EPITA Information Management Master

Introduction to Six Sigma 6σ

Module 1

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Source : Photo Afidium

Course Schedule

- **3 Theoretical sessions : Jan 11, Jan 25**
- **1 Practical session with a game : Jan 12**

Objectives of this course

- Understand the importance of Six Sigma methodology in business
- Understand the utilization of Six Sigma in continuous improvement projects in Information Technology
- Understand the impact of Six Sigma in the organization and its implementation
- Review the differences between Lean and Six Sigma
- Learn the different phases of a Six Sigma project
- Practice of a continuous improvement process through a game measurement

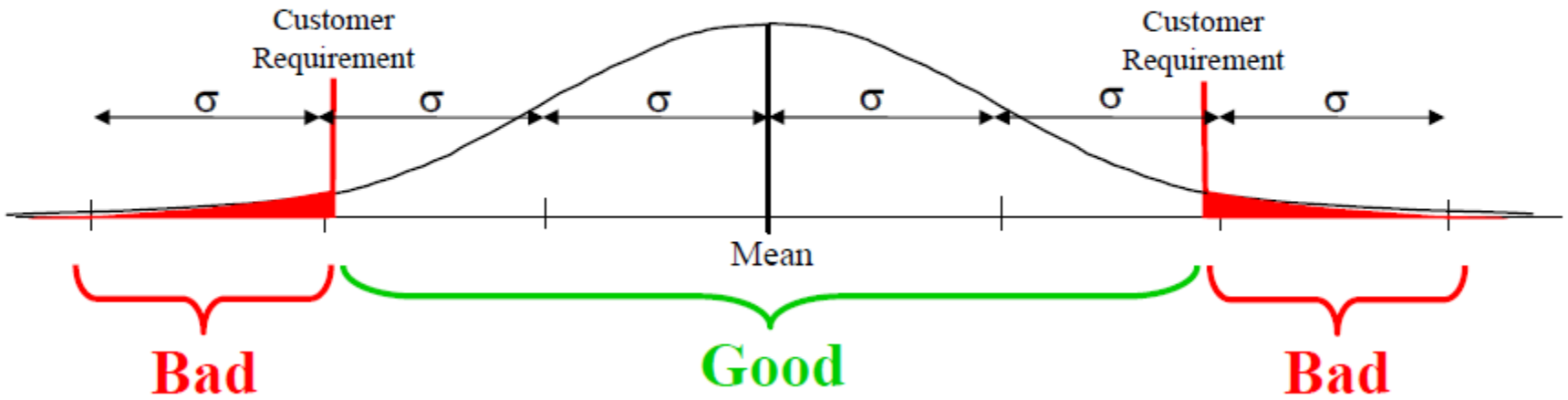
Exam

- **Participation to the 4 modules/sessions (40% of your score)**
- **Practical session (game play) 40%**
- **Quiz (20 questions) with no document 20%**

What is Six Sigma ?

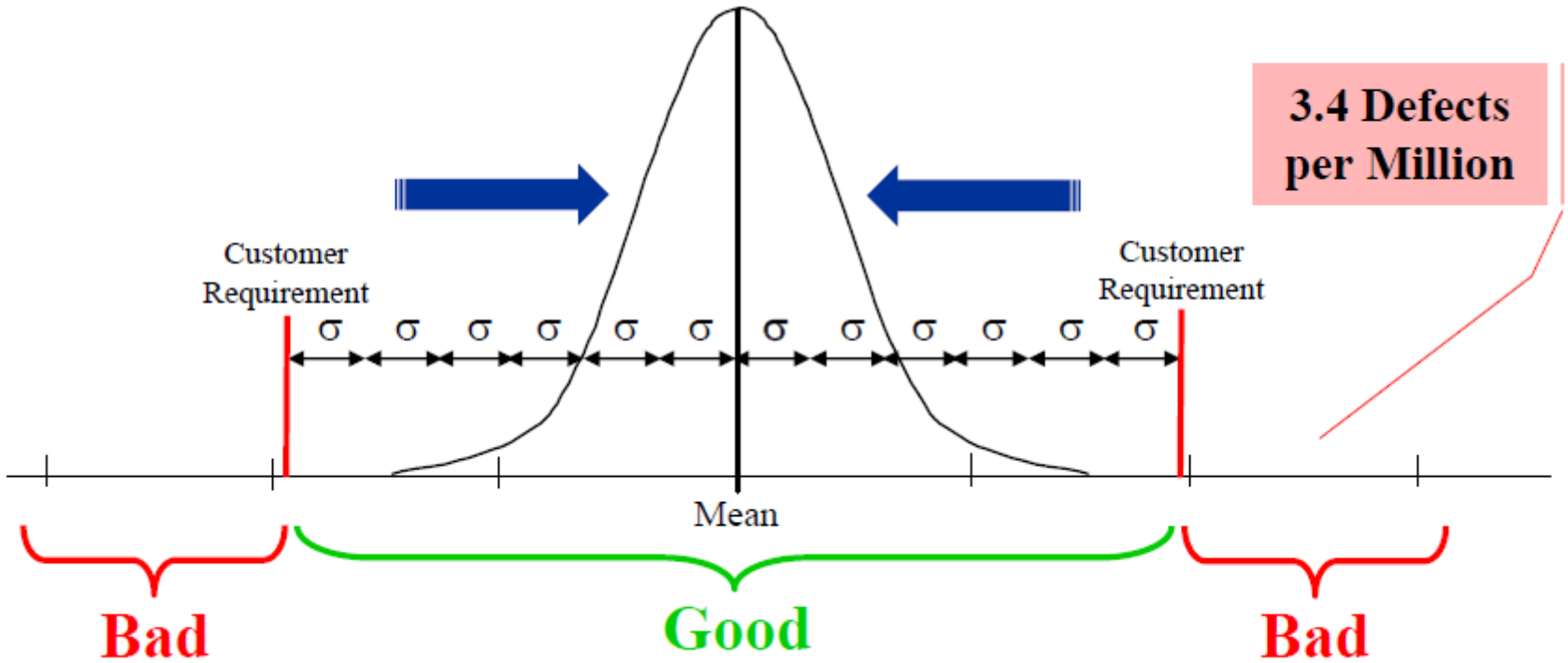
- **Six sigma is a highly disciplined and quantitative strategic business improvement approach that seeks to increase both customer satisfaction and an organization's financial health.**
- **Six Sigma helps a company focus on developing and delivering near-perfect products (durable goods or services), to improve customer satisfaction and the bottom line.**

Why 6 Sigma ?



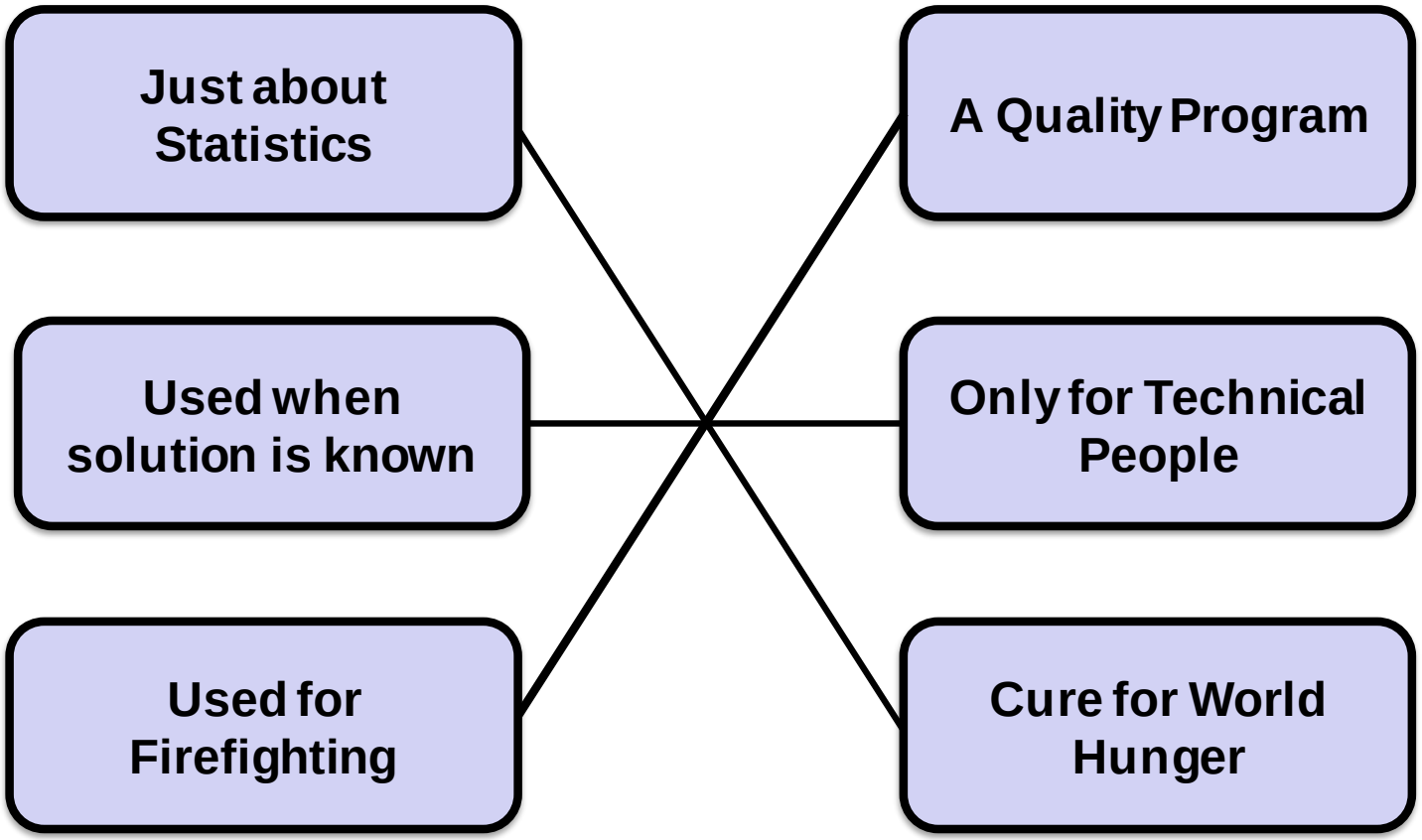
Sigma (σ, standard deviation) measures process variation (VOP)
Compared to Customer Requirements (VOC) shows the % Defects

Why 6 Sigma ?

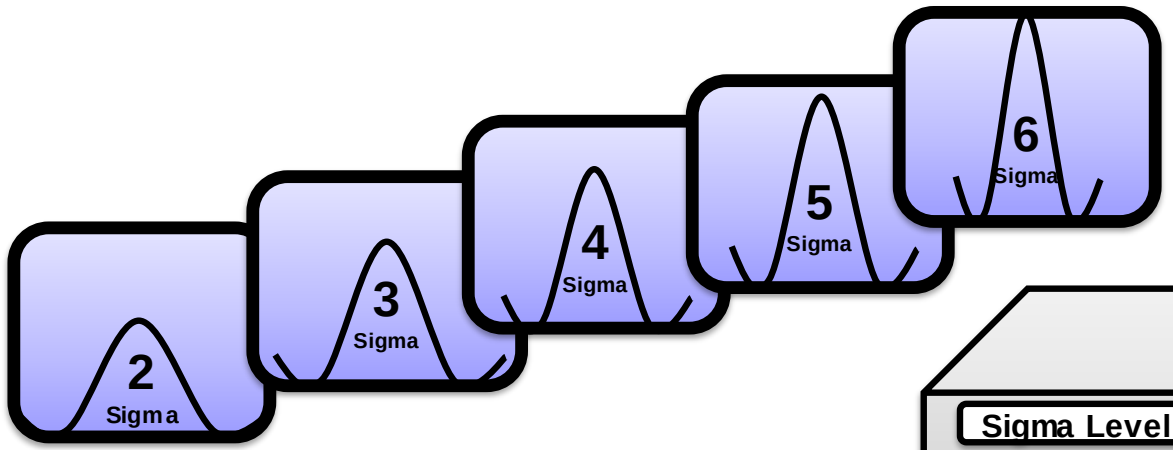


Six Sigma represents 6 standard deviations from the mean to the upper or lower specification limits of the customer

Six Sigma is NOT



What is Six Sigma Definition ?



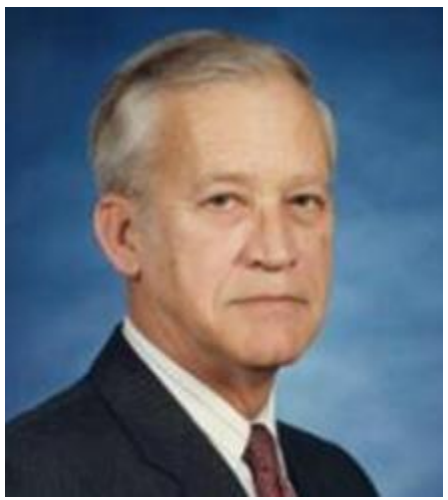
Sigma Level	% Yield	Defects/ Million Opportunities
2σ	69.1	308,537
3σ	93.3	66,807
4σ	99.4	6,210
5σ	99.98	233
6σ	99.9997	3.4

Six Sigma – Practical Meaning

99% Good (3.8 Sigma)	99.99966% Good (6 Sigma)
20,000 lost articles of mail per hour	Seven articles lost per hour
Unsafe drinking water for almost 15 minutes each day	One unsafe minute every seven months
5,000 incorrect surgical operations per week	1.7 incorrect operations per week
Two short or long landings at most major airports each day	One short or long landing every five years
20,000 wrong drug prescriptions each year	68 wrong prescriptions per year
No electricity for almost seven hours each month	One hour without electricity every 34 years

Introduction

- **Six Sigma is a set of techniques, and tools for process improvement. It was developed by Motorola in 1986**
- **Sir Bill Smith, " the Father of six sigma" introduce this quality improvement Methodology to Motorola.**
- **Six Sigma is now an enormous 'brand' in the world of corporate development.**



History

- Since the 1920's the word “sigma”(s) has been used by mathematicians and engineers as a symbol for a unit of Measurement in product quality variation.
- In the mid-1980's engineers in Motorola in the USA used “Six Sigma”(S) an informal name for an in-house initiative for reducing defects in production processes, because it represented a suitably high level of quality
- In the late-1980's Motorola extended the Six Sigma methods to its critical business processes, and significantly Six Sigma became a formalized in-house 'branded' name for a performance improvement methodology, i.e, beyond purely 'defect reduction.‘
- In 1991 Motorola certified its first 'Black Belt' Six Sigma experts, which indicates the beginnings of the formalization of the accredited training of Six Sigma methods.

History

- In 1995, Six Sigma became well known after Mr. Jack Welch made it a central focus of his business strategy at General Electric, and today it is used in different sectors of industry.
- By the year 2000, Six Sigma was effectively established as an industry in its own right, involving the training, consultancy and implementation of Six Sigma methodology

Other Definitions

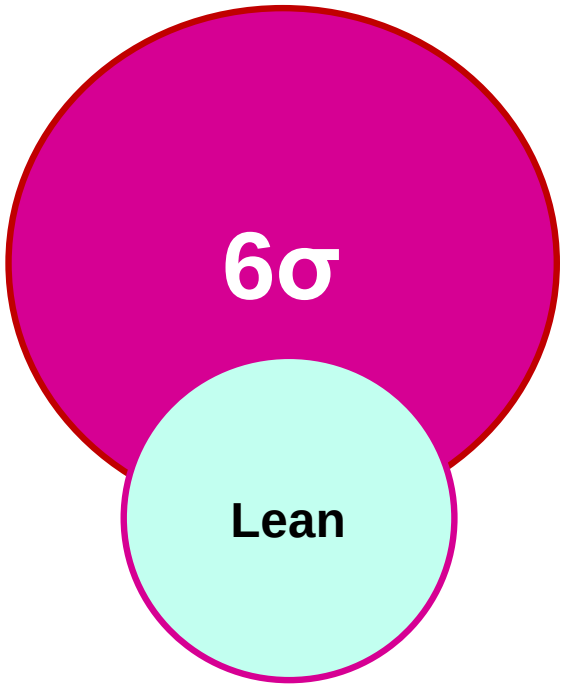
- **Six Sigma (6σ) is a set of techniques and tools for process improvement**

  Source: Wikipedia
- **A Management driven, scientific methodology for product and process improvement which creates breakthroughs in financial performance and Customer satisfaction.**

  Source: Motorola
- **A methodology that provides businesses with the tools to improve the capability of their business processes. This increase in performance and decrease in process variation lead to defect reduction and improvement in profits, employee morale and quality of product.**
  Source: ASQ

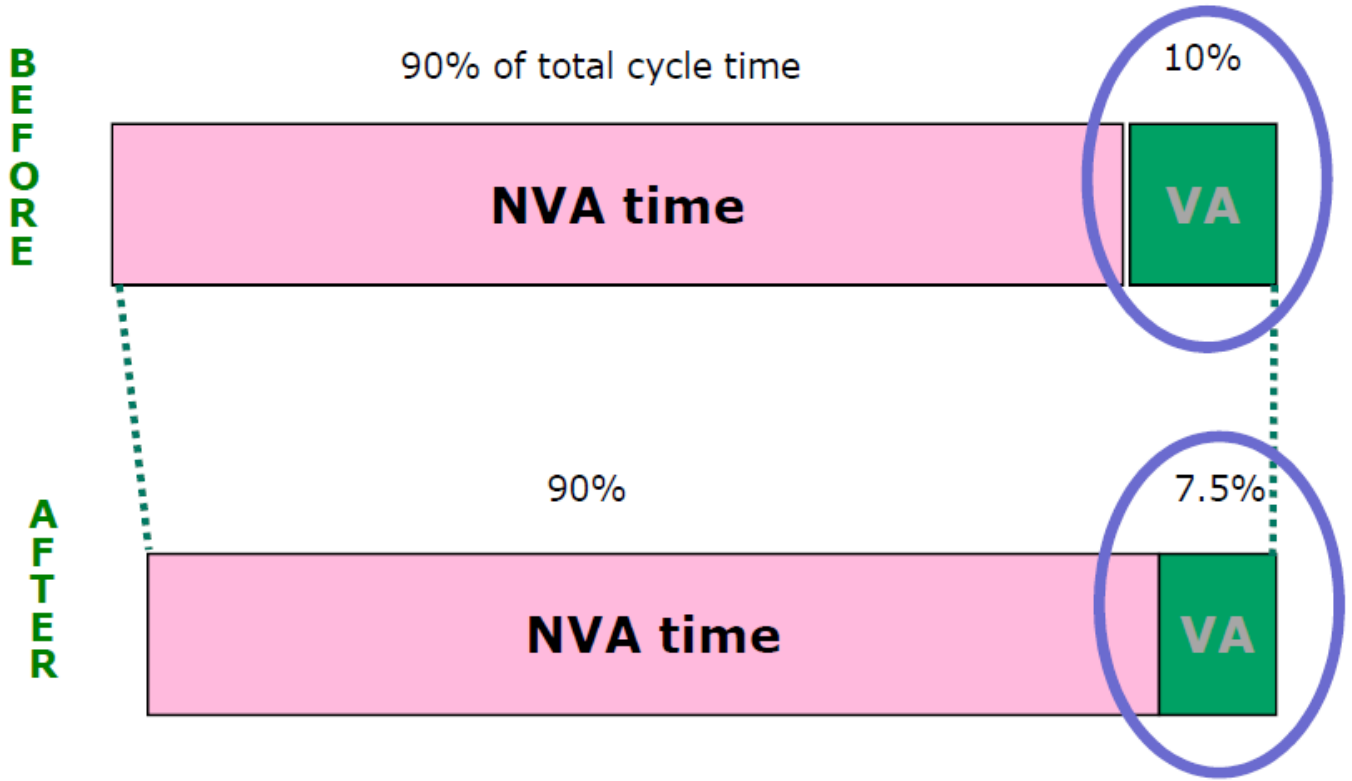
Lean and Six Sigma

- **Six Sigma Focus on Quality**
  - Voice of the customer
  - Variation & Defect reduction
  - Based on Data
- **Lean Focus on Speed**
  - Cycle Time Reduction
  - Elimination of waste
  - Rapid Project Execution



Why focus on waste ?

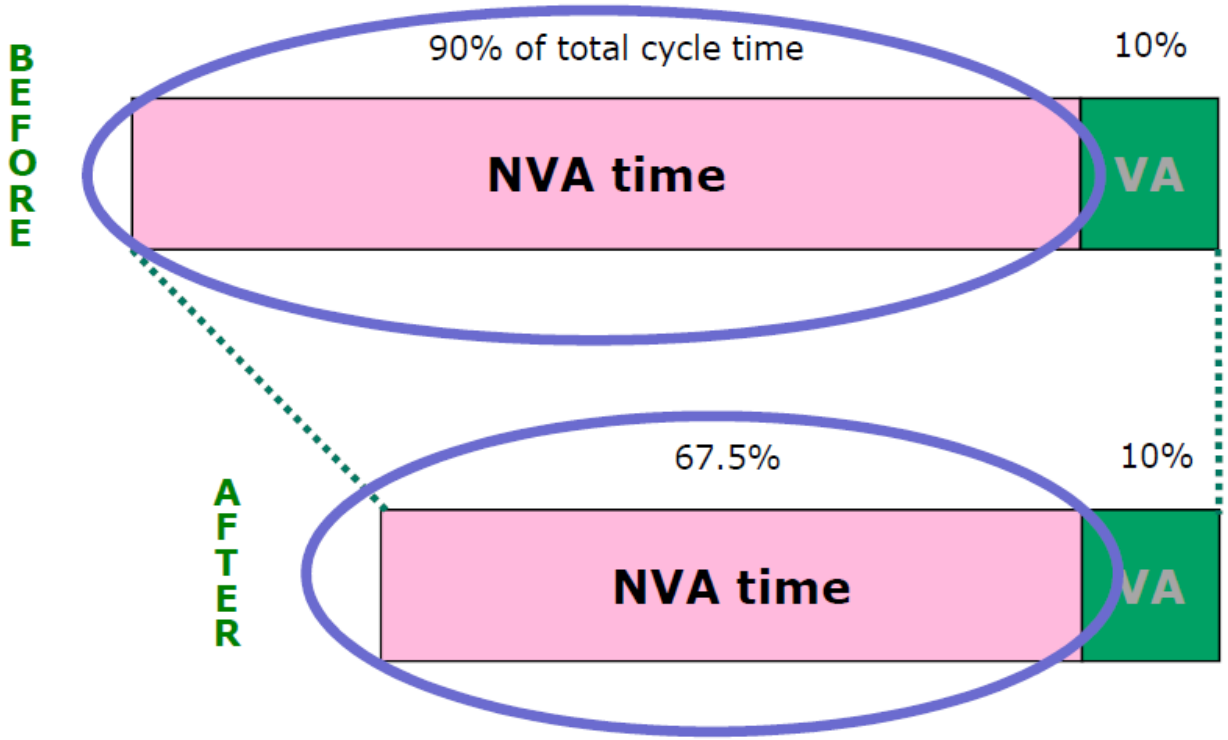
Traditional: Fix "Value Adding" activities



Results: 25% improvement in *Value-Added* time, but only **2.5%** reduction in total cycle time

Why focus on waste ?

Streamlining Processes: Address "Non-Value Adding" Activities



Results: 25% improvement in *Non-Value-Added* time, with **22.5%** reduction in total cycle time

Comparison of Six Sigma & Lean

	SIX SIGMA	LEAN
Objective	Deliver value to customer	Deliver value to customer
Theory	Reduce variation	Remove waste
Focus	Problem focused	Flow focused
Assumptions	▪ A problem exists ▪ Figures and numbers are valued ▪ System output improves if variation in all processes inputs is reduced	▪ Waste removal will improve business performance ▪ Many small improvements are better than system analysis

6σ

	Lean Thinking	Six Sigma
Principal aim	Reduce waste.	Reduce variation.
Approach	1. Identify value. 2. Identify value stream. 3. Make value streams flow. 4. Customer "pulls" value from value stream. 5. Aim for perfection.	1. Define the problem. 2. Measure. 3. Analyze data. 4. Improve. 5. Control.
Focus	Flow-focused.	Problem-focused.
Assumptions	Waste removal will improve business performance. Many small improvements are better than big-bang system improvements.	A problem exists. Figures and numbers are valued by the organization. System outputs improve if variation in all processes is reduced.
Primary effect	Reduced flow time.	Uniform process output.
Secondary effects	Less waste improves process efficiency and reduces cost.	Less variation improves product quality and reduces cost.
Weaknesses	Lean does not prescribe the culture necessary to achieve and sustain results. Customer needs are not first and foremost. Lean does not recognize the impact or value of variation. Lean reduces opportunities for innovation that are additive in nature.	Six Sigma does not identify waste. Six Sigma does not inherently look across functional silos. Six Sigma does not improve process speed or cycle time. Six Sigma does not recognize the value in variation.

DMAIC

- **DEFINE – Clarify opportunities/issues, set goals, make sure we're working on the right things. Understand and balance stakeholder needs.**
- **MEASURE – Target the right facts and data to build understanding, improve decisions, evaluate results**
- **ANALYZE – Assess relationships between actions and results, reasons for problems, potential impact of new solutions or innovations**
- **IMPROVE – Develop effective new ways to get things done that gets results**
- **CONTROL – Ensure solutions and innovations last, and can be leveraged to maximize benefit**

DMAIC: Structured Problem Solving

Define – What happened, when and where (use facts)? What's the impact of the problem? How does this problem stop us from getting the job done well? What's our goal?

Measure – How do we know? What evidence is there?(pictures? reports? tallies? drawings?). What would a "good job" look like (e.g. our goal)?

Analyze – What might be causing the problem? What facts will confirm the cause? How can we ensure we address causes, not symptoms?

Improve – What can we change that will target the root cause of the problem? How will we build support, implement, refine and confirm results?

Control – How will we ensure the solution sticks? Who will keep track of performance over time? What new standards should be developed?

DEFINE

- **Define is the first phase of the Six Sigma improvement process. It consists of defining the problem statement, the goal opportunity , the process, and the voice of the customer (VOC)**
  - **Project Charter**
  - **Voice of the Customer**
  - **SIPOC**
- **Define the system, the voice of the customer and their requirements, and the project goals, specifically.**

MEASURE

- In the Measure phase, the team focus on data collection, which takes time and effort
  - Select Measures
  - Data Collection Planning
  - Operational Definitions
  - Baseline Data
- Measure key aspects of the current process and collect relevant data.

ANALYZE

- **In the Analyze phase, the team reviews data collected during the measure phase. The goal is to narrow down and verify root causes of waste and defects**
  - **Process Analysis**
  - **Brainstorm Root Causes**
  - **Pareto Charts**
  - **Develop Hypothesis**
- **Analyze the data to investigate and verify cause-and effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.**

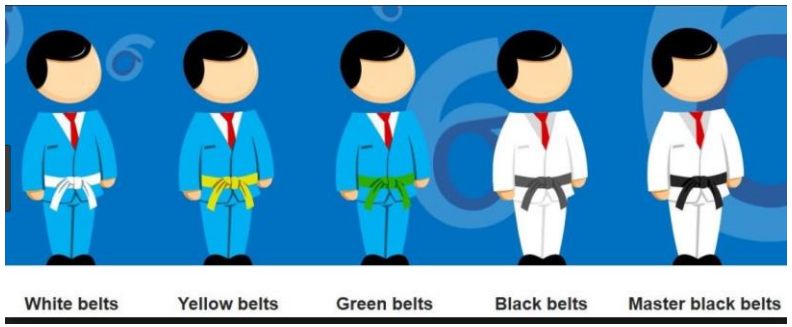
IMPROVE

- In the Improve phase, teams move on to solution development
  - Create Flow
  - Mistake-Proofing: Poka-Yoke
  - Visual Management & 5S
- Improve or optimize the current process based upon data analysis using techniques such as design of experiments, poka yoke or mistake proofing, and standard work to create a new, future state process.
- Set up pilot runs to establish process capability.

CONTROL

- **The Control phase is the final phase of Lean Six Sigma. The team focuses on how to sustain newly achieved improvements by passing it on to other employees**
  - **Process Control Plan**
  - **Monitoring & Response Plan**
  - **Documentation & Storyboard**
- **Control the future state process to ensure that any deviations from target are corrected before they result in defects.**
- **Implement control systems such as statistical process control, production boards, visual workplaces, and continuously monitor the process.**

Implementation roles



- **Six Sigma identifies several key roles for its successful implementation:**
  - **Executive Leadership : includes the CEO and other members of top management. They are responsible for setting up a vision for Six Sigma implementation.**
  - **Champions : take responsibility for Six Sigma implementation across the organization in an integrated manner**
  - **Master Black Belts : identified by champions, act as in-house coaches on Six Sigma. They devote 100% of their time to Six Sigma. They assist champions and guide Black Belts and Green Belts.**
  - **Black Belts : operate under Master Black Belts to apply Six Sigma methodology to specific projects.**
  - **Green Belts : are the employees who take up Six Sigma implementation along with their other job responsibilities, operating under the guidance of Black Belts.**
  - **Yellow Belts : are the employees aware of the Six Sigma methodology**

Six Sigma was introduced into Korea in 1997

- The First National Quality Prize of Six Sigma was given to two companies. One is Samsung and other is LG electronics ; which are virtually the leader of six sigma in Korea.
- Samsung SDI was founded in 1970 as a producer of the black/white Braun tube
- It began to produce the color Braun tube from 1980, and now it is the number one company for braun tubes in the world.
- The market share of Braun tubes is 22%. The major products are CDT (color display tube), CPT (color picture tube), LCD (liquid crystal display), VFD (vacuum fluorescent display), C/F (color filter), li-ion battery and PDP (plasma display panel).
- The total sales volume is about $4.4 billion and the total number of employees is about 18,000 including 8,000 domestic employees. It has six overseas subsidiaries in Mexico, China, Germany, Malaysia and Brazil.

Define

Define

- **What's the problem/opportunity?**
  - **Waste**
  - **Error**
  - **Customer need**
- **How do we know?**
- **Should we take action?**
- **What's our objective?**

Business Case

- **Concise description of project's like or relevance to the business road map, goals, site/functional targets, etc.**
- **Impact (benefit/relevance) of potential improvement**
- **Impact (cost or risk) of not improving**
- **Should be verified/accepted by leadership**

Selecting the right projects

- **Before beginning a Lean Six Sigma process improvement project, choose projects that are good candidates for improvement. A good project for improvement:**
  - **has an obvious problem within the process**
  - **has the potential to result in increased revenue,**
  - **reduced cost, or improved efficiency has collectable data**

Estimated Benefits: Hard or Soft

- **"Hard" Financial Benefits:**
  - Revenue / volume / price increase
  - Improved yield / reduced waste
  - Materials / supplies usage
  - Overtime labor reduction
  - Staffing reduction (headcount)
  - Inventory reduction
- **"Softer" Benefits:**
  - Avoidance of lost revenue
  - Avoidance of future cost
  - Increased speed to market
  - Improved customer satisfaction
  - Increased capacity or efficiency
  - Increased employee satisfaction

Soft impacts generally drive hard ones, but not in a proven, 1:1 ratio...

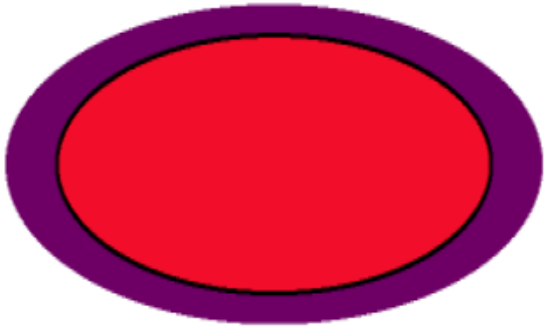
Scope

Leaders & sponsors think:

"They can do this."

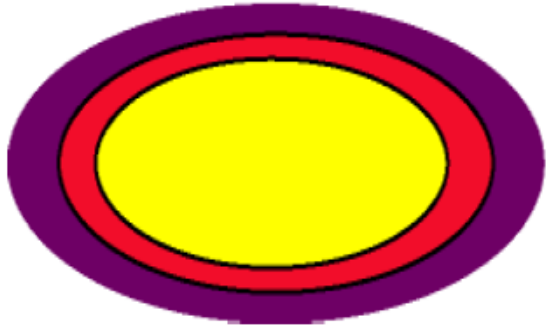
Team considers and thinks:

"We can do this."



Reality and time reveal:

"You can do this."

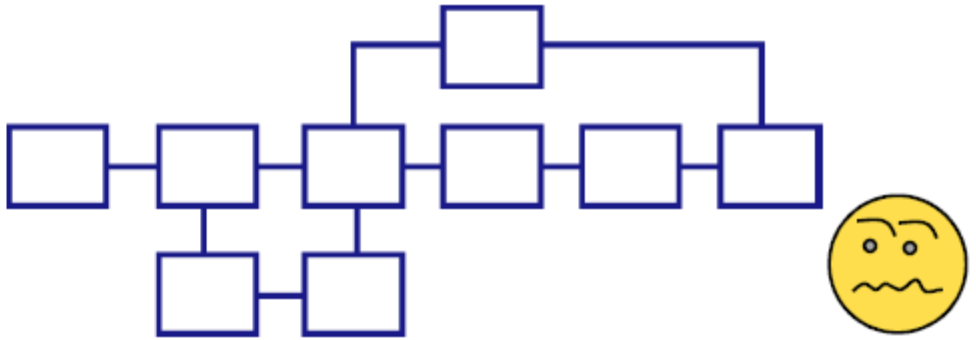


Facts about processes

AMAZING but true...

There are several versions:

- *As "supposed to be"*
- *As-is (Current state)*
  - *Should be*
- *Could be (Future State)*

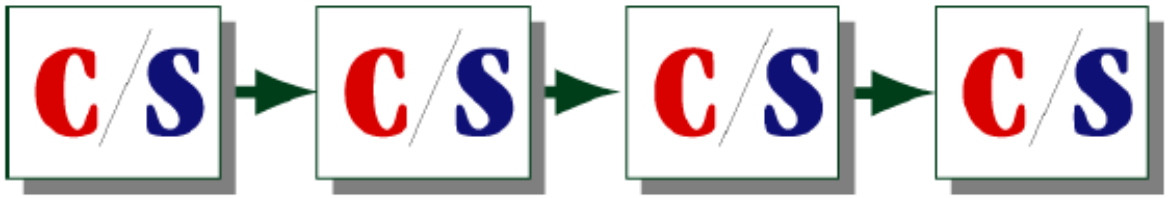


Usually,
simpler is better

Facts about processes

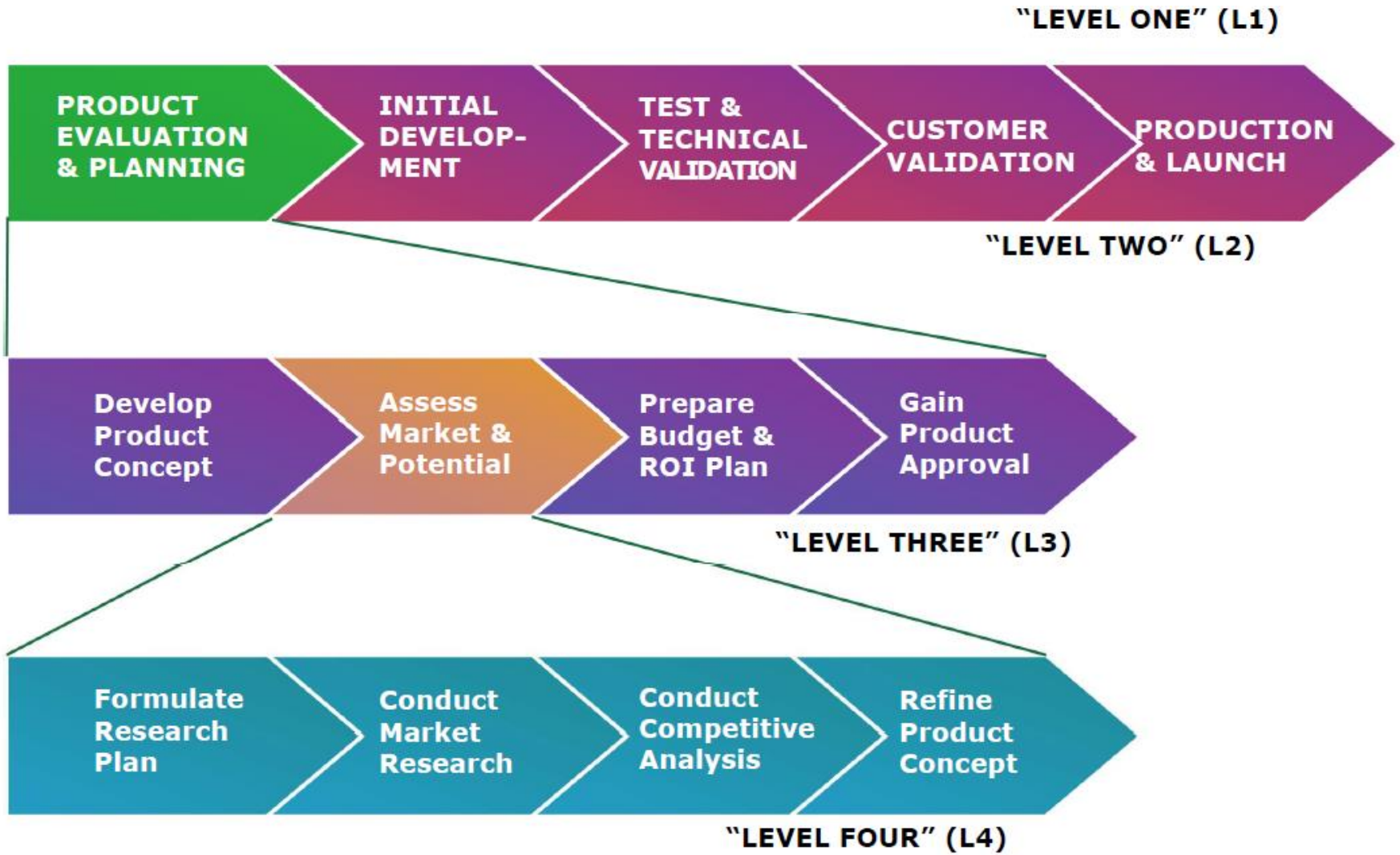
They tend to

GROW



In organizations,
everyone is both a "customer" and a "supplier"

Levels of a process



SIPOC

- Clearly defines boundaries/scope
- Identifies major outcomes & activities
- Avoids over-detail, confusion
- Helps plan & target measurement
- Focuses cross-functional alignment & analysis

SIPOC Mapping

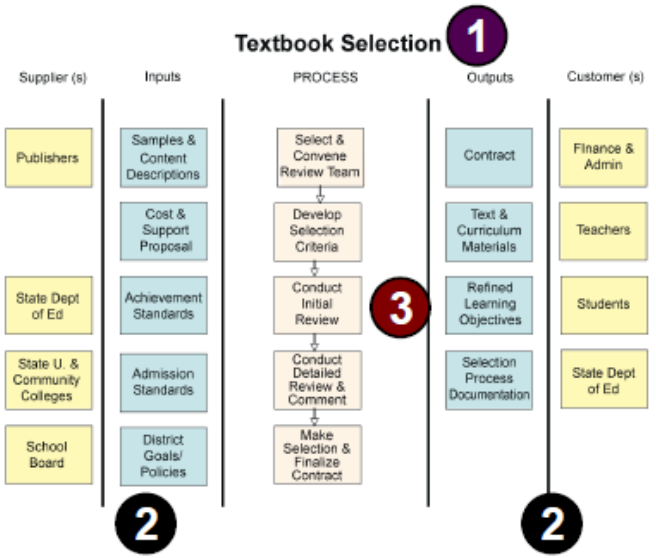
- **Supplier** is a person or company that supplies inputs
- **Input** is the material, energy, information, manpower, and financial resources which are needed to execute the process
- **Process** is a collection of activities that take one or more inputs to create an output that is of value to the customer
- **Output** is the product or service results from the process
- **Customer** is the person or company that receives the outputs of the process.

How to create a SIPOC Map

- Clearly explain the purpose for creating the SIPOC map.
- Emphasize that the map must represent the situation as it exist.
- Hang out five large flip-charts.
- Allow you team to provide input on each of the five categories.
- Begin with the process by writing the key highest-level steps.
- Identify the primary outputs of the process.
- Identify customers who will receive outputs.
- Identify the inputs required for the process to function properly.
- Identify the suppliers of those inputs.
- Discuss the SIPOC map with key stakeholders to verify accuracy.

Steps to Diagram SIPOC

1. Identify Process to be diagrammed & name it
   - Write at top-center of diagram
2. Define the "Boundaries"
   - Customer(s) and key Output(s)
   - Supplier(s) and key Input(s)
3. Establish high level process steps
   - Brainstorm major process activities on "sticky notes"
   - Group or organize activities into similar categories or "major steps" in the process
   - Place major steps in most appropriate order



Exercise : create a SIPOC diagram for your process

- Create in this order: O, C, I, S, P
- Maintain “action” (verb-noun) format for process steps
- Narrow to 3-7 high-level process steps
- Should not include decisions and rework loops
- Add Basic Input and Output Requirements
  - Timeliness
  - Accuracy
  - Efficiency

Exercise : Prepare a SIPOC

- **Car Purchasing process**

Identify the Problem and Goal

- **Describe a Problem:**
  - **Concise, specific description of pain, gap, challenge, type of waste**
  - **Tied to Requirements**
  - **Impact (potential or actual)**
- **Describe the Goal:**
  - **Specific measurable outcome**
  - **Tied directly to Problem**

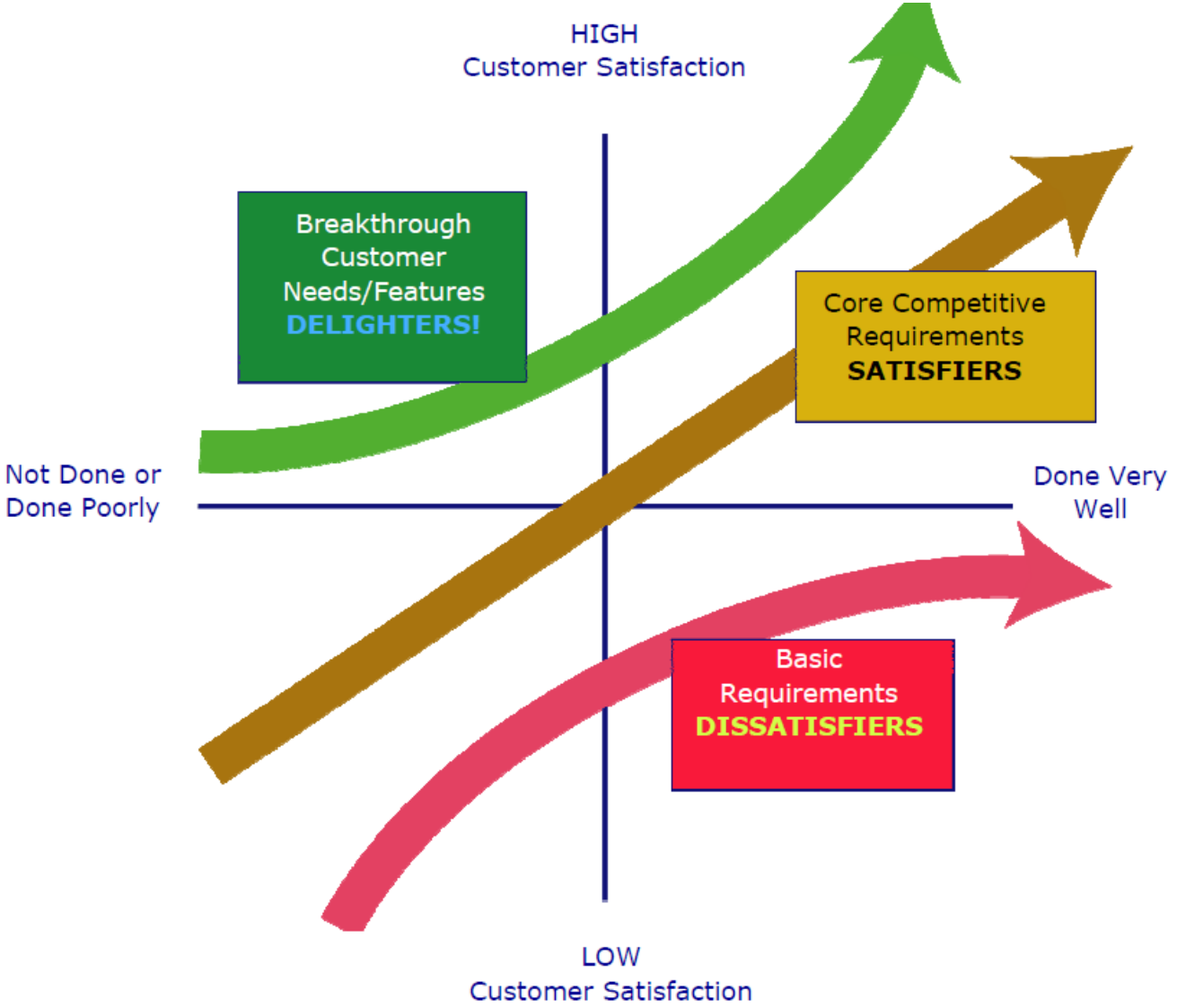
Start with the problem not with the solution

Example:

Problem: Field heading for OPEN DATE is inconsistent between screens, which leads to the input of incorrect data and therefore is affecting decisions quality

Goal: Create consistent field heading for OPEN DATE by 09/30/2018

Kano Analysis



Change Equation

$$R = Q \times A$$

Results = Quality x Acceptance

6σ

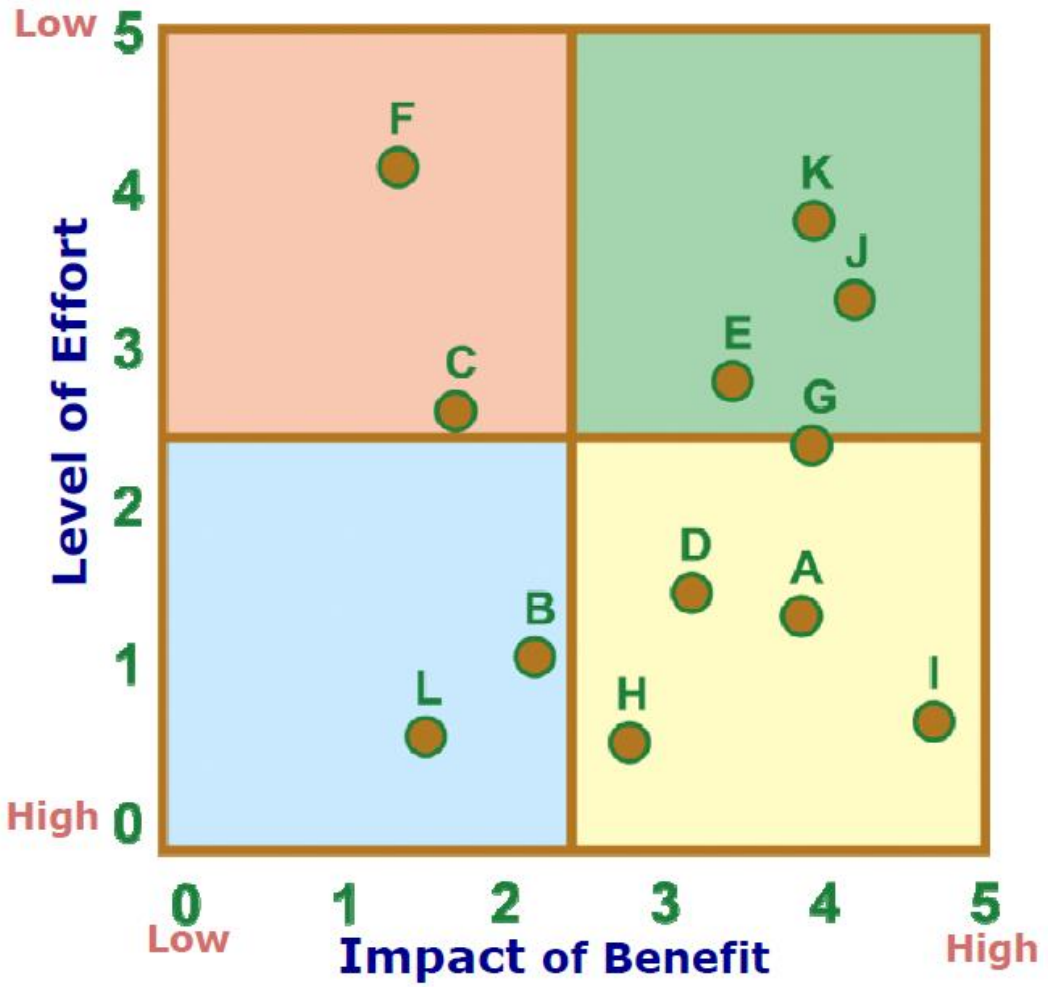
Project Stakeholder Analysis

Stakeholder	Relationship to Project			Position			What We Need From Them					Communication Strategy				Issues/Involvement	Contact
	Has decision authority	Can influence outcome	Will be affected	Resistor	Neutral	Supporter	Approval for implementation	Resources (people, funding)	Subject matter expertise	Data	Pilot support	Meet with regularly	Invite to team meetings	Send copy of mtg mins	Speak with informally as needed		

X = Current position O = Desired position

Example

Project portfolio



A. Poor space utilization in buildings
B. Purchasing system errors
C. Accounting errors
D. Inventory systems do not match physical counts
E. Increasing damages with shipped materials
F. Obsolete marketing materials being used
G. Website is not user friendly
H. Employee turnover is too high
I. New product development takes too long
J. Mergers & Acquisitions is too complicated
K. Increasing customer complaints on production materials
L. Office supplies costs are increasing

6σ

Project Charter

1. Problem/Opportunity
2. Business Case
3. SMART Objective
4. Metrics
5. Estimated Benefits
6. Scope
7. Team Members & Time
8. Constraints & Risks
9. Milestones

Project Charter

Ian

○ Customer Focus

○ CI Culture

○ Operational Excellence

Project Title: Waste OIP – Recycle of site waste in to Energy

Location of Process: EMEA – Ashford - Site

Problem/Opportunity Statement

Site waste is currently recycled by a third party waste management supplier. Typically waste is disposed off in the country of origin – for this service costs are applied. The opportunity is to recycle the waste on site and self generate a useable energy.

Business Case

Waste disposal from site in 2014 - £300k of this 90% is recycled for energy the Cost/kg impact is 32% of this figure – if recycled on site a potential saving of £270k with other opportunities to reduce service charges – see Energy OIP charter (i.e steam, hot water etc.)

SMART Objective

Unable to accurately detail a smart objective at this stage. Strong link to the Energy OIP -

Metrics

	%	% of C/kg	Burnt on site
Oil Waste	6%	tbc	possible
Other waste	94%	tbc	unlikely

Estimated Benefits

No benefit as oil waste is minimal and so can not be sustained as a fuel source. Also calorific value will flluctuate and so burn rate again not sustained.

Project Scope

IN: Site wide Waste – that can be recycled for energy

OUT: none recycled waste for energy

Team Members and Time Allocation per Week

	Name	Time Allocated
Project sponsor		
Project leader		
Process owner		
Controller		
Other team members		

Constraints & Risks

The percentage of waste vs demand is unknown.
Investment and on going specialist services would be required to operate this service.
Physical location.
Purchase price of Gas is variable. Variable on Production volumes.
UK and Corporate Regulations and Environment Legislation –
Investment capex approval

Milestones

Kick-off: << DD/MM/YY>>

Define: << DD/MM/YY>>

Measure: << DD/MM/YY>>

Analyze: << DD/MM/YY>>

Improve: << DD/MM/YY>>

Control: << DD/MM/YY>>

Targeted **end date**: << DD/MM/YY>>

Rev: N°_____

Date :_____

Sponsor, Process Owner and Leader Sign-off: _____

Problem/Opportunity Statement Elements

The thing	*The suspected pain or gap*
Sales leads	are not being handled promptly.

Evidence

Initial/ Anecdotal	Prospective customers have called to complain that no one has contacted them.
Adding Data	____% of leads in past two months were not followed up for two weeks or more.

Impact

Initial/ Anecdotal	We risk losing business and hurting profits.
Adding Data	Slower follow-up appears to coincide with a recent 12% decline in new customers

Software used for 6σ

- **There are generally four classes of software used to support the Six Sigma process improvement protocol:**
  - **Analysis tools, which are used to perform statistical or process analysis;**
  - **Program management tools, used to manage and track a corporation's entire Six Sigma program;**
  - **DMAIC and Lean online project collaboration tools for local and global teams;**
  - **Data Collection tools that feed information directly into the analysis tools and significantly reduce the time spent gathering data.**

Software used for 6σ

- Minitab 15
- Process Model 5
- Microsoft Office/Visio
- Arena
- ARIS Six Sigma
- Bonita Open Solution BPMN2 standard
- KPIs for statistic monitoring
- JMP
- Mathematical
- MATLAB or GNU Octave
- STATA
- STATISTICA

Storyboard and DMAIC documentation

- Focus on the major actions and learning
  - Keep it simple, easy to read
- Include charts, pictures, maps
  - Make sure they're well labeled and conclusions highlighted
- Add explanation/narrative of the story
- Update regularly, highlight key findings
- Post and/or distribute to sponsors, stakeholders
- Use documentation process to help build consensus and clarify action items