Lean Six Sigma Overview

Father of Six Sigma

Bill Smith

Six Sigma Was Born 0n 15 January 1987

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Discovery of bill smith

Field Failures

Number of repairs in factory
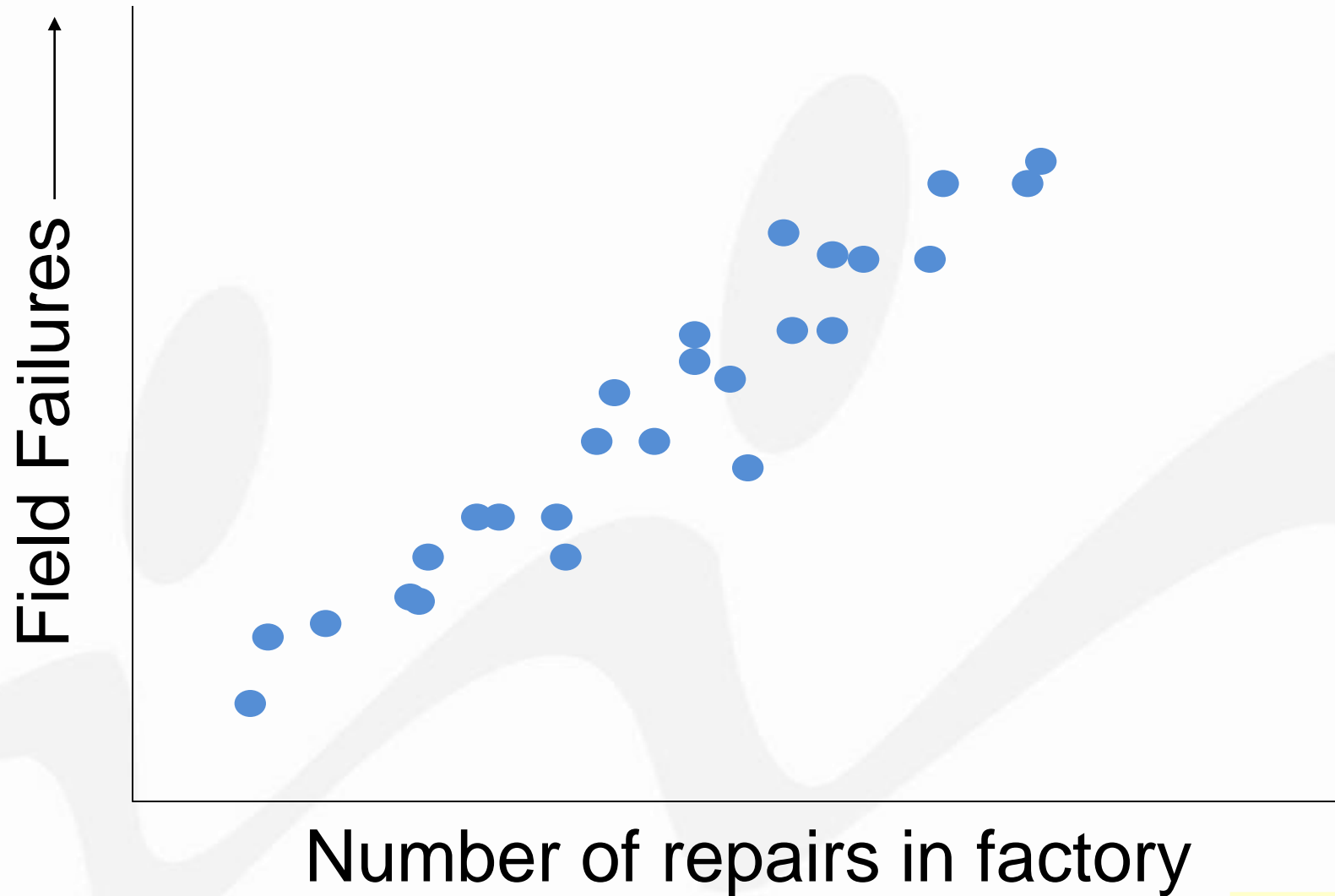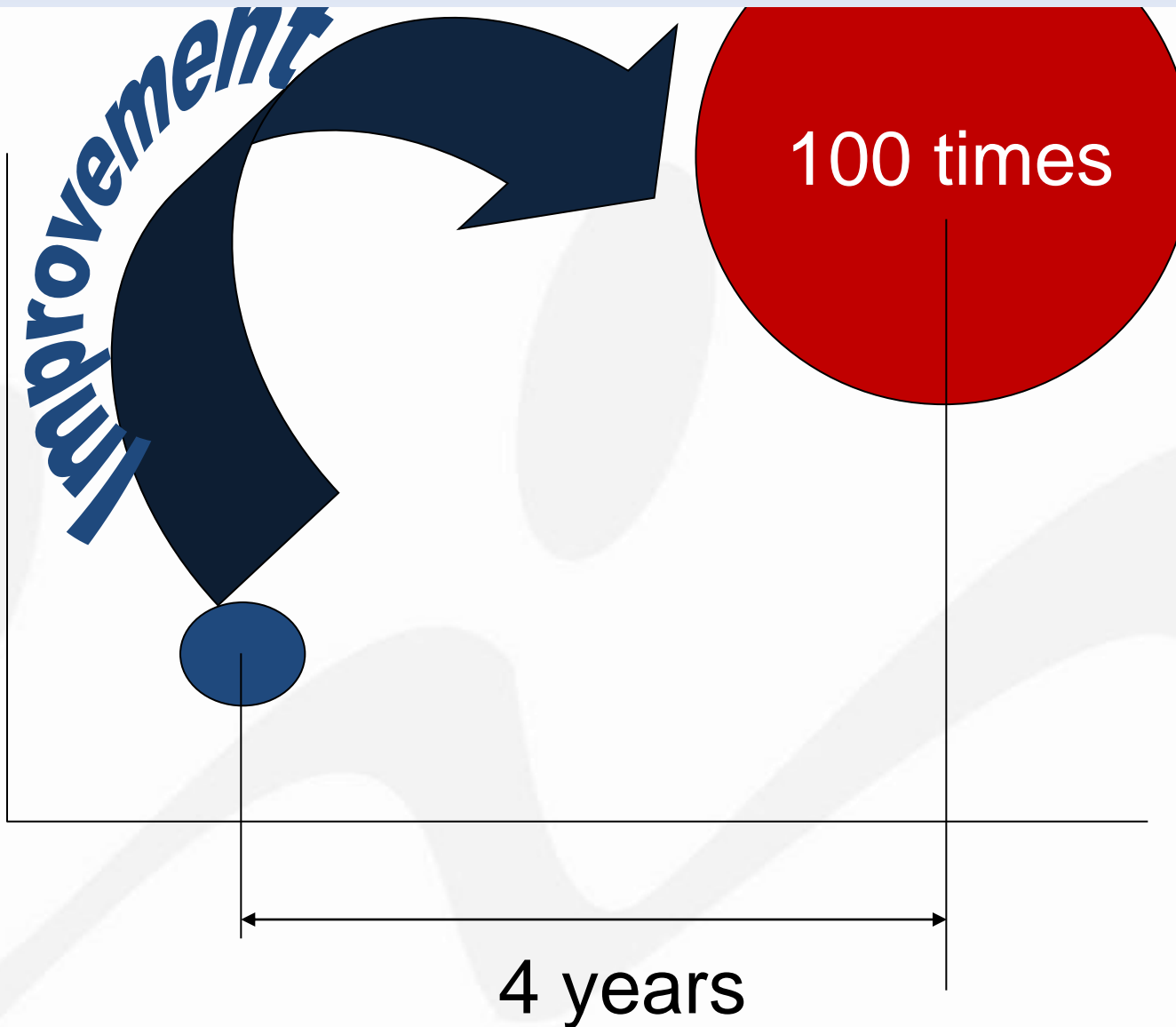
Realization at Motorola

- To reduce field failures, much higher level of internal quality is required.

- Done right, improving quality will reduce cost.

- Cost of correcting poor quality ranged $800-$900 million per year.

Desire of Bob Galvin

Improvement

100 times

4 years

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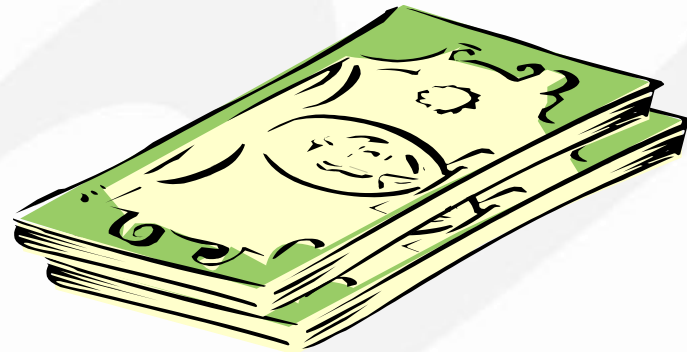
Results of Six Sigma at Motorola

- Five fold growth in sales

- Annual increase of profit 20%

- Cumulative saving $14 Billion

- Annual stock price gain 21.3 %

Philosophy of Six Sigma

Make customer extremely happy

And

Improve Bottom Line

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What is Six Sigma (6σ)?

✓ Six Sigma is a philosophy for managing process improvement.

✓ Six Sigma is a way to integrate quality into day-to-day activities.

✓ Six Sigma is a means of continuously improving to meet customer needs.

✓ Six Sigma is a measurement of defects and variation.

Basic Definitions

Sigma

- A mathematical term used to designate the distribution or spread of any process around the average (mean) as expressed in "standard deviations".

- For a business or a manufacturing process, the sigma value is a metric used to indicate how well the process is performing.

Six Sigma Is…

…an initiative

- Improvement
- Breakthrough
- Right Projects
  - Linked to Business Goals
- Right People
  - Selected & Trained
- Project Management
  - Management Reviews
- Right Results
  - Process & Financial ($$)
- Sustaining Gains

…a methodology

- Process Thinking
- Process Variation
- Facts, Figures, Data
- Define, Measure, Analyze Improve, Control (DMAIC)
- Statistical Tools
- Critical Few Variables

…a measurement

- Quantifies our Process Capability

Six Sigma Is…

…a simple, unique, proven and lasting approach for improving our business performance based on:

- Alignment of the customer, strategy, processes and people

- Big, measurable business results

- Selective but broad deployment of advanced quality and statistical tools

Six Sigma Is Emerging Into All Aspects Of Business

Value (products, services, information) →

← Cash

Order Entry	Purchasing	Scheduling	Operations	Invoicing /Collection

Human Resources

Finance & Accounting

Information Technology

Marketing, Sales

Management & Leadership

New Product / Service Development

DMAIC Approach

- Once Projects are identified, the Six Sigma Methodology is applied to provide a structure to problem solving.

The Methodology:

- Define the Process / Problem

- Measure the Process / Problem

- Analyze the Process / Problem

- Improve the Process / Problem

- Control the Process / Problem

D M A I C

Another View : The Roadmap

Define	Measure	Analyze	Improve	Control

Define
- ✓ Initiate the Project
- ✓ Define the Process
- ✓ Determine Customer Requirements
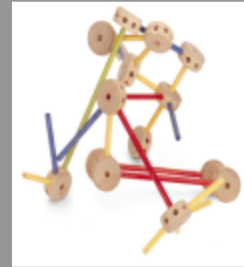- ✓ Define Key Process Output Variables

Measure
- ✓ Understand the Process
- ✓ Evaluate Risks on Process Inputs
- ✓ Develop and Evaluate Measurement Systems
- ✓ Measure Current Process Performance

Analyze
- ✓ Analyze Data to Prioritize Key Input Variables
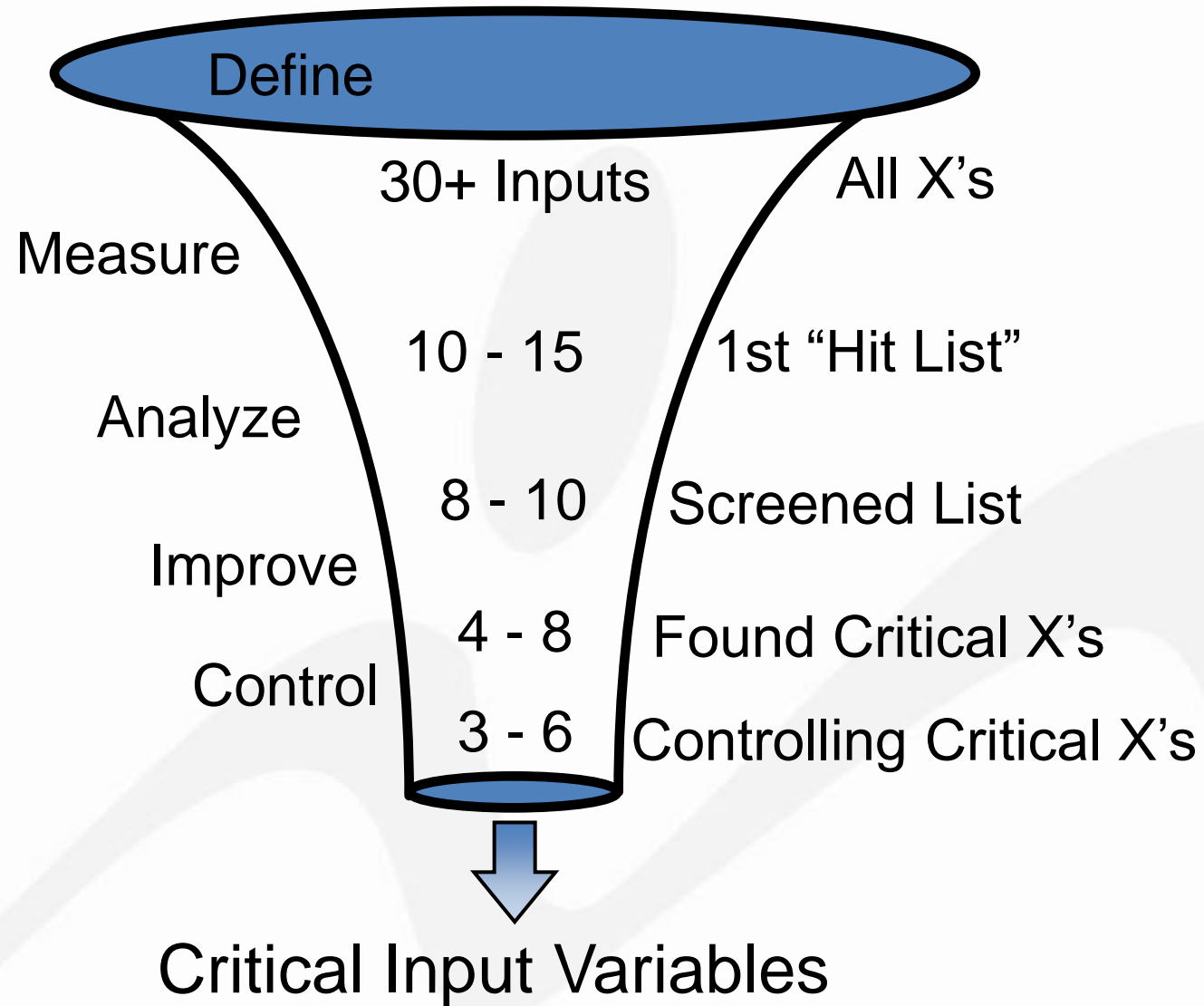- ✓ Identify Waste

Improve
- ✓ Verify Critical Inputs Using Planned Experiments
- ✓ Design Improvements
- ✓ Pilot New Process

Control
- ✓ Finalize the Control System
- ✓ Verify Long Term Capability

DMAIC Is A Filter Process

Define

30+ Inputs   All X's

Measure

10 - 15   1st "Hit List"

Analyze

8 - 10   Screened List

Improve

4 - 8   Found Critical X's

Control

3 - 6   Controlling Critical X's

Critical Input Variables

Level of Competition

Sigma	DPMO	Cost of poor quality (% of sales)	% OK	Competitive level
6	3.4	<10	99.999%	World class
5	233	10 – 15	99.97%	
4	6,210	15 – 20	99%	Industry average
3	66,807	20 – 30	93%	
2	308,537	30 – 40	63%	Non competitive
1	690,000	> 40		

Why is 99% not good enough?

www.sixsigmaconcept.com

What Does 6σ Mean In Your Daily Life?

www.sixsigmaconcept.com
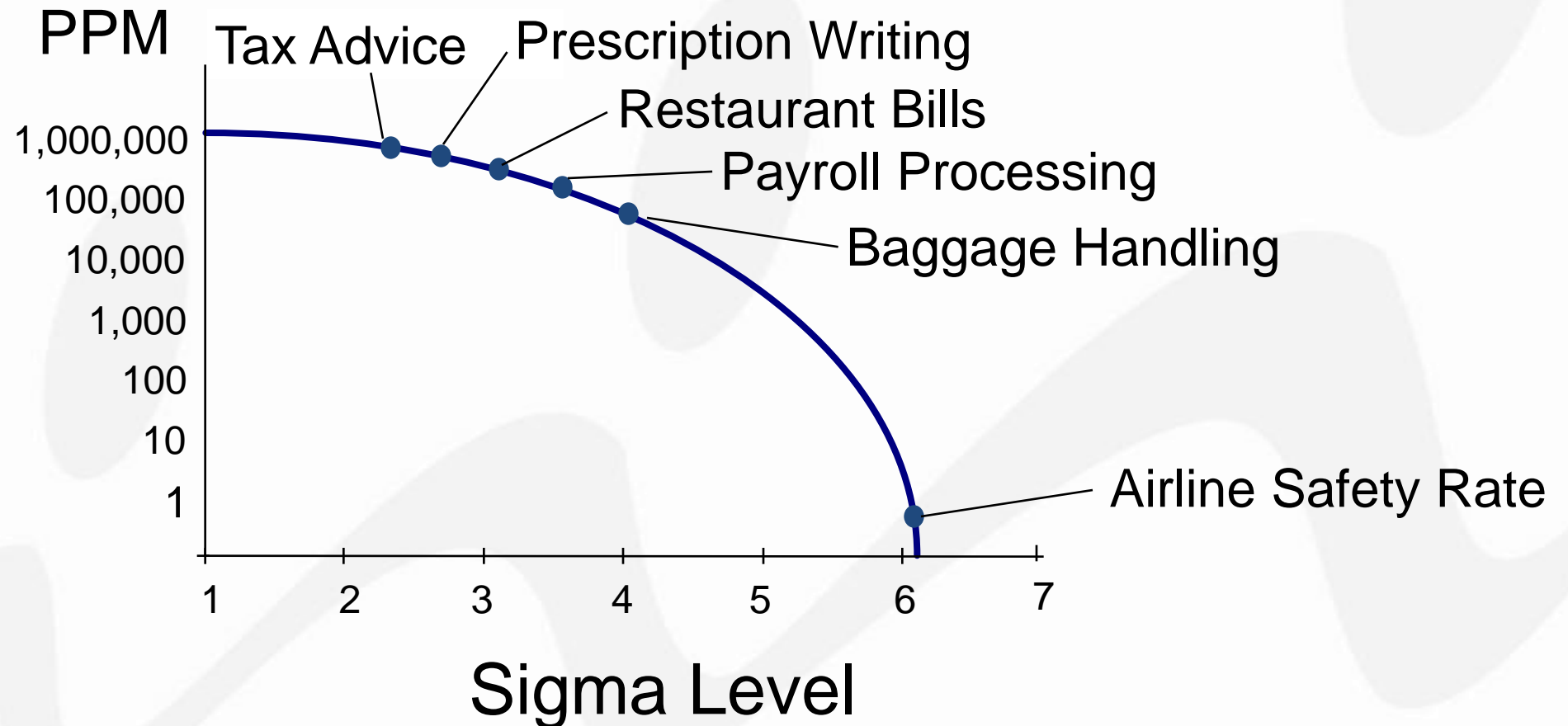
Benefits

- Financial
  - ✓ GE – $ 2 Billion to bottom line. (1999)
  - ✓ Honey Well – $ 1.4 Billion (1996)
  - ✓ DuPont – $ 1.6 Billion (1998)
  - ✓ Wipro – $ 21 Million (2003)
  - ✓ VSNL – $ 16.6 Million (2005)

- Customers

- Employees

- Quality

Lean Six Sigma

What is **LEAN** SIX SIGMA?
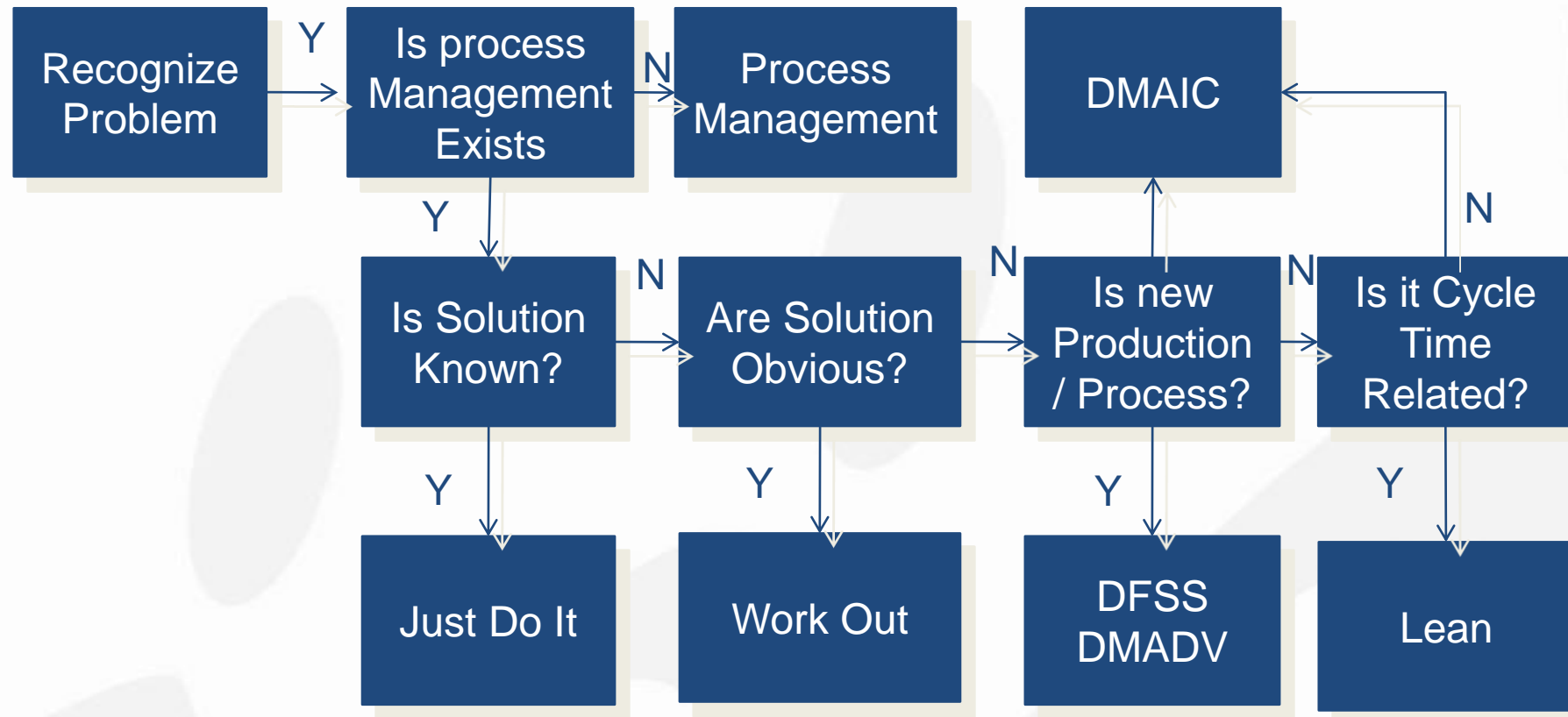
LEAN
Reduce waste by reorganazing a process
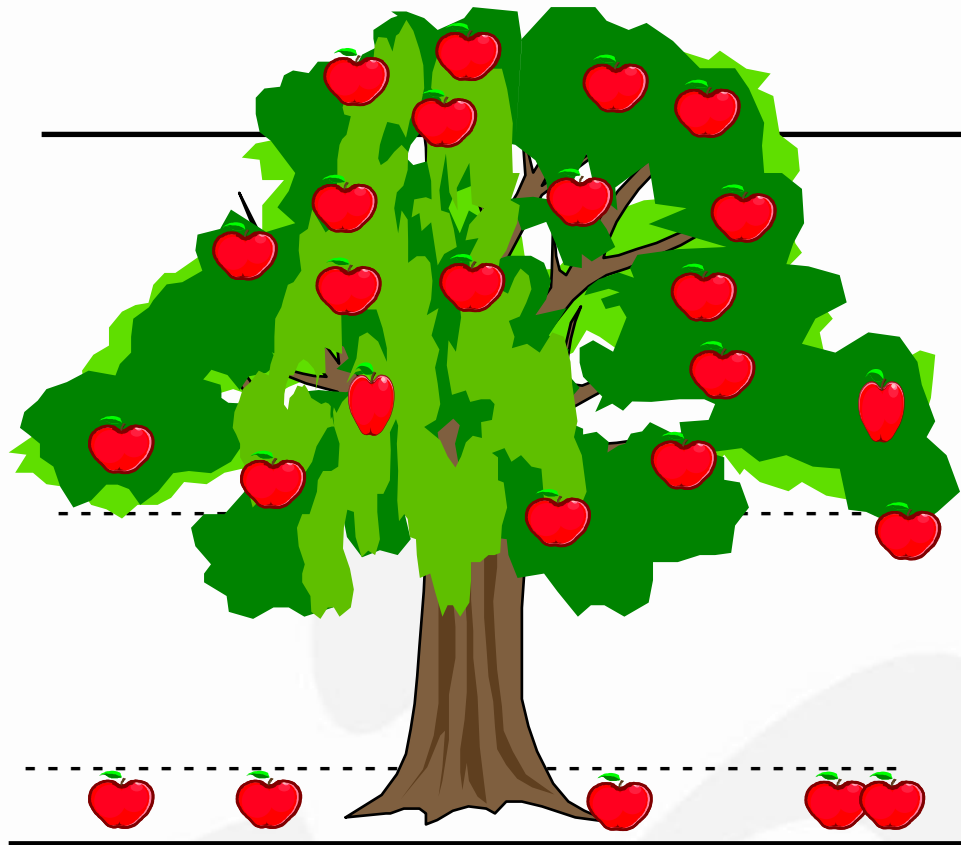
+

SIX SIGMA
Reduces defects by solving problems

=

LEAN SIX SIGMA
LEAN improves SIX SIGMA: Reducing waste and solving problems to be faster and more efficient

Design for Six Sigma Roadmap

Recognize Problem —Y→ Is process Management Exists —N→ Process Management

Is process Management Exists —Y→ Is Solution Known? —N→ Are Solution Obvious? —N→ Is new Production / Process? —N→ Is it Cycle Time Related?

Is Solution Known? —Y→ Just Do It

Are Solution Obvious? —Y→ Work Out

Is new Production / Process? —Y→ DFSS DMADV

Is new Production / Process? → DMAIC

Is it Cycle Time Related? —N→ DMAIC

Is it Cycle Time Related? —Y→ Lean

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Harvesting the Fruits of Six Sigma

Sweet Fruit
Design for Six Sigma (DMADV)

5 ☐ Wall, Improve Designs

Bulk of Fruit
Process Characterization & Optimization
 (DMAIC)

4 ☐ Wall, Improve Processes

Low Hanging Fruit
Seven Basic Tools

3 ☐ Wall, Beat Up Suppliers

Ground Fruit
Logic and Intuition
Quick hits - KAIZEN

When Do You Call A Company A Six Sigma Company?

- 20-30% of Bottom line coming from Six Sigma Projects
- 5-10% of the Population are BB & MBB
- 40-50% of the Population are GB
- All the HOD are Champions
- A Stream of Projects are in pipe line
- HR Policies are aligned with Six Sigma deployment
- The Six Sigma Performance is reported to all the stake holders
- Six Sigma efforts self sustaining without external help
- It has the expertise to spread 6 Sigma culture to its Suppliers and Customers and insist on them being 6 Sigma Companies

Ways to select the projects

Top-Down approach

Opportunities to reach the goals

Potential Projects

Bottom-Up approach

Issues needing attention

Problems, Errors, Dissatisfied Customers, Inefficiency

Objectives Of Six Sigma Project

- Reduce Variability

- Reduce Defects

- Improve Customer Satisfaction

- Reduce Cost.

- Reduce Lead Time

- Improve First Pass Yield.

- Improve Rolled Throughput Yield.

- Shorten Lead Time

- Optimize Process Performance

- Optimize Supply Chain.

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Six Sigma Project Identification

- Usually, Six Sigma projects are undertaken at the process level. However, all such projects should tie to the strategic business level goals.

- Key Performance Indicators (KPI) are metrics that reflect strategic value drivers, specify organizational goals and are key to organizational success.

Business Level
KPI 1
KPI 2
KPI 3
KPI 4

Function Level
KPI 1
KPI 2
KPI 3
KPI 4
KPI 5
KPI 6

Process Level
KPI 1
KPI 2

KPI n

Project 1
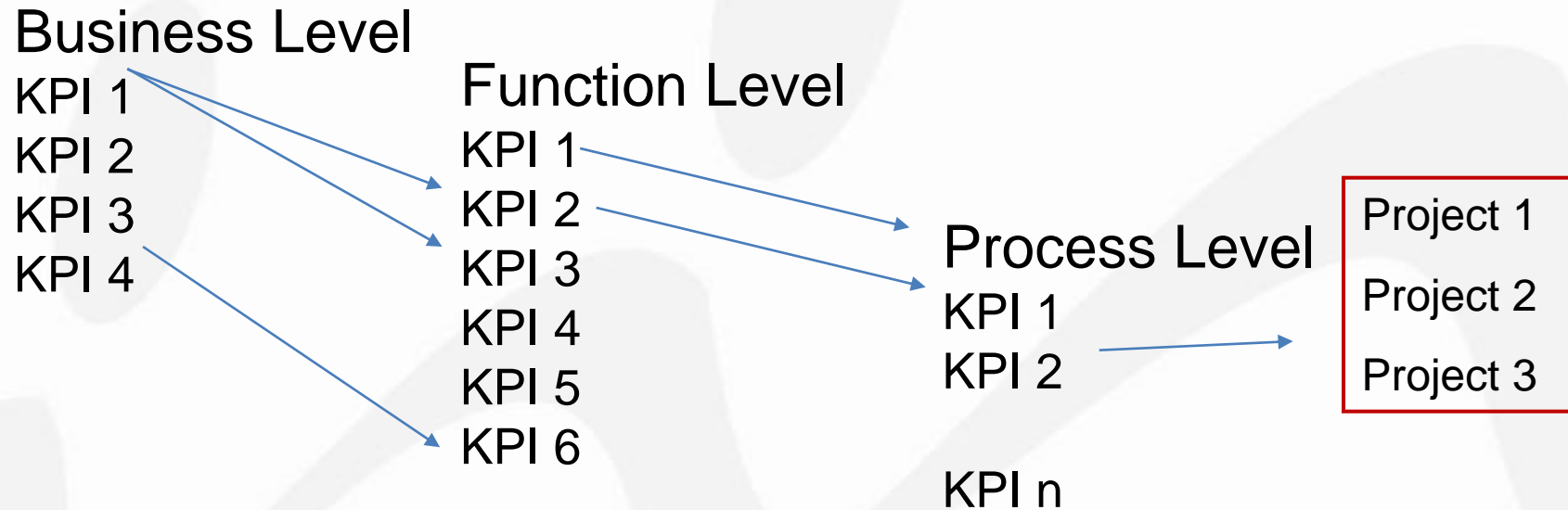
Project 2

Project 3

Each project should address at least one KPI at the business level

Linking Projects to the Big Ys – The Decision Tree

- Show how each project rolls up to the Big Ys

- Indicate the amount of impact of each project.

  - %

  - $

  - Number (e.g. days)

- Indicate the direction of impact if applicable

  - Increase

  - Decrease

The Big Ys

Little Ys

The Xs

The Vital Few Projects

| Client Satisfaction | → | EBITDA |

↑ 5% ↑ $1.5 mm

| Reduce time to deliver | Reduce costs | Increase revenue |

↓ 60 days ↓$1.5 mm

| Planning Process | Manufacturing | Laboratory |

↓40 days ↓20 days

| Implement new requirements form | → | Reduce total wait time |
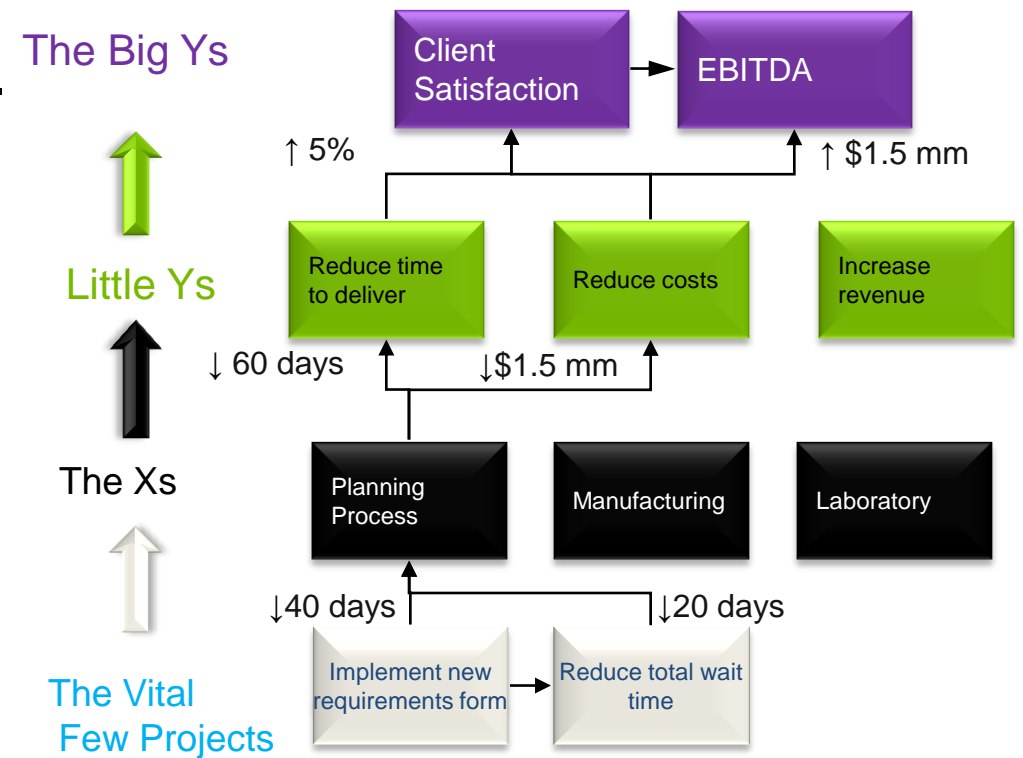
Six Sigma - Define

DEFINE : What is the Problem?

- Goals
  - Define Project Purpose
  - Determine Scope And Goals
  - Identify Voice Of The Customer And Define Value
  - Create The Project Charter And Plan
- Deliverables
  - Approved Project Charter
  - Timeline chart
  - Critical To Quality (CTQ) Characteristics
  - VOC (Voice of Customer)
  - Kano Model
  - Define phase toll gate review

DMAIC
DEFINE: Define the problem/reason for the project, and map the value stream steps
MEASURE: Populate the value stream map with data, measure and baseline current state performance
ANALYZE: Identify and confirm root causes
IMPROVE: Generate and implement solutions and evaluate results
CONTROL: Maintain the gains

Six Sigma – Measure

MEASURE : What is the Problem?

- **Goals**
  - Gather relevant data
  - Determine magnitude of problem
  - Understand waste, cycle time, defects, and variation within the process

- **Deliverables**
  - Baseline data and control charts, Sigma Level, Process Capability (yield, trends, etc.)
  - Focused problem statement.

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Six Sigma – Analyse

Analyze : What is Causing the Problem?

- **Goals**
  - Identify Potential Root Causes
  - Conduct Data Analysis
  - Validate Critical Root Causes

- **Deliverables**
  - List of Root Causes (Critical X's) and how they were validated
  - Determination of how much of the Problem is accounted for by the Critical x's

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Analyze : Common Tools

- Data and Graphical Analysis from Measure,
  - Control Chart
  - Histogram
  - Boxplot
  - Graphical Summary
  - Pareto Chart

- Successive Pareto
  - Can the 80/20 rule help narrow the focus on the key drivers by diving deeper into the big bars?
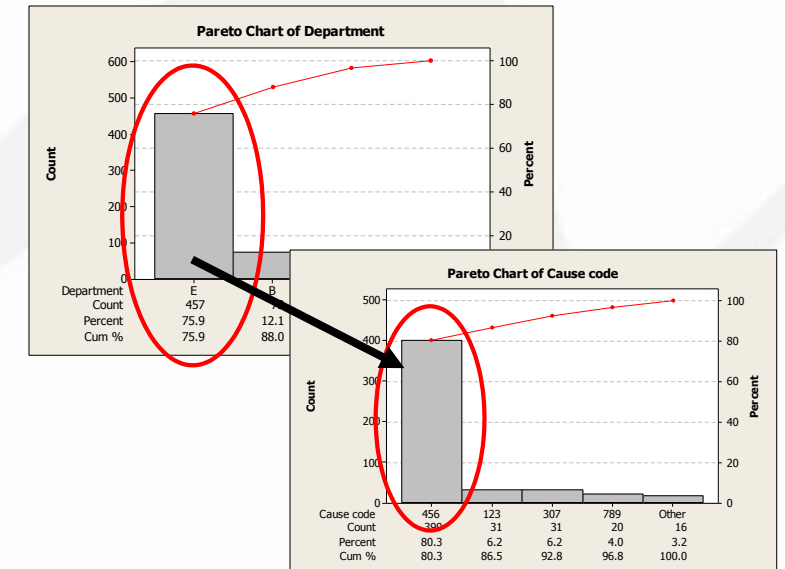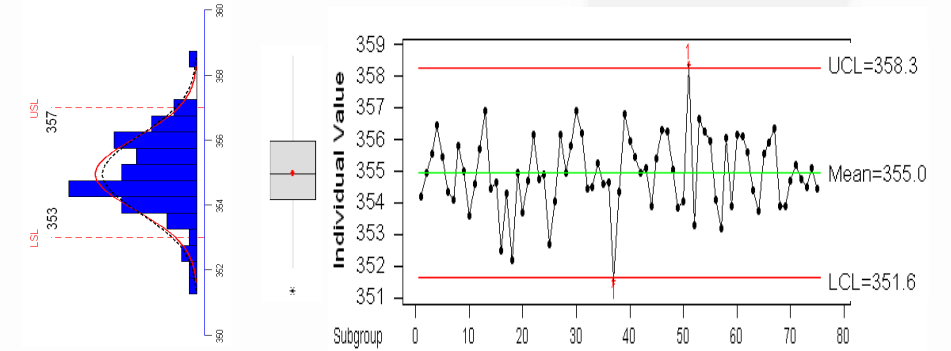
Analyze : Common Tools, cont.
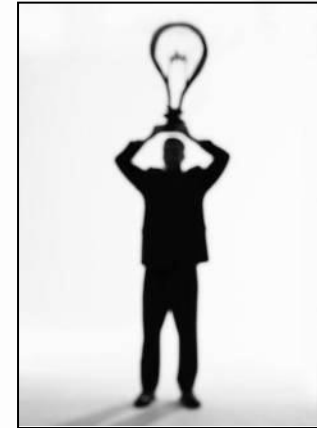
- ## Brainstorming

  – What factors might be causing the problem?

- ## 5 Whys

  – What are the deeper causes of problems?

  – Can you peel away the layers of symptoms to identify the root cause?

Problem

Why? → | Because |

Why? → | Because |

Why? → | Because |

Why? → | Because |
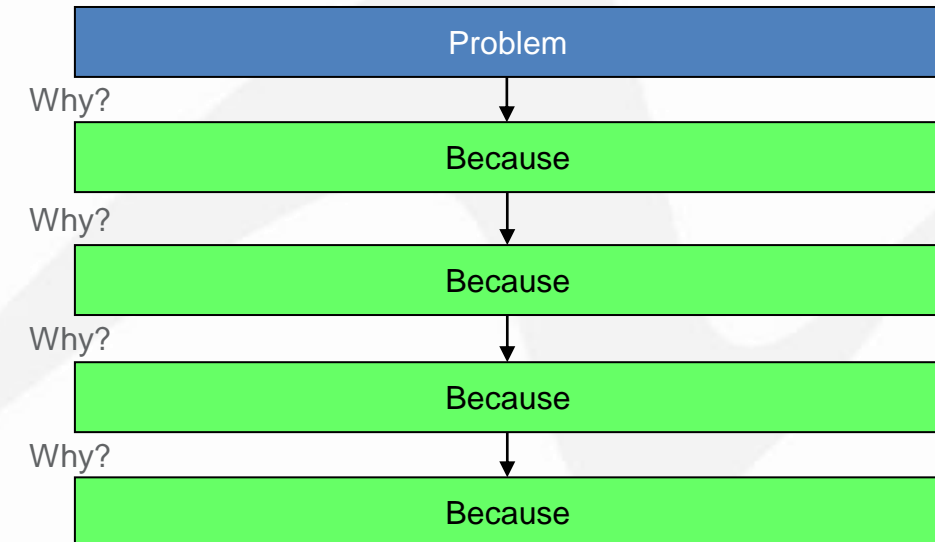
Analyze : Common Tools

- ## Cause-and-Effect Diagram

  - What are all the potential causes?

  - What are the relationships between identified causes?

  - Which are the deeper causes?

  - What other data should we collect to validate what the root causes?
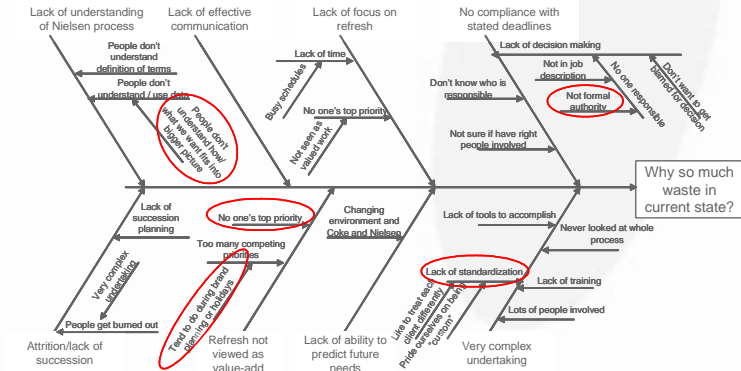
- ## Scatter Plot

  - Does the suspected cause have a correlation to the problem?

  - Could there be another factor contributing to the correlation?
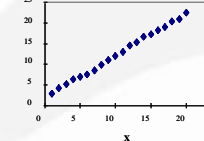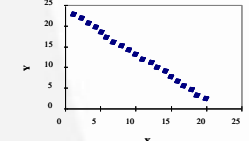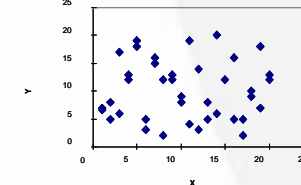
Analyze : Common Tools

- **Linear Regression**

  – Does the suspected cause have a correlation to the problem?

  – If so, what is the mathematical model describing the correlation?

  – If the x changes, how does it affect your y?
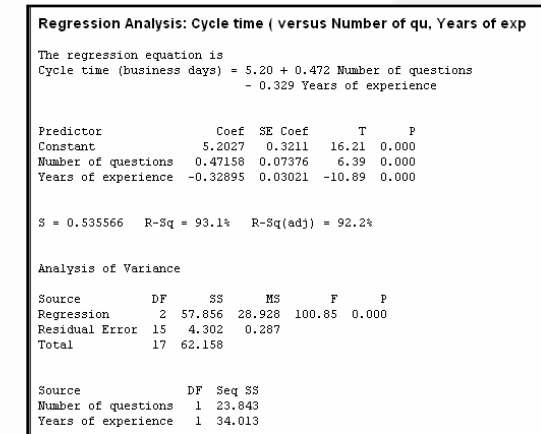
- **Advanced Statistical Tools**

  – What other ways can we verify the root causes?
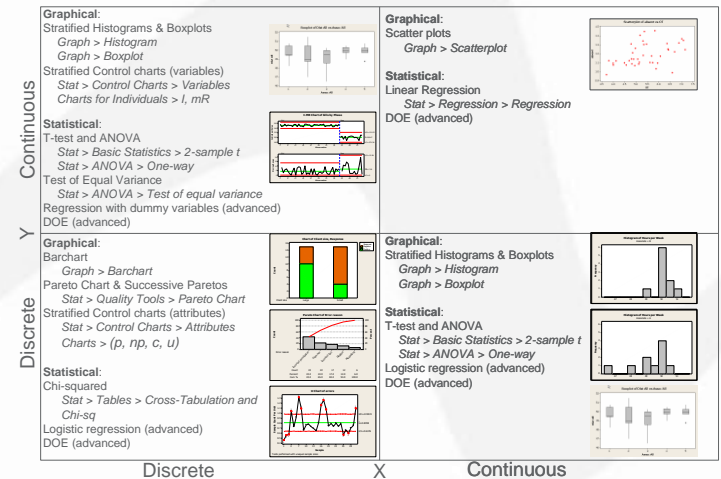
Six Sigma – Improve

Improve : Making the Problem GO Away

- **Goals**
  - Generate, evaluate and select solutions
  - Quantify financial impact
  - Conduct a pilot
  - Plan implementation
- **Deliverables**
  - Recommended solution(s)
  - Cost-benefit analysis
  - Evaluated pilots / simulations / experiments
  - Full-scale implementation

| DMAIC |
|---|
| **DEFINE:** Define the problem/reason for the project, and map the value stream steps |
| **MEASURE:** Populate the value stream map with data, measure and baseline current state performance |
| **ANALYZE:** Identify and confirm root causes |
| **IMPROVE:** Generate and implement solutions and evaluate results |
| **CONTROL:** Maintain the gains |

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Improve : Common Tools

- ## Brainstorming
  - What are the possible specific solutions?

- ## Solution Implementation plan (Piloting and Full Scale)
  - Implement the identified solutions on a pilot basis
  - Do validation of the solution effectiveness
  - Make a full scale implementation plan

Improve : Common Tools

- ## Before and After Metrics

  - How much improvement was made?

Before	After
Total Cycle Time = 35 - 140 business days	Total Cycle Time = 2 - 20 business days
Yield = 14%	Yield = 67%

- ## Before and After Chart

  - How effective was the pilot?

  - What went right?

  - What went wrong?

  - What needs to change before full implementation?
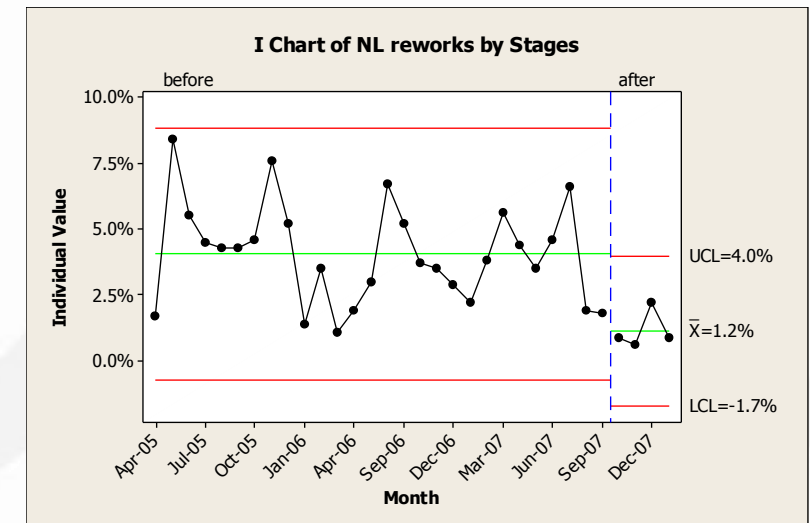
Six Sigma – Control
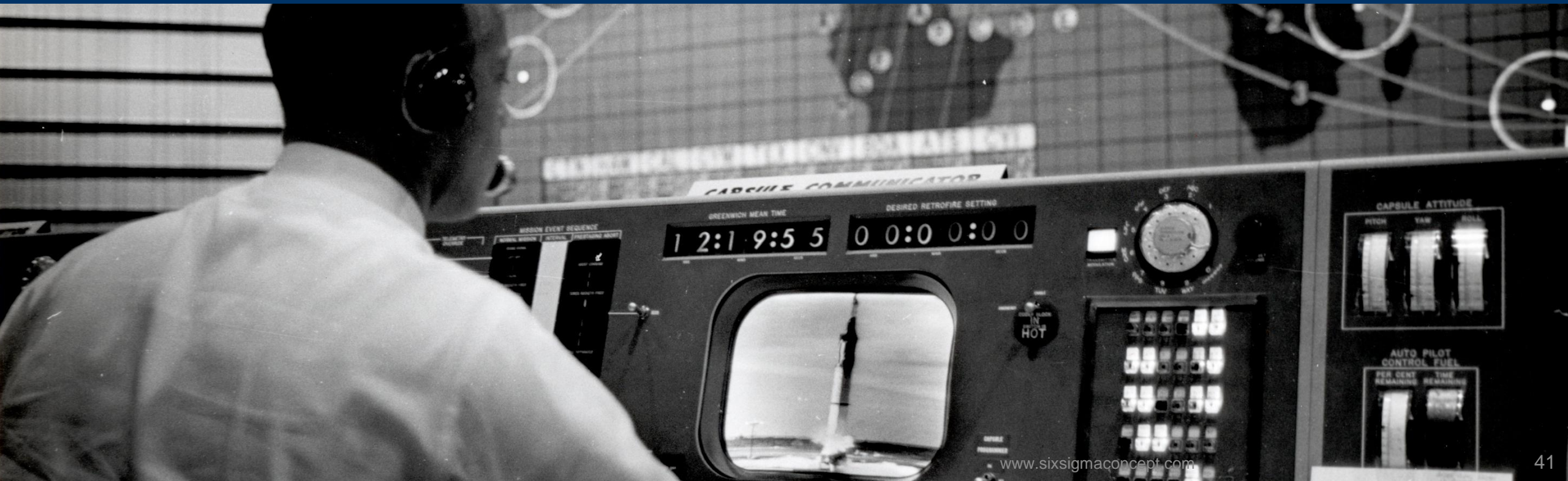
Control : Making the Problem STAY Away!

- Goals
  - Determine process controls and monitoring system
  - Update standardized process documentation
  - Establish clear, ongoing process ownership
  - Effectively transition from a improvement project to ongoing process management
  - Translate/replicate where appropriate
- Deliverables
  - Process control system
  - Updated process documentation
  - Replication opportunities
  - Final tollgate review

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CONTROL: Maintain the gains

- # Monitoring Plan
  - How will we monitor the process in the future?
  - How will we monitor and control the x's in order to prevent problems with the y's?
- # Control Chart
  - How will we make sure the process stays in control and continues to meet customer requirements?
  - How will we identity future improvement opportunities?
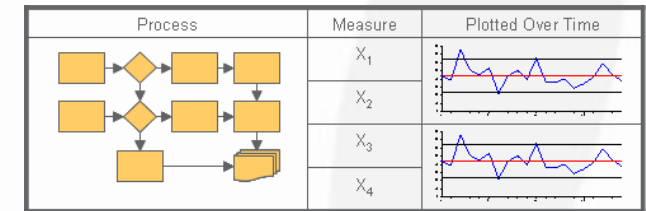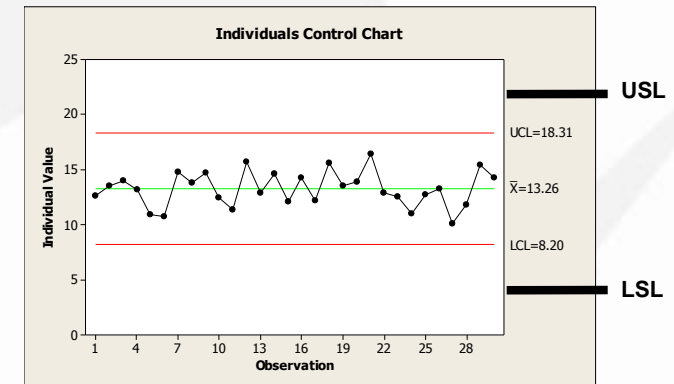
Control : Common tools

- Standard Work Document / Procedure

  – How will we train staff and standardize the new way of working?

- Final Tollgate Storyboard

  – What is the executive level view of the complete story of the project?

  – What is the more complete story of the project meant for specific audiences?

  – How did the logic flow from DEFINE to CONTROL?

  – What were the lessons learned?

Thank You!!!