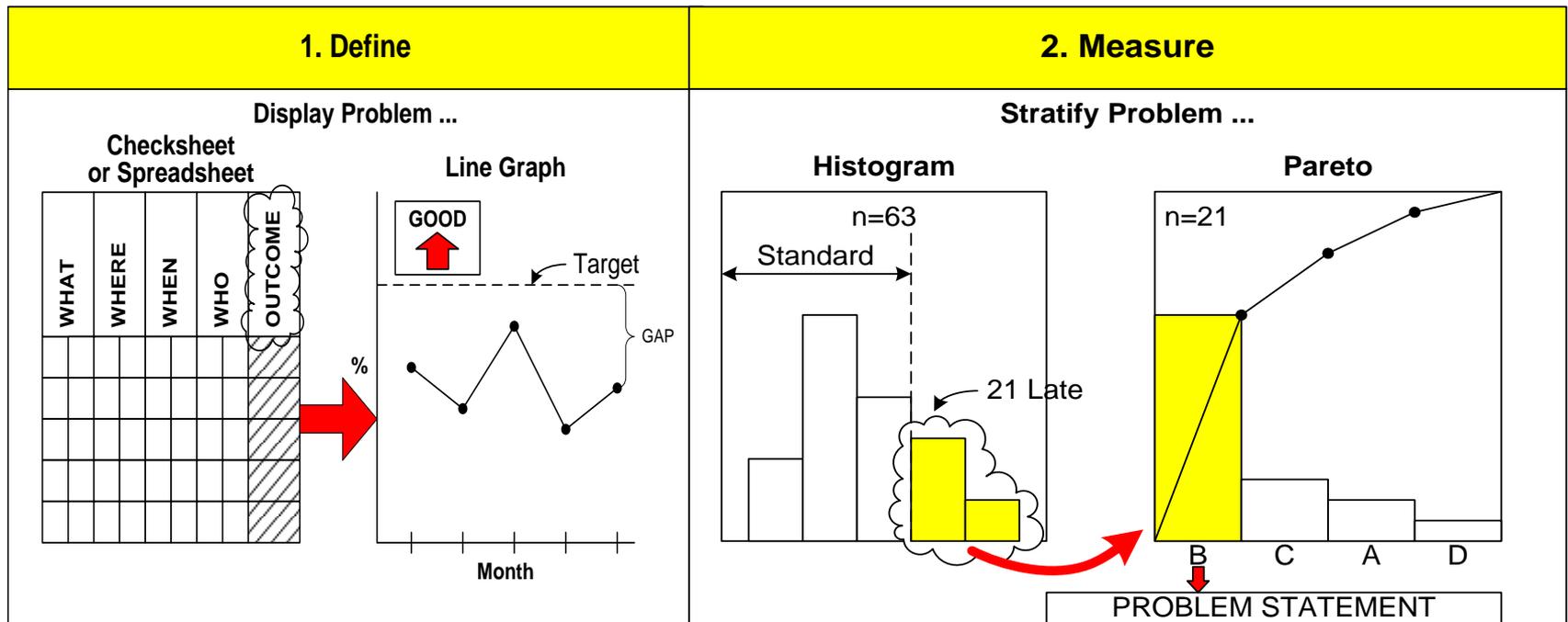
## Late Payments to Vendors for Drainage - 2013



**Problem Statement: 70% of invoices paid late for drainage work were initially submitted for processing in the MLK Building.**

# Morning Summary

**Green Belt** teams use a Six Sigma 5 step problem solving **DMAIC** process. The first 2 steps are **Define** and **Measure** and often use 4 tools:



**Spreadsheets** help organize process data

**Line Graphs** display the Performance GAP

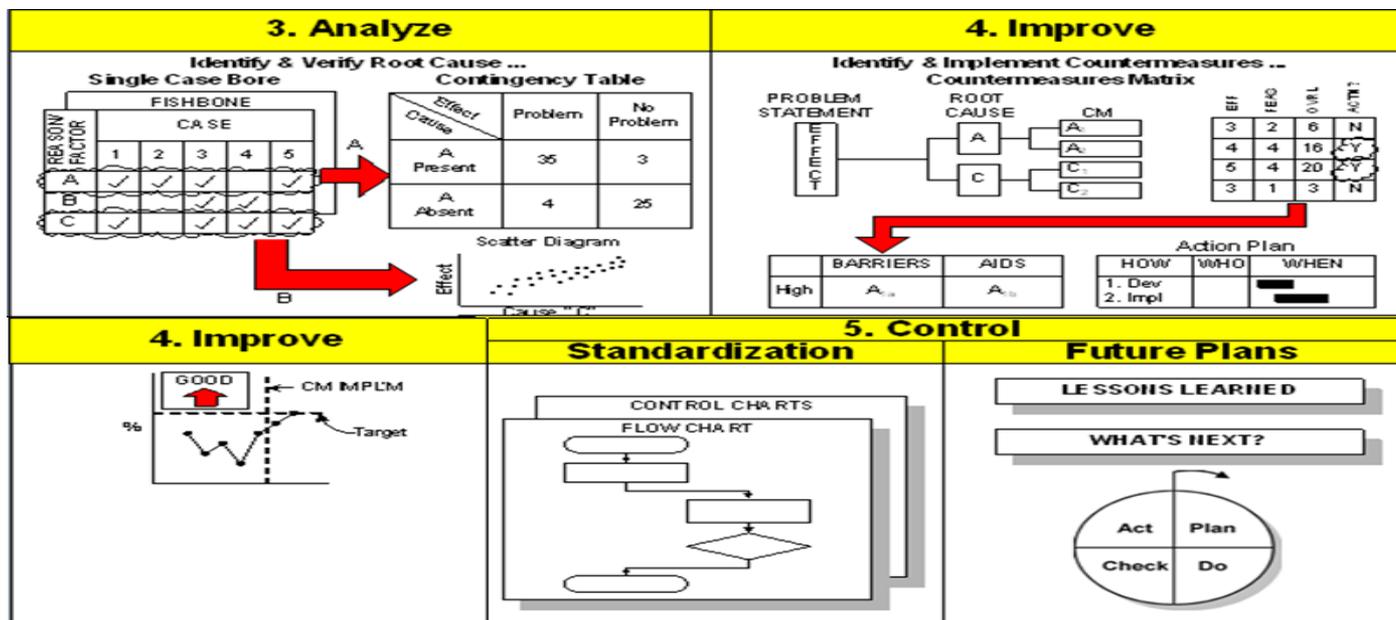
**Histograms** help us drill down on bad outputs.

**Paretos** also help us drill down on bad outputs

# DMAIC Process Steps 3, 4 & 5: Analyze, Improve, Control

The objective of steps 3, 4 and 5 are to identify root causes, identify and implement solutions and locking in the gains made over time.

3. Analyze: Study the stratified data to identify and verify the root cause of your problem
4. Improve: Develop and implement countermeasures to eliminate the verified root cause of the problem
5. Control: Prevent the problem and its root causes from recurring



Lets look more closely at the Single Case Bore and the Fishbone Diagram tools.

# LSS Tool: Single Case Bore

## Single Case Bore Analysis

Instructions to Team: Erase the example factors and x's below and secure Invoice documentation and the attached spreadsheet and interview knowledgeable involved workers as needed before completing this Single Case Bore Analysis

**Problem Statement: 70% of invoices paid late for drainage work were initially submitted for processing in the MLK Building.**

Reasons or Factors <i>(That possibly contributed to late verification of Payroll and Insurance)</i>	Sampled 20 of the 74 late payments													Total	Percentage							
	104219	104224	104485	104488	104829	104830	105437	105446	105637	105639	105720	105731	106017			106315	106364	106578	106726	106579	106870	106892
1) Invoice took more than five working days for PM to verify quantities after initial submittal	x	x		x			x					x	x		x	x	x	x			10	50%
2) Key staff on vacation		x		x					x							x					4	20%
3) Funding authority exhausted			x							x							x				3	15%
4) Internal processing time lag noted in case files				x										x					x		3	15%
5) New federal funding requirements not followed					x								x								2	10%
6) Change order not on file	x								x								x				3	15%
7) Subcontractor payrolls not submitted. Invoice returned to vendor		x	x	x			x	x	x	x		x		x	x				x	x	11	55%
8) Insurance documentation not complete	x				x						x										3	15%

# Sources of All Root Causes



Where do Root Causes Come From?

Standards Failed

People Failed the Standard

No Standard

Standard Poorly Designed

Standard Out of Date

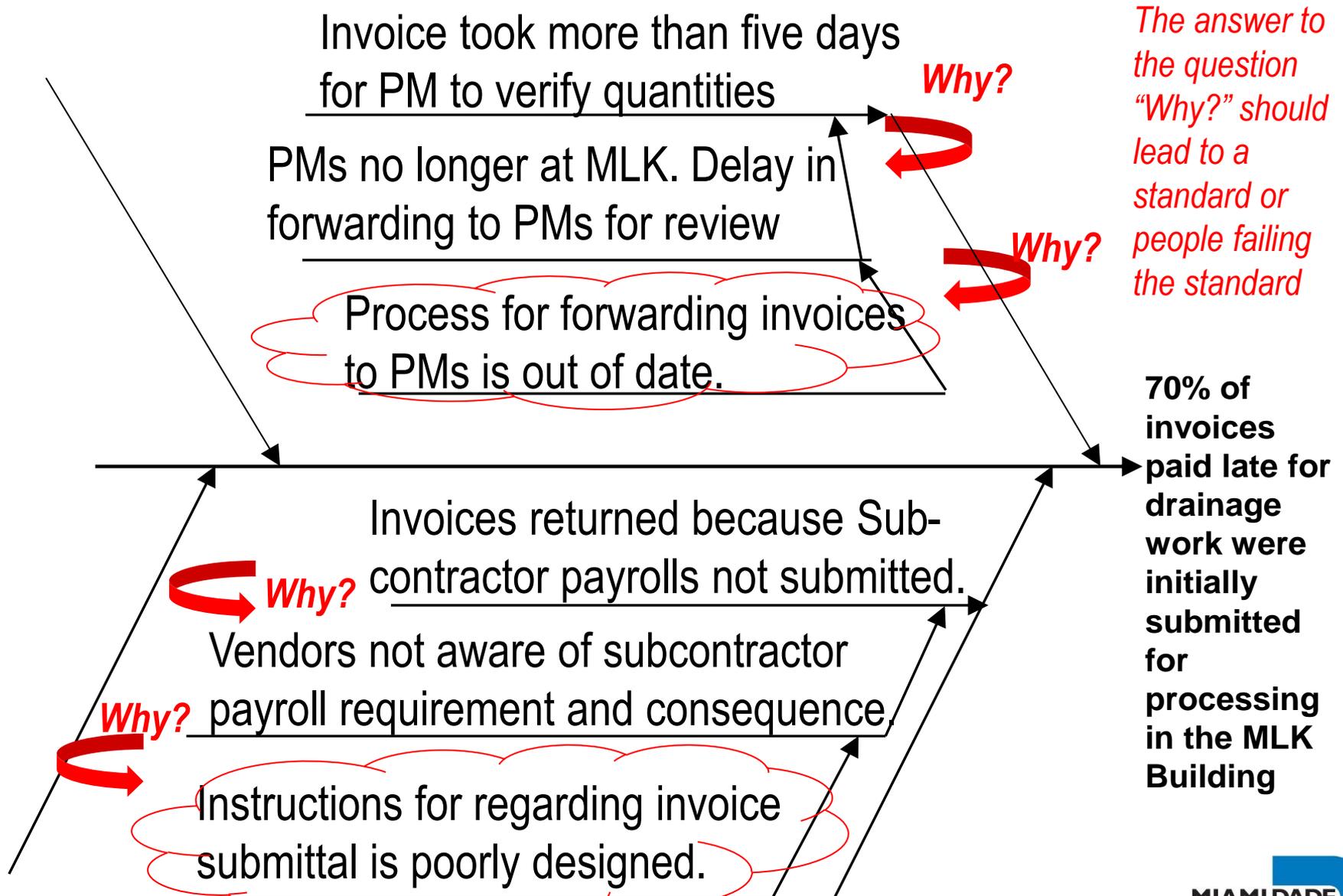
People not trained

People Poorly Trained

People failed (despite having appropriate standards and training)

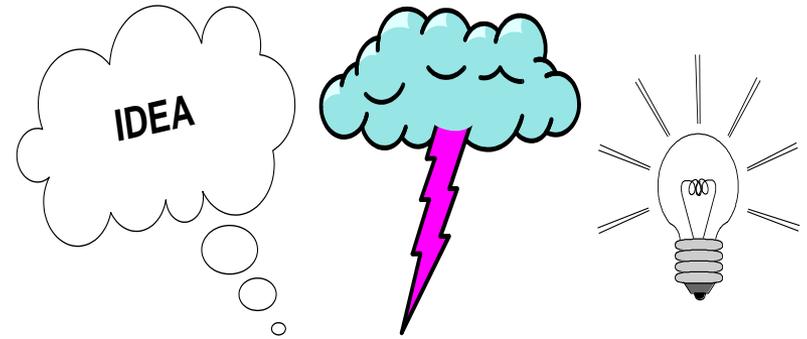
**The goal is to identify and address root causes not symptoms.**

# LSS Tool: Fishbone Diagram



# LSS Technique: Brainstorming

**Brainstorming** is a technique to generate many diverse ideas using a team or group of employees using two (2) principles and several rules:



- ◆ **Delayed Judgment** - People are able to produce more ideas when they delay evaluation of ideas until a later time.
- ◆ **Extended Effort** - More original and useful ideas are created when the group continues to generate ideas beyond the initial, more obvious responses. The emphasis is on "quantity" of ideas not the "quality."
- ◆ **“Brainstorming Rules”**
  - State ideas briefly and clearly.
  - All Ideas recorded
  - Build on recorded ideas.

# LSS Technique: Brainstorming Procedure

## The Leader....

1. **Selects the brainstorming method: Round Robin** (go around group in order for responses); **or Green Light** (allow anyone to respond anytime)
2. **Makes the topic visible, selects recorder**
3. **Reviews brainstorming rules:** State ideas briefly. build on recorded ideas and all ideas are recorded.
4. **Leads the group through three phases:**
  - a) **Generation Phase** – Post ideas on the flip chart, whiteboard or screen.
  - b) **Clarification Phase** - Go over the list to make sure that everyone understands all of the items.
  - c) **Evaluation Phase** - Eliminate duplications, irrelevancies and issues that are off limits or cannot possibly be addressed or acted upon by this team.

# Improvement Exercise Using Brainstorming

**Purpose:** Use brainstorming to identify potential solutions to identified root causes of our vendor payment problem statement

- Agenda:**
1. Each group selects facilitator and recorder.
  2. Brainstorm potential solutions to root causes that impede the payment of vendors. Refer to the Vendor Payment Process Flowchart earlier in presentation.
  3. Record input on brainstorming form located in pocket of folder.

**Limit:** Full group: 30 Minutes

# Improvement Exercise: Develop Counter Measures

Based on your brainstorming, use this form to develop and prioritize counter measures for your selected root causes.

Problem Statement	Root Cause	Counter Measure	1-lowest 5-highest Rankings			
			Effectiveness	Feasibility	Overall (Effectiveness x Feasibility)	Take Action (Y or N)
70% of invoices paid late for drainage work were initially submitted for processing in the MLK Building	Process for forwarding invoices to PMs is out of date					
	Instructions regarding invoice submittal is poorly designed					

# Case Study from a Green Belt Team

Team Name and Logo

Improvement Area

*The Incredible Bulk*



Bulky Trash Pick-ups

*Trash Talkers*



Waste Disposal

*The "Roadsters"*



Road & Bridge Repairs

*Procurement Xpress*



Contract Procurement

*On-Time Payment Services (OPS)*



Vendor Payments

*The Empire Strikes Back*

For Six Sigma,  
it's worth it.



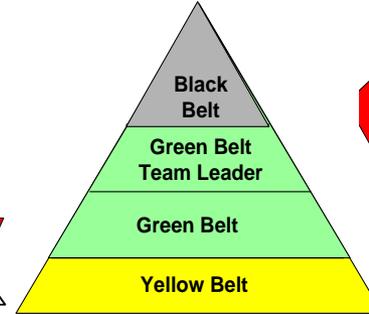
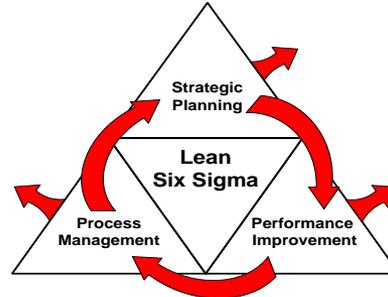
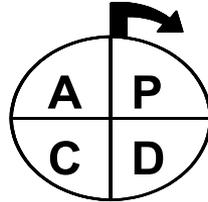
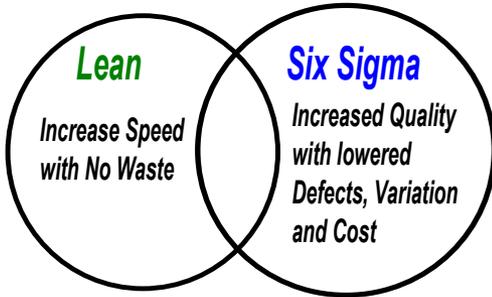
Garbage/Trash  
Collections

# Summary

- ◆ **Lean Six Sigma (LSS) is a proven methodology** that will help us improve our work processes.
- ◆ **Miami-Dade County will train and certify employees as **Yellow Belts**, **Green Belts**, or **Black Belts**.**
- ◆ **Green Belt improvement teams will utilize the DMAIC process**, a five step problem solving Six Sigma methodology.
- ◆ **LSS tools and techniques** used by Green Belt teams include:
  - *Spreadsheet* ... to help gather What, Where, When and Who demographic process data
  - *Line Graph* ... to display performance GAP and trends
  - *Flowchart* ... to map the process and display “Best Path”
  - *Histograms and Paretos* ... to “Drill Down” on data to help identify problem statement
  - *Single Case Bore and Fishbone* ... to further determine root cause(s) to problems
  - *Brainstorming* ... to engage employees to identify improvements

# Lessons Learned

## What did you learn today?



Waste Transfer Spreadsheet										
DEMOGRAPHICS										
WHEN			WHAT			WHERE			WHO	
A	B	C	D	E	F	G	H	I	J	
Line #	Hr of Day	Trip Min.	Transfer Date	Day	Waste Type	Load (Tons)	Transfer Pick-Up Location	Delivery Location	Driver	
1	10	25	3/12/12	Mo	Trash	23	8-South Dade Fac	3-Resource Rec.	Jeff	
2	8	25	3/14/12	We	Garbage	22	3-North East T. S.	3-Resource Rec.	Sally	
3	9	30	3/22/12	Th	Clean Tires	10	8-South Dade Fac	3-Resource Rec.	Fred	
4	10	25	3/22/12	Th	Trash	12	2-Central T. S.	5-North Dade Lan	Carlos	

For WHEN Columns consider:

A) Calendar Time (date, time, day of week, etc.)

B) When in life cycle of product

C) When in the process

D) Durations (seconds, minutes, hours, days, etc.)

For WHAT Columns consider:

A) Type

B) Category

C) Complexity

D) Severity

E) Priority

F) Cost

G) Group

H) Amount

For WHERE Columns consider:

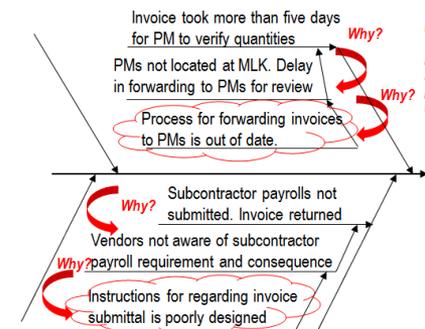
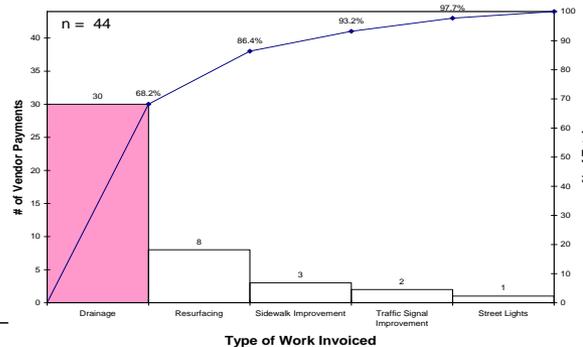
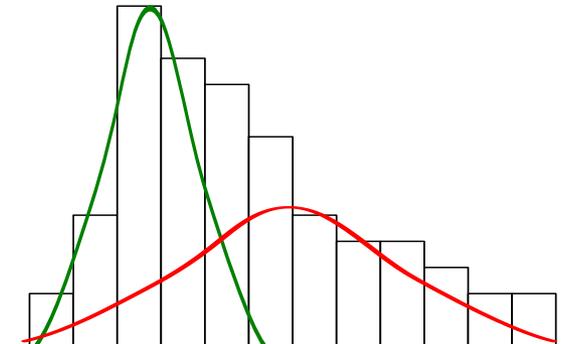
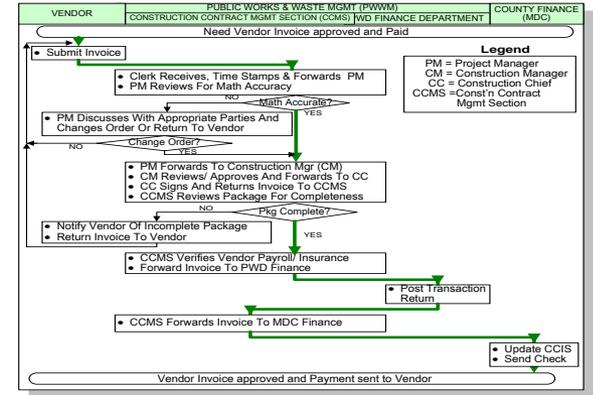
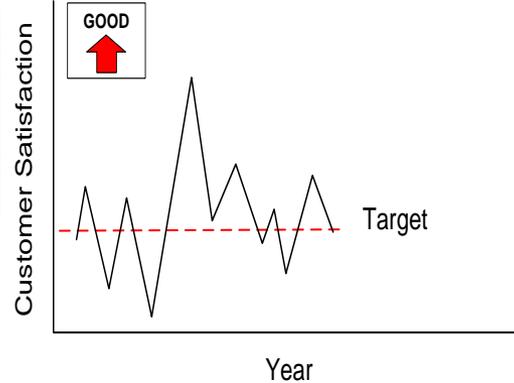
A) Where geographically on earth (country, state, county, city, street, zip code)

B) Location type (inside/outside, or hall, stairs, etc.)

C) Where is "defect" or "object" (e.g., body part)

For WHO Columns consider:

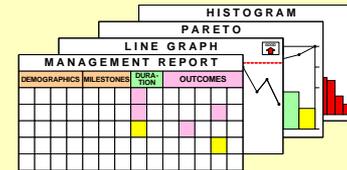
A) Customer, worker, worker's supv, name, position, experience, gender, race, employment years, age, role, etc.



# Congratulations!



**Certified**



## Lean Six Sigma **Yellow Belt**

This is to certify that  
**I. M. Employee**  
Is a **Yellow Belt** and has completed

**6 Hours of Analytical Tools And  
Techniques Training**

**2013**

\_\_\_\_\_  
Instructor

\_\_\_\_\_  
Miami-Dade



# Appendix-Histogram (Vendor Payment Exercise Answer)

1. Select data (for example purposes, vendors are to be paid within 45 days of complete invoice submittal)
2. Sort data low to high: 21, 25, 28, 30, 31, 32, 35, 37, 38, 38, 39, 39, 40, 40, 40, 40, 41, 42, 43, 43, 44, 45, 51, 52, 55
3.  $n = 25$
4. Range = (maximum data point) - (minimum data point) = 34
5. Class =  $K = \text{square root of } n = 5.0$  (round up for # of bars = 5 bars)
6. Width =  $W = \text{Range} / K = 34 / 5 = 6.8$  (round up for bar width = 7)
7. Starting point = (minimum data point) -  $\frac{1}{2} = 21 - \frac{1}{2} = 20.5$ .
8. Mean = (Sum all data points) /  $n = 969 / 25 = 38.76$

