



Introduction to Lean & Six Sigma

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Before we begin ...

Let's watch a [video](#)

Contents

- Lean
 - History of Lean
 - Tools of Lean
 - Philosophies of Lean
- Six Sigma
 - Quality Management
 - Fundamentals
 - Success stories
 - History
 - Methodology
 - Sample Case Study

History of Lean

- The first person to truly integrate an entire production process was **Henry Ford**.
- An American industrialist, the founder of the Ford Motor Company, and sponsor of the development of the assembly line technique of mass production.



History of Lean

- Ford lined up fabrication steps in process sequence wherever possible using special-purpose machines and go/no-go gauges to fabricate and assemble the components going into the vehicle within a few minutes, and deliver perfectly fitting components directly to line-side.
- This was a truly revolutionary break from the shop practices of the American System that consisted of general-purpose machines grouped by process, which made parts that eventually found their way into finished products after a good bit of tinkering (fitting) in subassembly and final assembly.



History of Lean

- As Kiichiro Toyoda, Taiichi Ohno, and others at Toyota looked at this situation in the 1930s, and more intensely just after World War II, it occurred to them that a series of simple innovations might make it more possible to provide both continuity in process flow and a wide variety in product offerings.
- They therefore revisited Ford's original thinking, and invented the Toyota Production System.



Kiichiro Toyoda

History of Lean

The thought process of lean is thoroughly described in the book *The Machine That Changed the World (1990)* by James P. Womack, Daniel Roos, and Daniel T. Jones. In a subsequent volume, *Lean Thinking (1996)*, James P. Womack and Daniel T. Jones distilled these lean principles even further to five:

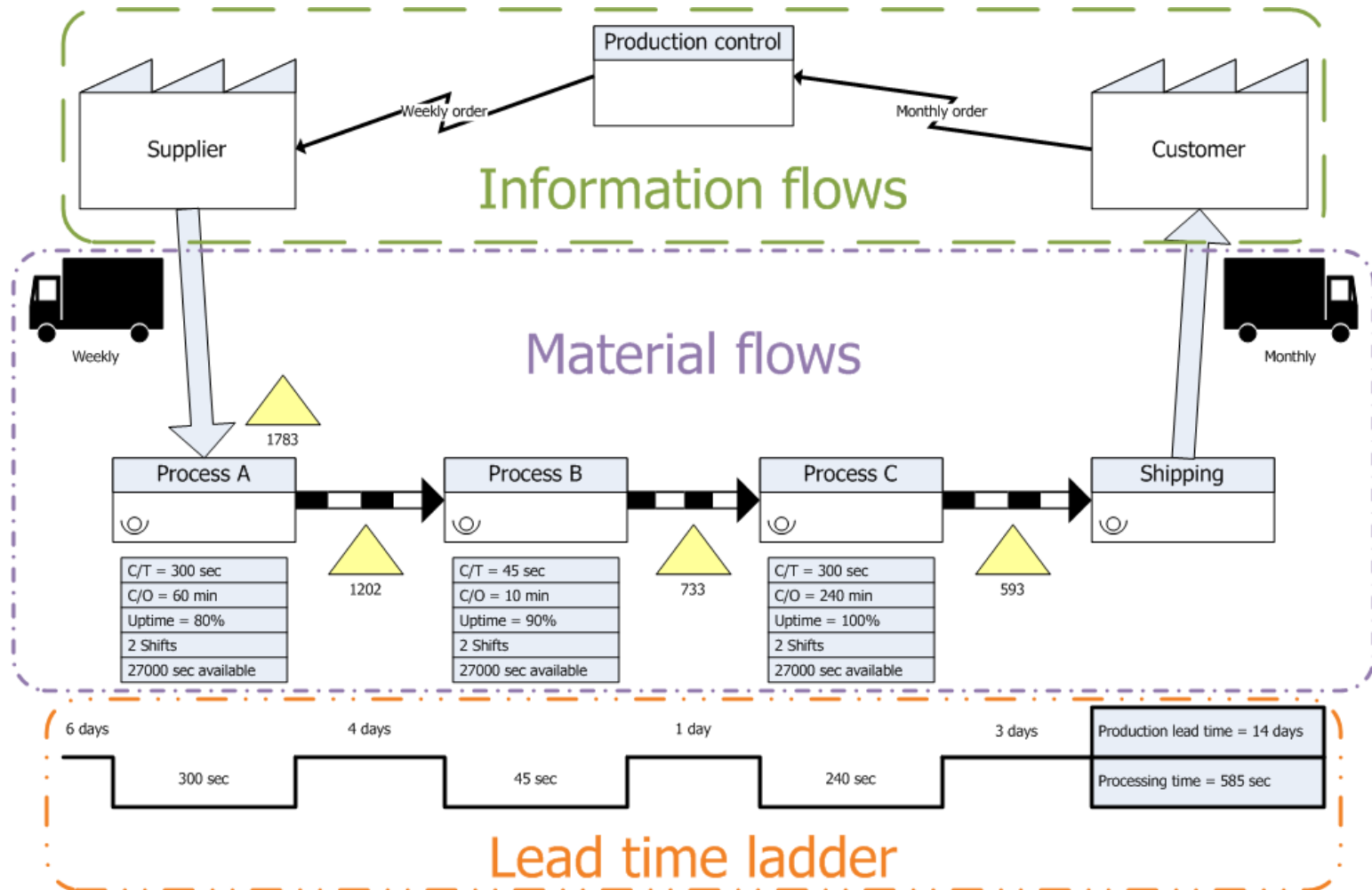
- Specify the value desired by the customer
- Identify the value stream for each product providing that value and challenge all of the wasted steps (generally nine out of ten) currently necessary to provide it
- Make the product flow continuously through the remaining value-added steps
- Introduce pull between all steps where continuous flow is possible
- Manage toward perfection so that the number of steps and the amount of time and information needed to serve the customer continually falls

Tools of Lean

There are more than 25 essential lean tools but with Six Sigma we incorporate mainly 6 of them as follows:

1. Value Stream Mapping
2. 5S
3. Takt Time
4. Ishikawa (Cause and Effect) Diagram
5. Heijunka (Load Balancing)
6. Poka Yoke (Mistake Proofing)

Value Stream Mapping



5S



5S

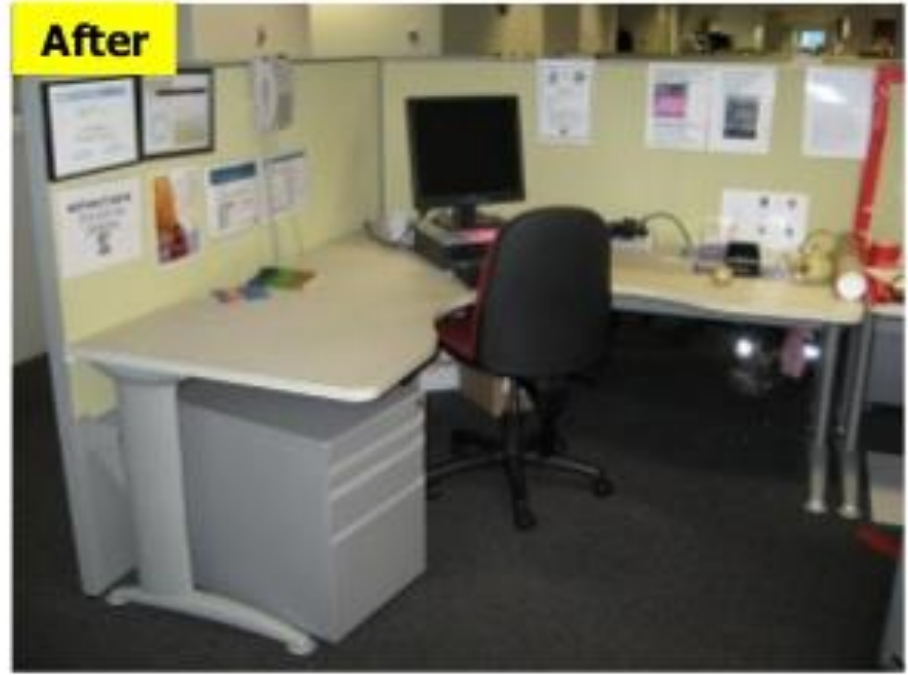
1. Sort
2. Set
3. Shine
4. Standardize
5. Sustain

5S

Before



After



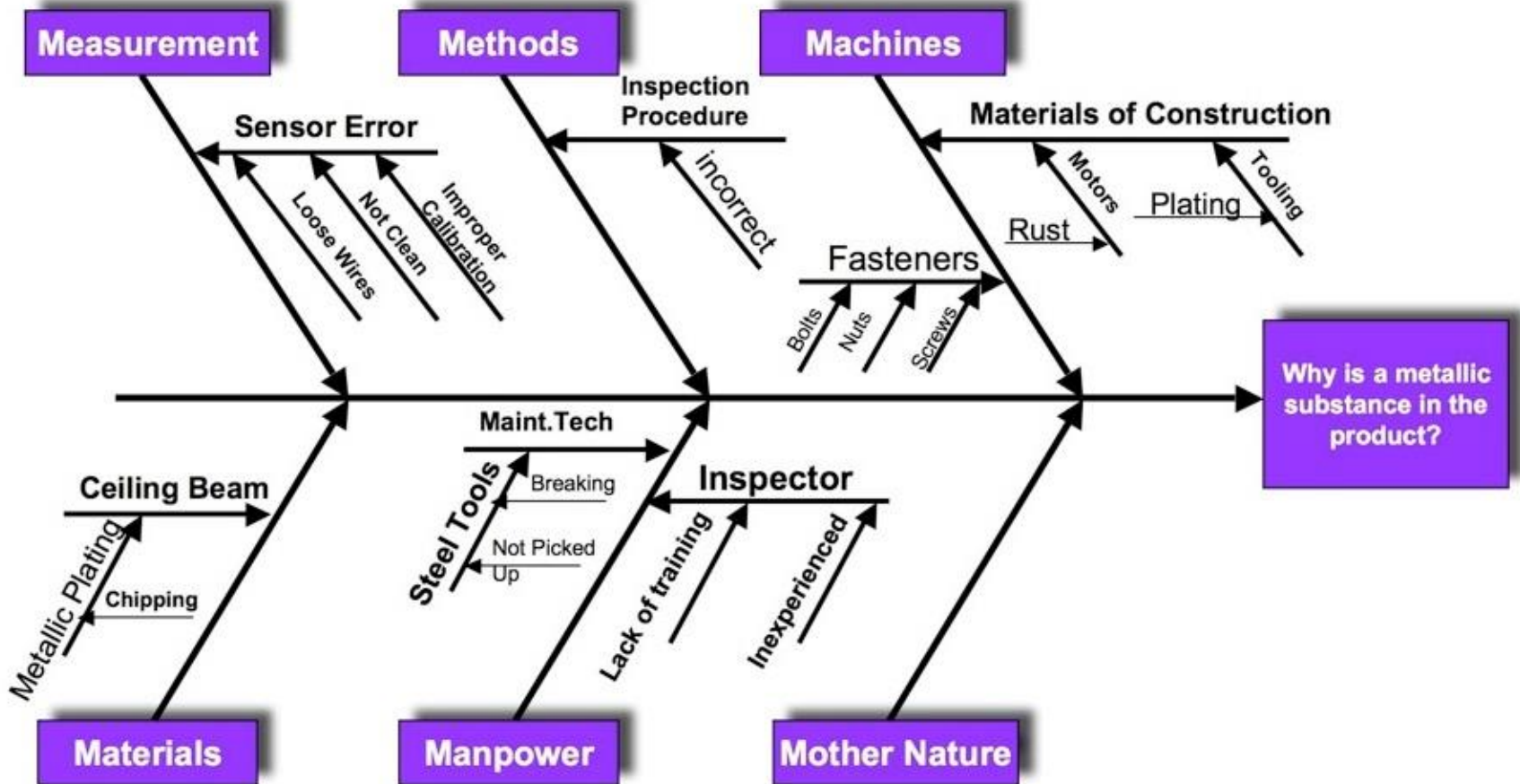
5S



Takt Time

- Takt time, derived from the German word Taktzeit, translated best as meter, is the average unit production time needed to meet customer demand.
- $Takt\ Time = \frac{Available\ time\ for\ production}{Required\ units\ for\ production}$

Cause and Effect Diagram



Poka Yoke (Mistake Proofing)



Poka Yoke (Mistake Proofing)



Lean

- Seeks to remove waste from a system

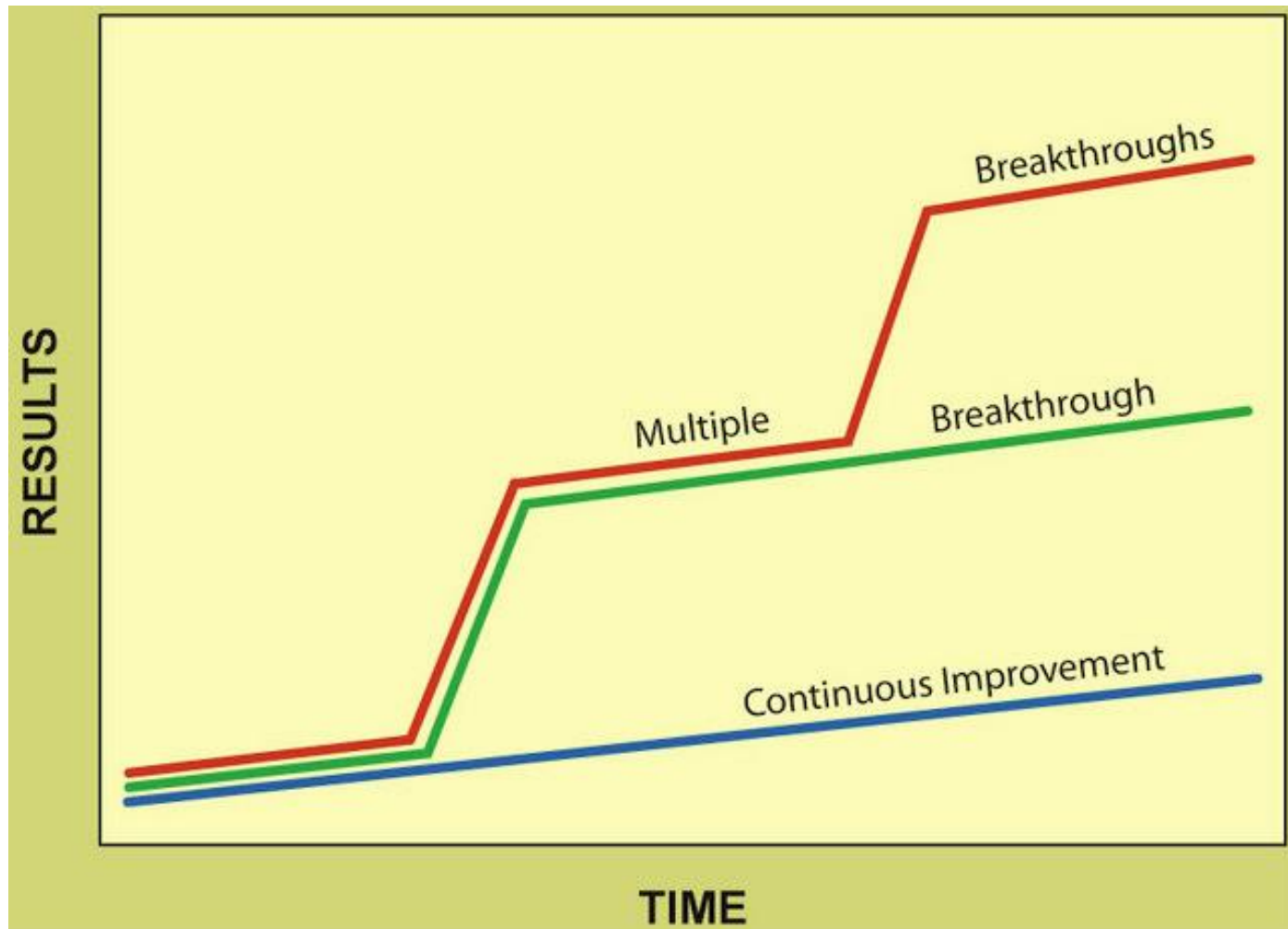
Six Sigma

- Seeks to remove defects, variation and their causes in a system

Six Sigma

- A Management driven, scientific methodology for product and process improvement which creates breakthroughs in financial performance and customer satisfaction.
- A methodology that provides businesses with the tools to improve the capability of their business processes. This increases the performance and decrease the process variation, leads to defect reduction and improvement in profits, employee morale and quality of product.

Breakthrough and Continuous Improvement



Six Sigma Project Types

- Transactional Projects
Focused on operational excellence, customer satisfaction and cost reduction within all components of the operation. Areas of focus include Sales, HR, Finance, Materials etc.
- Production Projects
Focused on product production excellence, variation and defect reduction, lean production techniques, customer satisfaction and cost reduction within all components of the production delivery system.
- Design for Six Sigma
Focused on product design excellence, design for manufacturability. Customer satisfaction and cost reduction within all components of the development of a new product.

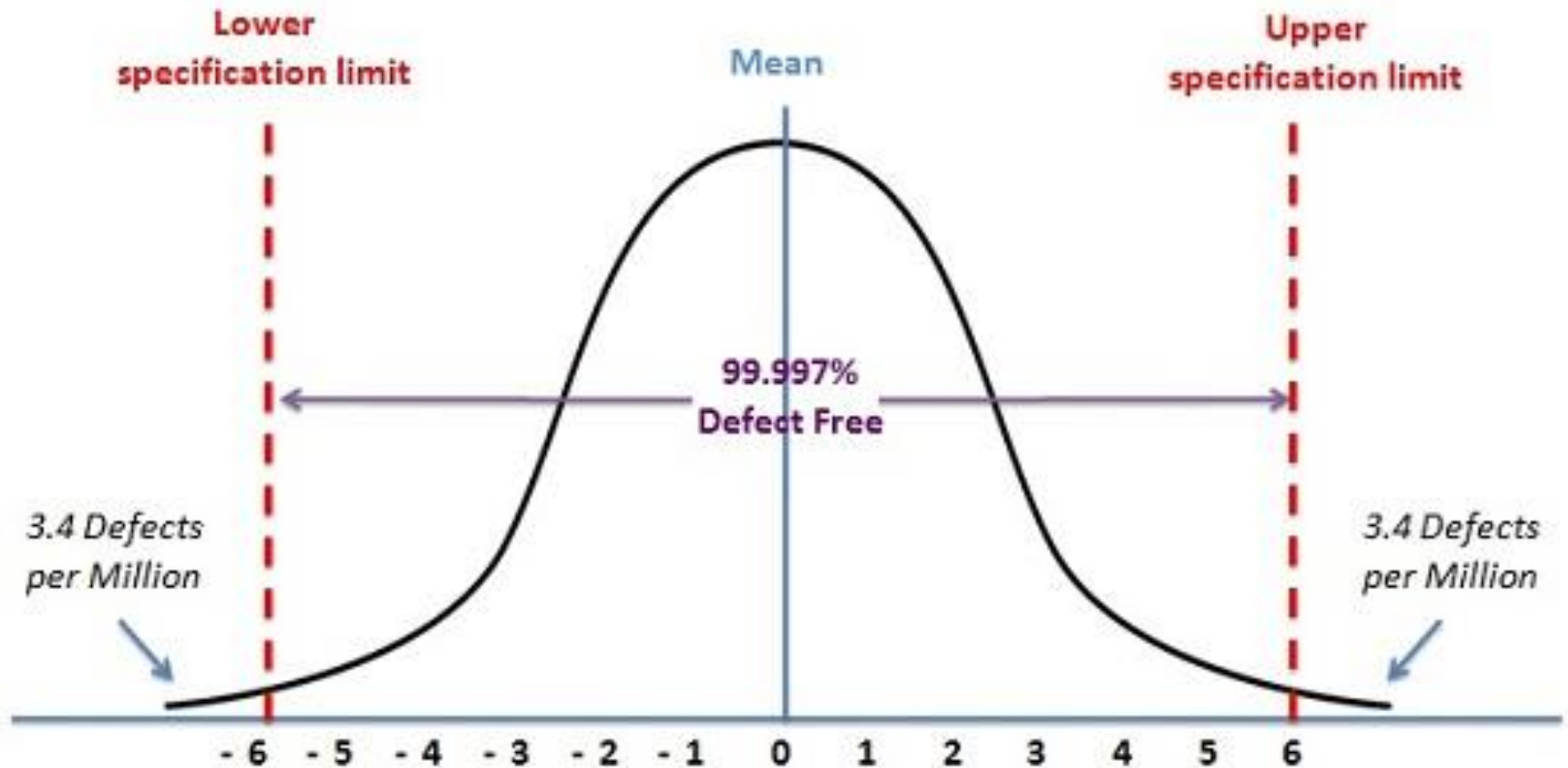
Six Sigma History



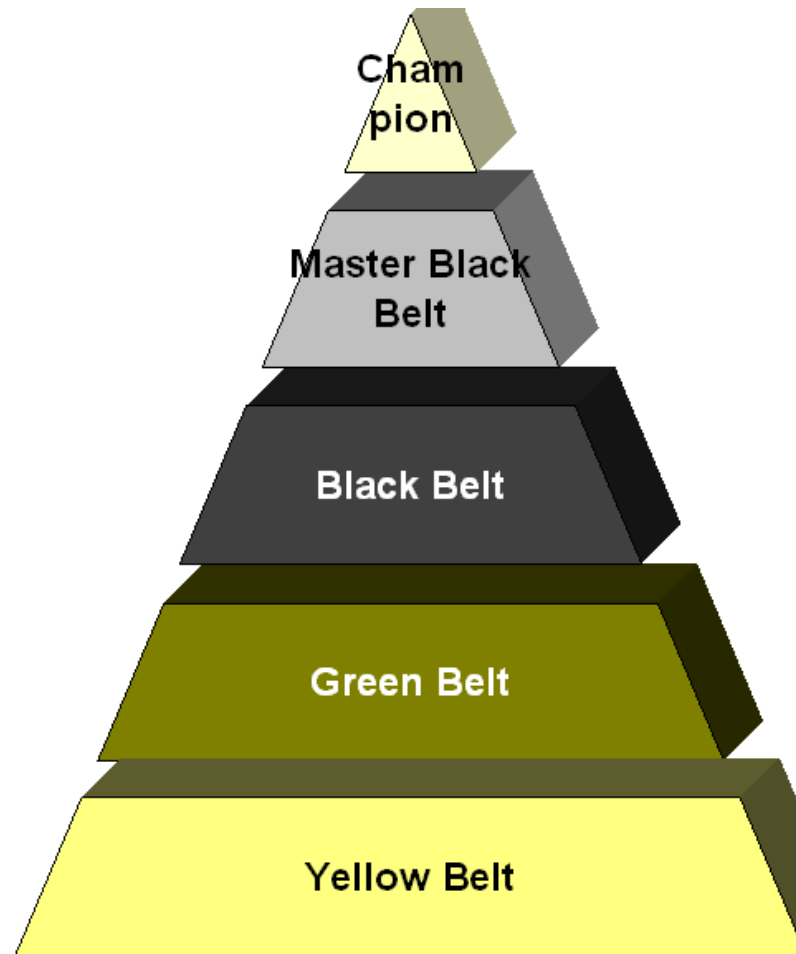
Success Stories

- “We achieved \$600 million in Six Sigma cost savings in 1999” – Honeywell
- “The Six Sigma program has flourished to the point where it is producing more than \$2 billion in benefits in 1999 with much more to come this decade.” – General Electric

Sigma Level



Six Sigma Hierarchy



Six Sigma

- Six Sigma seeks to identify and remove the causes of variation in manufacturing and/or service delivery and business processes.
- Six Sigma methodology is following five steps.
 1. Define
 2. Measure
 3. Analyze
 4. Improve
 5. Control


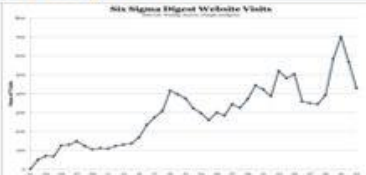

Define Phase

- The Six Sigma team determines the boundaries of the process area to improve and the requirements for the output of that process.
- The team answers the question “What is important to the business”.
- The project starts with the investigation of the problem statement.

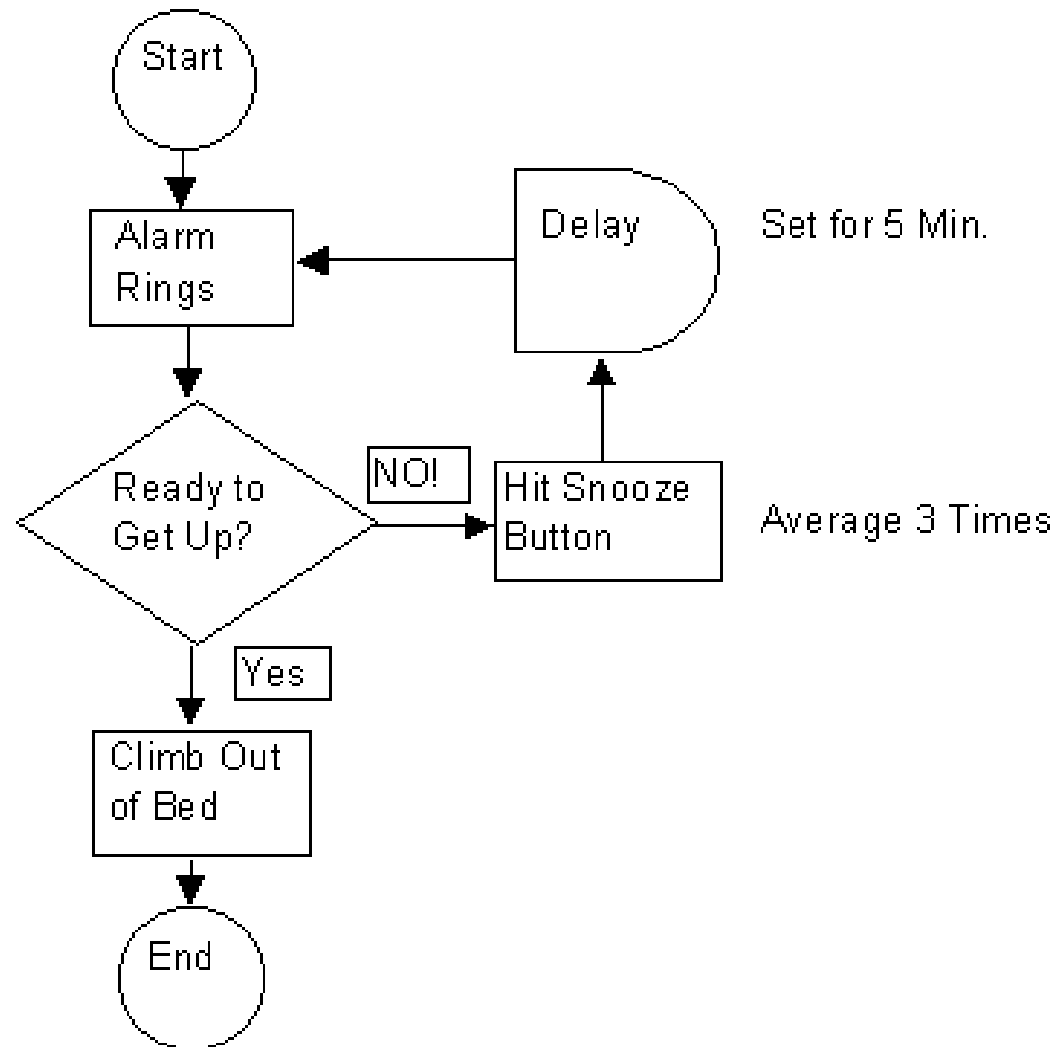
Define Phase

- For this purpose following tools are used:
 - Project Charter
 - Process Flow Diagram of relevant functions
 - SIPOC Diagram

Define Phase

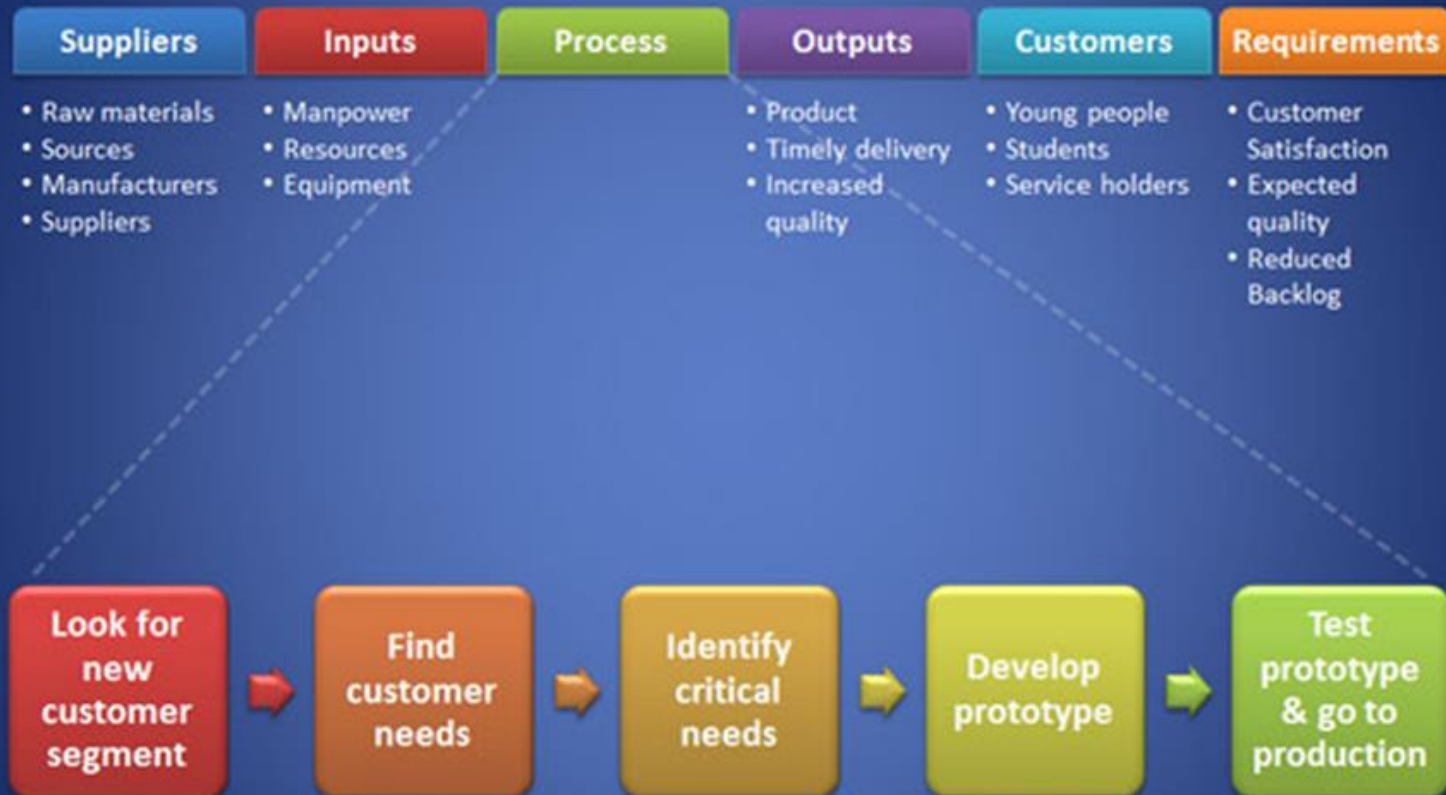
			Project Title: Project Digest									
			Project Lead		Project Champion	Executive Sponsor	MBB/Mentor					
Michael Parker			Michael Parker		Michael Parker	Michael Parker						
Primary Metric			Secondary Metric									
 <p>Primary Metric: Website Visits Data Type: Continuous Frequency: Weekly Baseline: 471 visits/week (last 10 weeks) Goal: 3,500 visits/week Timeline: 2012</p>			 <p>Secondary Metric: Bounce Rate Data Type: Attribute~Proportion Frequency: Weekly Baseline: 63% (last 10 weeks) Goal: <= 60% Timeline: 2012</p>									
Problem Statement & Objective			Business Case									
Six Sigma Digest currently averages 471 weekly visits to it's website. The goal is 3,500 weekly visitors. This leaves a gap of 3,029 weekly visitors to be closed by the end of the year 2012.			Six Sigma Digest is a new online start-up that has only been open for business since 8/21/2011. In the year leading up to our opening we made significant investments of time and finances to establish our business plan, curriculum, website, learning management system etc. Our marketing budget is low and we need to fully leverage as many effective online and virtual sales channels as possible. The trick is figuring out which channels and avenues provide the best ROI and most impact to our business growth.									
High Level Project Timeline			Constraints & Dependencies		Project Risks							
Phase	Start	Finish	Constraints: Marketing Budget Dependencies: N/A		1. Disclosure Risk: Six Sigma Digest runs the risk of sharing too much information regarding its business. 2. Y=f(x) correlation assumption: To mitigate some disclosure risk we have chosen visits as our primary metric instead of our true primary metric which is sales.							
Define	11/1/2011	12/1/2011										
Measure	12/1/2011	1/1/2012										
Analyze	1/1/2012	2/1/2012										
Improve	2/1/2012	3/1/2012										
Control	3/1/2012	4/1/2012										
Other Diagnostics			1. Unique visitors 2. Avg time on site 3. Pageviews 4. Pages/visit 5. Clicks & CTR 6. Cost per click									
Approval/Steering Committee												
Stakeholders & Advisors												
Project Team & SME's												
Name		Organization	Name		Organization	Name		Organization				
Michael Parker		Six Sigma Digest	Instructors		Six Sigma Digest	Blog Commentors		Six Sigma Digest				
			President		Six Sigma Digest	Survey Respondants		Six Sigma Digest				
			Customers		Six Sigma Digest	Customers		Six Sigma Digest				
						Newsletter Subscribers		Six Sigma Digest				
						Instructors		Six Sigma Digest				

Define Phase



Define Phase

SIPOC Diagram



Measure Phase

- The team determines how the current process is performing compared to the requirements.
- We start collecting data to measure current states of our independent and dependent variables.
- This involves following steps:
 - C&E Diagram or Matrix
 - Data Collection Plan
 - Sampling Plan and Segmentation
 - Descriptive Study, including pivot charts, box plots etc
 - Measuring and displaying the current baseline (Sigma level, Cp, Cpk, Pp, Ppk, DPMO, yield, CoQ)

Analyze Phase

- After the measurement stage and establishing the baseline and target levels, the team analyzes the casual relationships in detail.
- This phase involves identifying and validating possible X's.
- The key deliverable from this phase is validated root causes.
- Anything done in the analyze phase is a means to get to this end.
- The team may use a variety of tools and statistical techniques to fine these root causes.
- These may be as follows:
 - XY Matrix, Cause and Effect Diagram
 - Data Distributions
 - 5-Why's
 - Comparative Methods (Hypothesis Testing)
 - Correlation/Regression Analysis
 - Conclusion on Significant causes, KPIVs, KPOVs

Improve Phase

- The team puts on creative hat to generate solution ideas.
- Team evaluates those ideas and uses various decision making tools to select the one or more ideas they deem the best.
- A pilot project could be used to test any idea and demonstrate its effectiveness.
- The phase involves following steps:
 - Identify Solutions alternatives to address critical Xs
 - Select best choices (Cost benefit analysis)
 - Experiments with DOE to verify solutions

Control Phase

- Successful implementation and maintaining the gains achieved.
- They need to ensure that when they finish the project, the success that they have seen will continue.
- This involves transferring the responsibilities to the process owner
- For this purpose following activities are carried out:
 - Solutions plan
 - Potential problem analysis
 - Solution implementation schedule
 - Training plan
 - Communication plan
 - Cost and benefits
 - Transfer to owner plan
 - Process Control Plan
 - Revised flow diagram
 - Revised procedures
 - Control charts to be used for process Control
- Project Conclusion Activities
 - Overall team evaluation & lessons learnt
 - Reward and recognition
 - Knowledge sharing

Conclusion

- There are tremendous improvement and savings available to companies in their operations if they will mobilize their resources toward reduction of waste and improvement of quality
- Six Sigma requires Leadership from the Executive Staff
- The roadmap is clear and the methods for improvement are well defined
- Software tools make the data collection and analysis clear
- Development of an implementation and training plan is the next step

Thank You!
Any questions???

