

Lean Six Sigma Green Belt



Course eBook

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Printed in the United States of America

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eBook Overview

Welcome to the eBook for the Acuity Institute Lean Six Sigma Green Belt Certification Programs.

- ✓ You will need the most recent version of **Adobe Reader** to view the eBook. We do not recommend viewing the eBook with Adobe Acrobat.
- ✓ We recommend becoming familiar with the eBook and its features. A few features include printing, viewing notes, and capturing your comments.
- ✓ For ease of use, we have included numerous bookmarks in the eBook so you can quickly access common course concepts.
- ✓ The eBook is for personal use only. Please do not use the eBook for presentations and training facilitation.
- ✓ The eBook is for the intended parties only.
- ✓ This eBook contains various exercises that are represented by the following icons:



EXERCISE

General Exercises



Simco International Products Simulated Project. When you see this icon you can quickly navigate to the Simulated Project Deliverable by clicking on the “Go To Deliverable” link.

When you are done with the Deliverable you can return to the course by selecting the “Go Back To Lesson” link.

Go To
Deliverable

Go Back To
Lesson

This Simulated Project is included in Acuity Institute’s Standard and Advanced Certification Programs only. If you are enrolled in the Basic Certification Program please proceed forward in the course when you see these icons.

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Lean Six Sigma Toolkit



Template Name

The Lean Six Sigma Toolkit icon is periodically introduced in this eBook. The toolkit icon informs you that a Lean Six Sigma template is available for your use. The templates are located in the “Lean Six Sigma Toolkit Templates” folder. To access the templates you will need to download this folder onto your computer.

The Lean Six Sigma Toolkit assists practitioners in keeping focused on their project work and not creating “templates”. The toolkit includes common templates used throughout the Lean Six Sigma DMAIC phases. The templates are developed in common formats (MS Word, MS Excel or MS PowerPoint).

- ✓ 5 Whys
- ✓ Communication Plan
- ✓ CTQ Chart
- ✓ Dashboard Measurement Plan
- ✓ Data Collection Plan
- ✓ DMAIC Project Plan
- ✓ DMAIC Tollgate Presentation
- ✓ FMEA
- ✓ Force Field Diagram
- ✓ Implementation Plan – Detailed
- ✓ Implementation Plan – High Level

Included Templates

- ✓ Pilot Plan
- ✓ Process Monitoring Plan
- ✓ Process Value Analysis
- ✓ Project Charter
- ✓ Project Storyboard
- ✓ Quick Win Identification
- ✓ Response Plan
- ✓ Sigma Calculator
- ✓ SIPOC

- ✓ Solutions Benefits and Implications
- ✓ Solutions Prioritization Matrix
- ✓ Solutions Selection Matrix
- ✓ Stakeholder Identification
- ✓ Stakeholder Management Plan
- ✓ Stakeholder Map
- ✓ Standardized Procedures
- ✓ Team Meeting Agenda
- ✓ Team Profile
- ✓ VOC Research Plan
- ✓ XY Matrix

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Lean Six Sigma Training



Lean Six Sigma Introduction

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Overview - Objectives - Key Topics

By the end of this lesson, you will be able to:

- ✓ Learn what Lean Six Sigma is
- ✓ Learn about various Lean Six Sigma Improvement Methodologies
- ✓ Learn what the Lean Six Sigma Roles and Responsibilities are

Objective

- ✓ Identify past experiences with other Quality or Process Improvement initiatives.

Instructions

- ✓ Answer the following questions:
 - § What has been your experience with other Quality or Process Improvement initiatives?
 - § What was good about the other Quality or Process Improvement initiatives you were involved in?
 - § What struggles or challenges have you had with other Quality or Process Improvement initiatives?
 - § What could have made them better?
- ✓ Prepare your findings.



EXERCISE

Experience with Other Quality Initiatives

Please Do Not Proceed Forward



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EXERCISE

Experience with Other Quality Initiatives

Discussion



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Lean Six Sigma Training

Lean Six Sigma Overview

Lean Six Sigma Improvement Methodologies

Lean Six Sigma Roles

Vital Questions in an Increasingly Competitive World

Does your current performance meet customer expectations? Is there a gap between what your company's leaders want to achieve and the organization's ability to deliver it?

“Leaders who execute look for deviation from desired managerial tolerances – the gap between the desired and actual outcome in everything from profit margins to the selection of people for promotion... Like Six Sigma, the discipline of execution doesn't work unless people are schooled in it and practice it constantly... Execution has to be part of an organization's culture...”

-- Larry Bossidy, Former CEO of Allied Signal --

-- Execution: The Discipline of Getting Things Done --

Lean Six Sigma Definition

Lean Six Sigma was developed out of necessity as a very rigorous and disciplined approach for companies to improve products and services based on their customers' expectations and requirements...an "outside looking in" approach. Lean Six Sigma has many facets.



Lean Six Sigma can improve profits and cut costs, but more importantly, it can keep customers loyal as well as improve a company's competitive advantage.

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Lean Six Sigma Definition

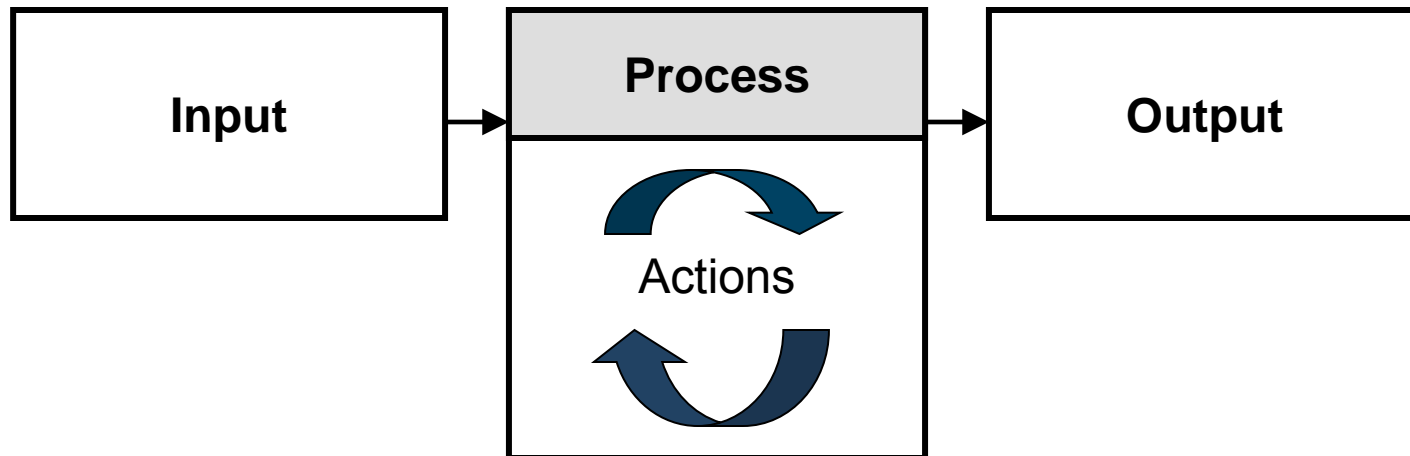
Lean Six Sigma uses a variety of tools and techniques to achieve superior process performance, such as:

- ✓ Customer Surveying (Voice of Customer)
- ✓ Metric Identification and Collection
- ✓ Baselining / Measuring Process Performance
- ✓ Data Based Decision Making (Analysis and Statistics)
- ✓ Lean Process Flow / Value Analysis
- ✓ Benchmarking “Best In Class” Companies
- ✓ Risk Analysis / Assessment
- ✓ Implementation Planning / Management
- ✓ Change Management

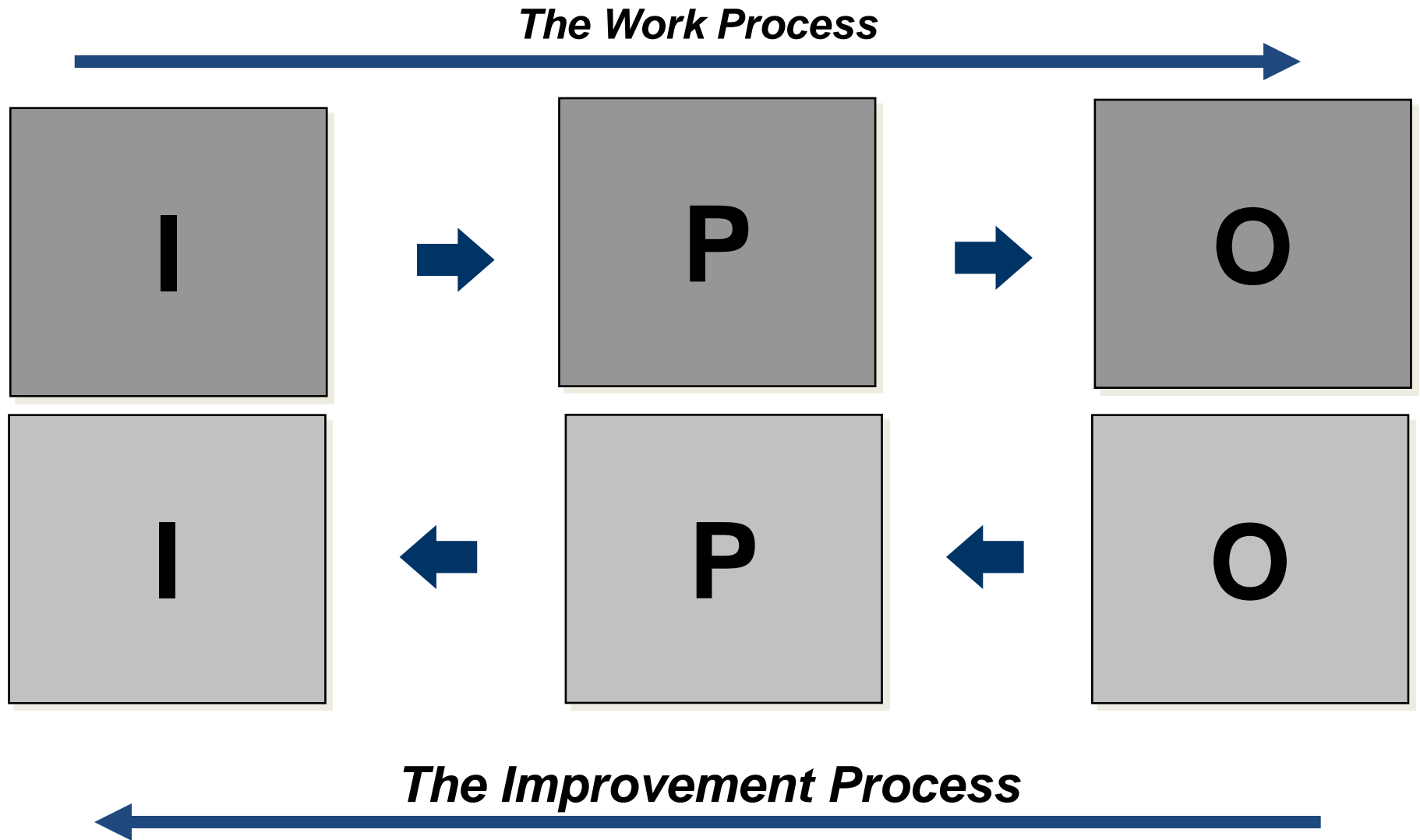
What is a Process?

A process is defined as a repetitive and systematic series of actions or operations whereby one or more inputs from suppliers is used to achieve an output of value to the customer (internal/external)

Process Model



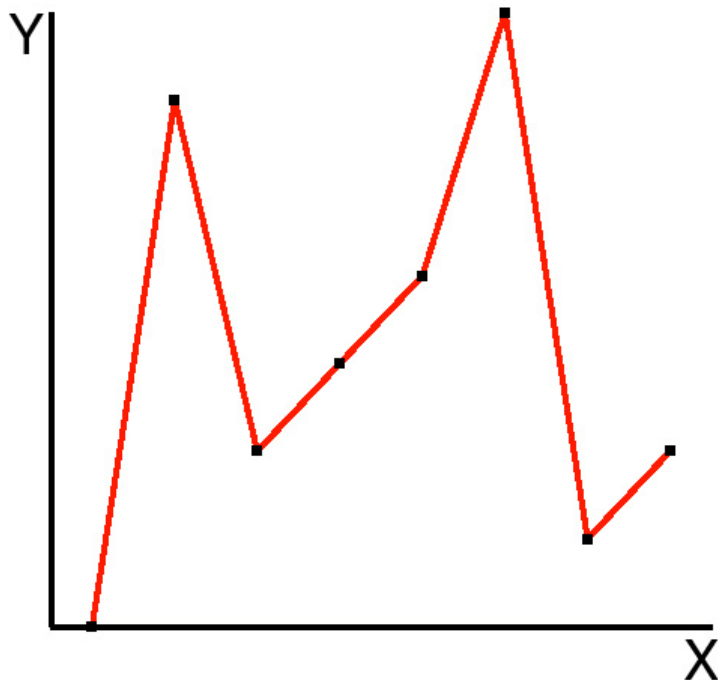
Relationship of Work Process and Improvement Process



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The Focus of Lean Six Sigma

For every process there is a dependent variable called Y that we are attempting to influence. The independent variables which determine what happens to our Y are called the process X's. Thus, we can boil down every process into a simple formula:



$$Y = f(x^1, x^2, x^3 \dots x^n)$$

The goal of Lean Six Sigma is to understand the relationship between our various Xs and our Y, so we can manipulate the Xs to modify Y as desired, then lock down the process so that Y remains within the proper range and is meeting customer requirements.

Lean Six Sigma Focuses on Reducing Variation

Variation Happens

- ✓ All repetitive activities of a process have a certain amount of fluctuation or variation
- ✓ Variation is the “Voice of the Process”
- ✓ When plotted, process variation becomes visible over time
- ✓ Input, process, and output measures will have variation
- ✓ Failure to understand variation could be costly



Time

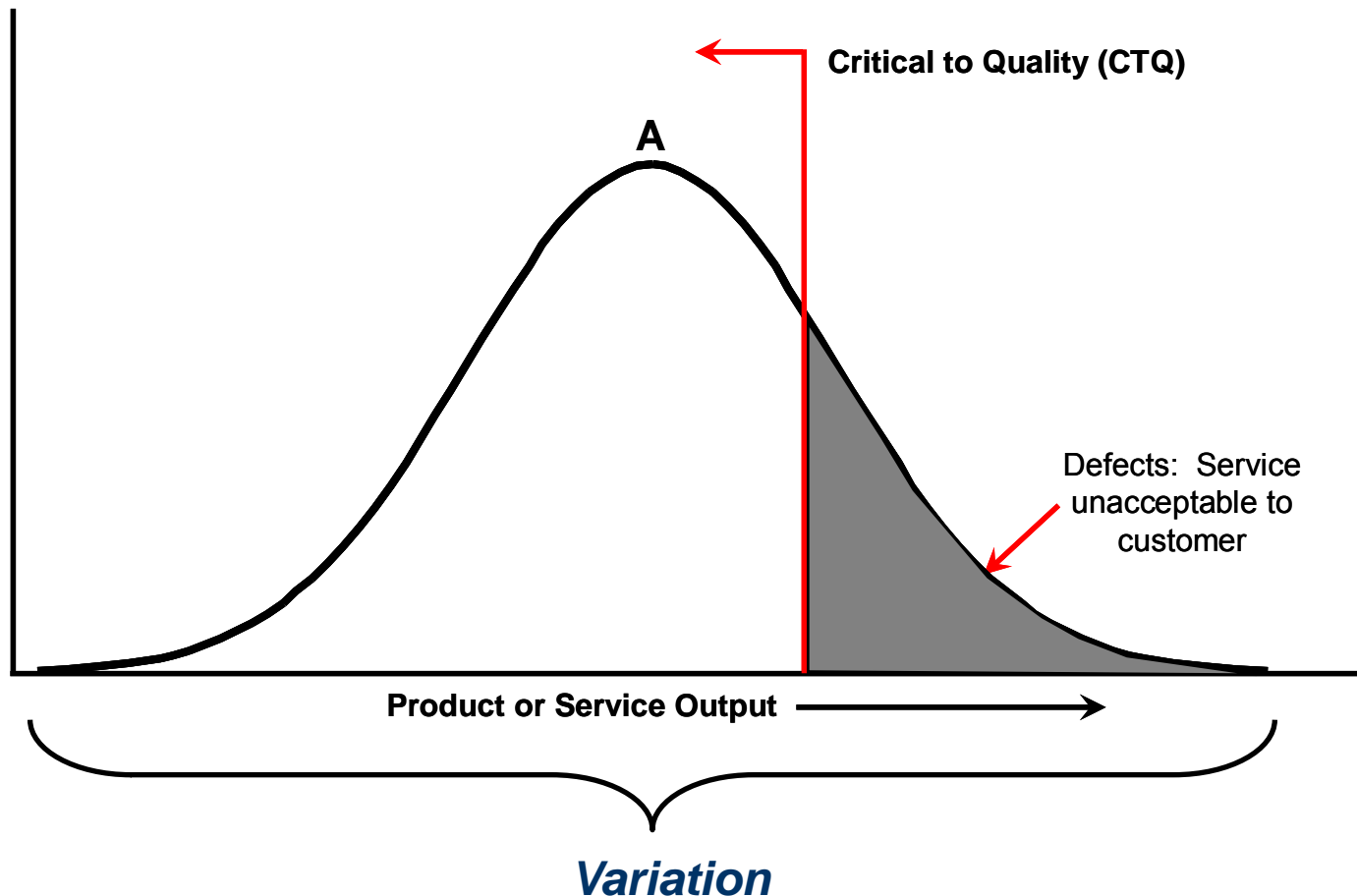


Frequency

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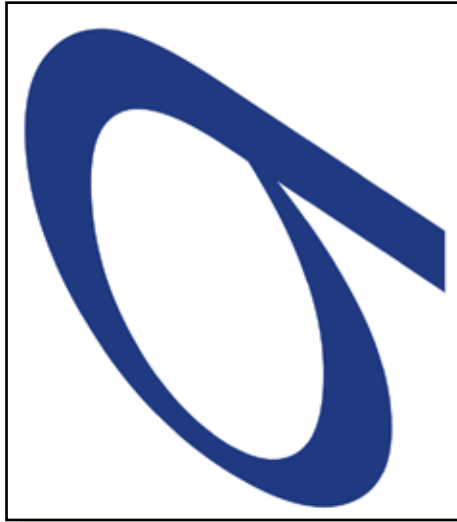
Why It's Important To Understand Variation

PROCESS VARIATION INHIBITS OUR ABILITY TO MEET CUSTOMER REQUIREMENTS



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“Sigma” Defined

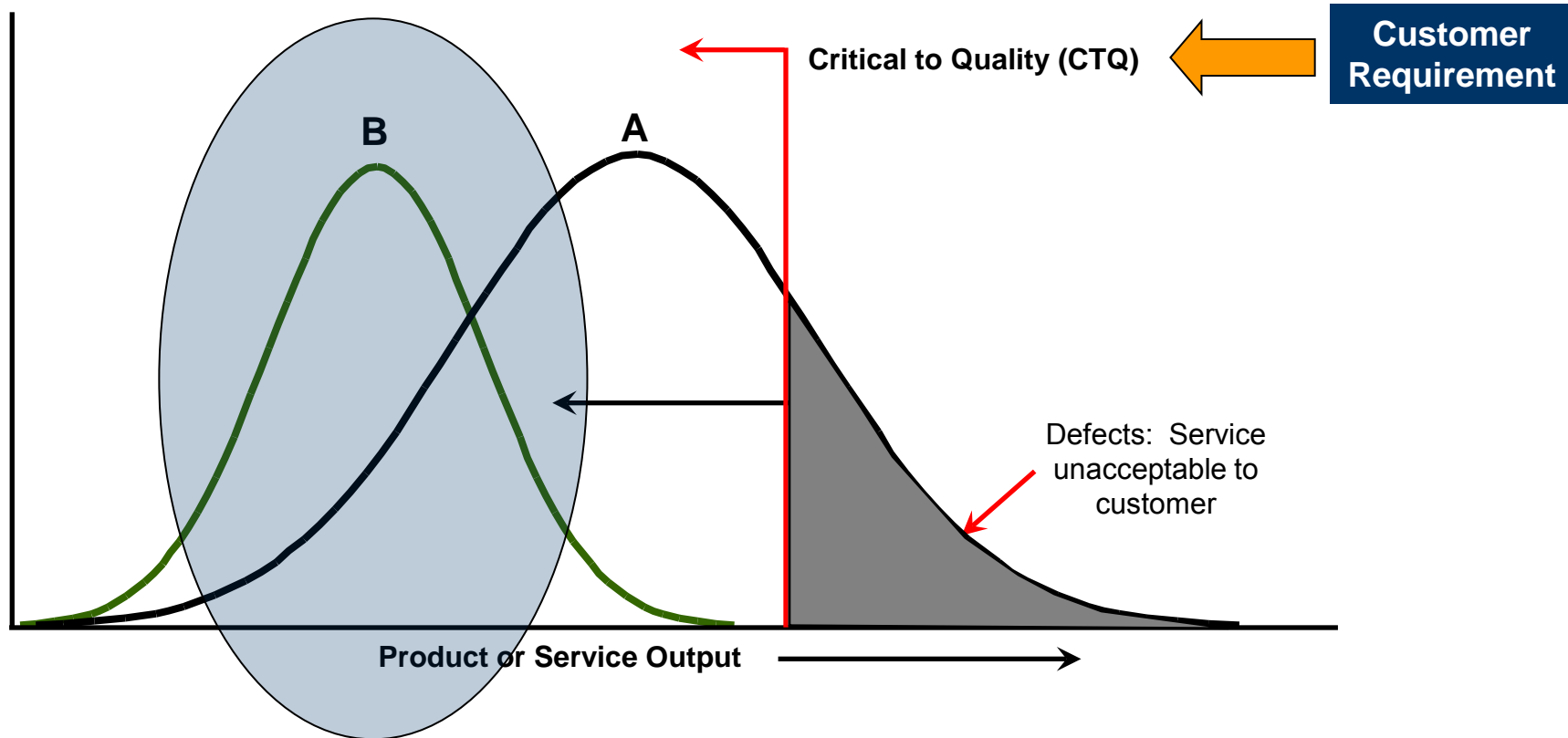


Sigma is a Greek letter that is a statistical unit of measurement used to define the standard deviation of a population. It measures the variability or spread of the data.

Sigma is a name given to indicate how much of the data falls within the customers' requirements. ***The higher the process sigma, the more the process outputs, products and services, meet customers' requirements – or, the fewer the defects.***

“Sigma” Defined

In this diagram, the Sigma is calculated by the number of occurrences (defects) that fall outside of the customer requirement (for Process A). **Process B** represents the *optimal performance* with no occurrences outside of the requirement.



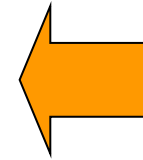
Optimal Performance

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Sigma Scale

With performance at 2 Sigma:

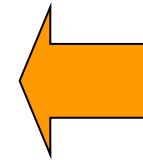
ONLY 69.146% of products and/or services meet customer requirements with 308,538 defects per million opportunities.



Most companies processes perform at this level or below prior to improvement

With performance at 4 Sigma:

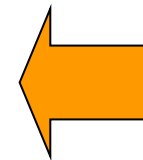
99.379% of products and/or services meet customer requirements...with 6,210 defects per million opportunities.



Realistic business performance target for transaction / service industry

With performance at 6 Sigma:

99.99966% – As close to flaw-free as a business can get, with just 3.4 defects per million opportunities.



Superior business performance target (common goal in manufacturing environments)

Why “6” Sigma?

When Processes Operate at Less than 6 Sigma:

Even if your goal is 99.0% quality... Your Results Would Be:

- ✓ **Two unsafe plane landings per day at most major airports**
- ✓ **500 incorrect surgical operations per week**
- ✓ **One hour unsafe drinking water per month**
- ✓ **16,000 pieces of mail lost every day**
- ✓ **No electricity for 7 hours per month**

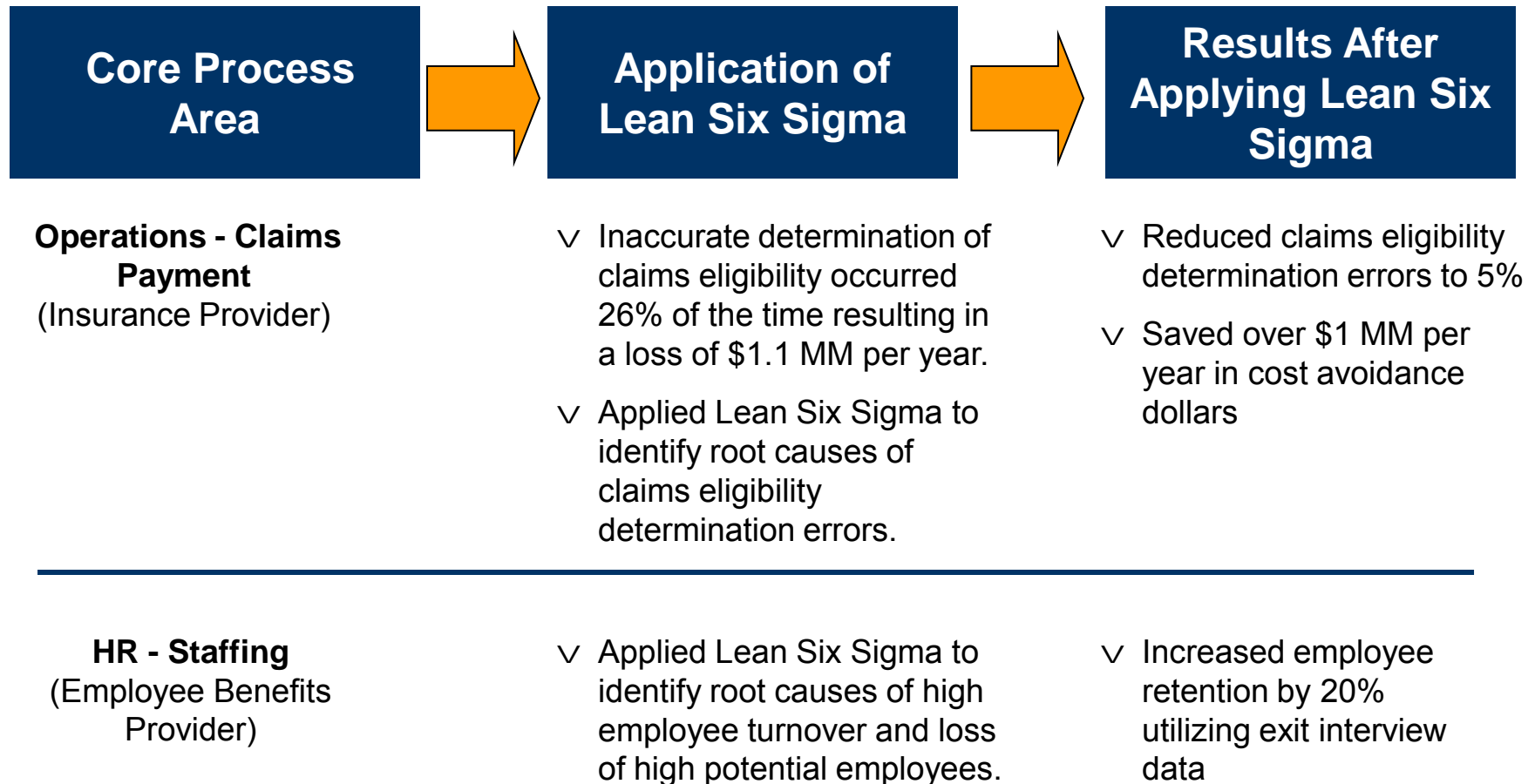


Lean Six Sigma – What it Is and What it is Not

- ✓ Lean Six Sigma is a framework to improve performance
- ✓ Lean Six Sigma is not the solution for everything
- ✓ Lean Six Sigma does apply to every function and business
- ✓ Lean Six Sigma is not just about statistics
- ✓ Lean Six Sigma is about Business Performance
- ✓ Lean Six Sigma is not new work
- ✓ Lean Six Sigma is a better way to work

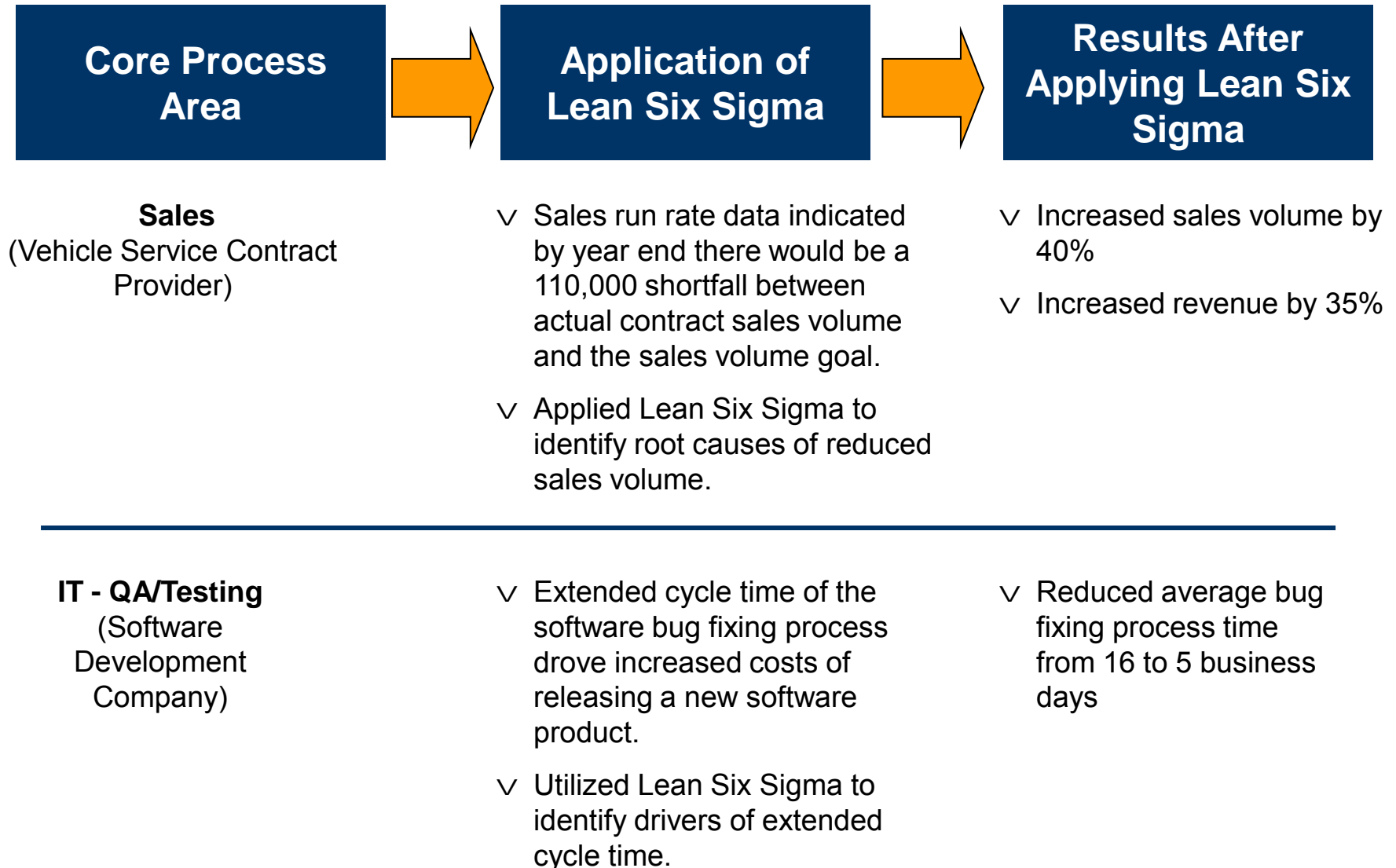
Applying Lean Six Sigma

Lean Six Sigma can be applied to any process problem to achieve significant improvement results. The following are a few examples.....



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Applying Lean Six Sigma



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Companies Deploying Lean Six Sigma (a sample)

Motorola

Dow

Jaguar

Allied Signal

IBM

Johnson & Johnson

Sony

American Express

Bank of America

Honda

General Electric

Nokia

Maytag

Lockheed Martin

Polaroid

Raytheon

Texas Instruments

Digital Electronics

Bombardier

DuPont

Kodak

Canon

Toshiba

Fidelity Investments

Lean Six Sigma Training

Lean Six Sigma Overview

Lean Six Sigma Improvement Methodologies

Lean Six Sigma Roles

Types of Improvement Methodologies



Process Management

- Process performance is unknown or not understood
- Implement a process monitoring dashboard to decide what to do next

Just Do It

- Problem identified and solution is known
- Implement a fix and establish a dashboard to continuously monitor process

Kaizen

- Problem identified and solution is unknown.
- Small in scale or urgency needed for process improvement
- Initiate 2-5 day Kaizen Event to analyze the process and implement improvements

Lean

- Process is inefficient and contains wasteful activities
- Initiate a Lean project to identify non value-add activities and remove waste from the process

DMAIC

- Existing process is not meeting customer requirements or business objectives
- Initiate a DMAIC project to identify root causes of the problem and initiate breakthrough improvements

DFLSS

- New product or process needs to be designed or significant problems to current process exist
- Initiate DFLSS project to design processes to meet customer requirements

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“Process Management” and “Just Do It”

Process Management

- ✓ Manage processes more effectively by the collection, display, and evaluation of process data.
- ✓ Data is important in that it fuels the various problem solving approaches, specifically the ability to execute Lean Six Sigma projects.

Just Do It

- ✓ Pinpoint process problem
- ✓ Solution(s) already known
- ✓ Implement solution(s)
- ✓ Measure performance (ongoing Process Management)

“Kaizen” Events



Kaizen Event

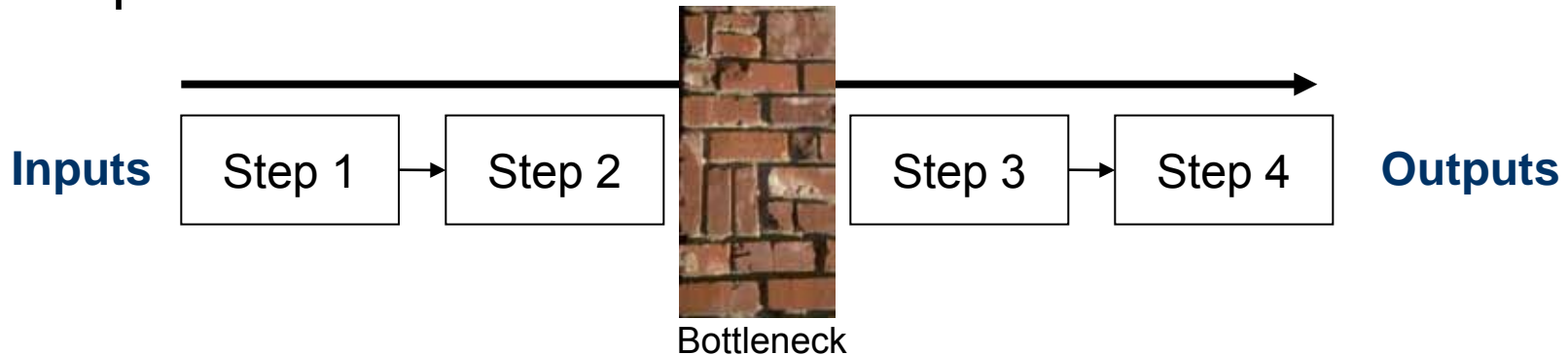
A ***Kaizen Event*** is a very concentrated team-oriented effort to rapidly improve the performance of a process.

- ✓ Team effort is coordinated over a brief period of time – typically no more than 5 days.
- ✓ A Kaizen Event can be very chaotic for a short period until solutions can be implemented as numerous and major improvements will be implemented at the same time.
- ✓ Kaizen involves deliverables and activities prior to and right after the Kaizen Event that must be completed to ensure successful execution.

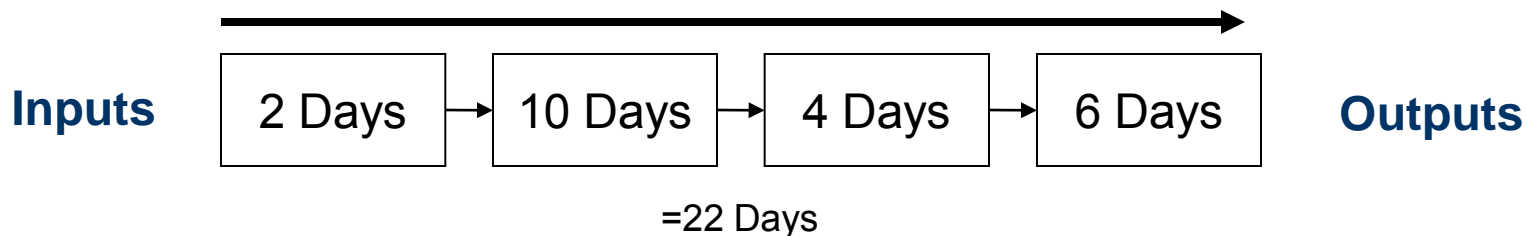
“Lean”

Lean is utilized for the following purposes:

- ∨ To reduce or eliminate **capacity constraints** of the process



- ∨ To reduce the **cycle time** of the process



“DMAIC” and “DFLSS”

Methodology and Primary Focus of Each Discipline

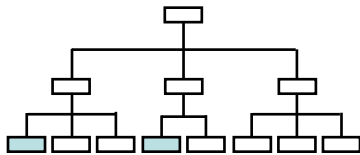
- ✓ Define
- ✓ Measure
- ✓ Analyze
- ✓ Improve
- ✓ Control

Continuous Process Improvement (DMAIC)

Design for Lean Six Sigma (DFLSS)

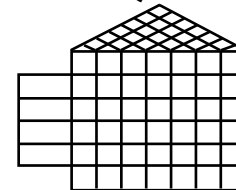
- ✓ Define
- ✓ Measure
- ✓ Analyze
- ✓ Design
- ✓ Verify

CTQ Tree



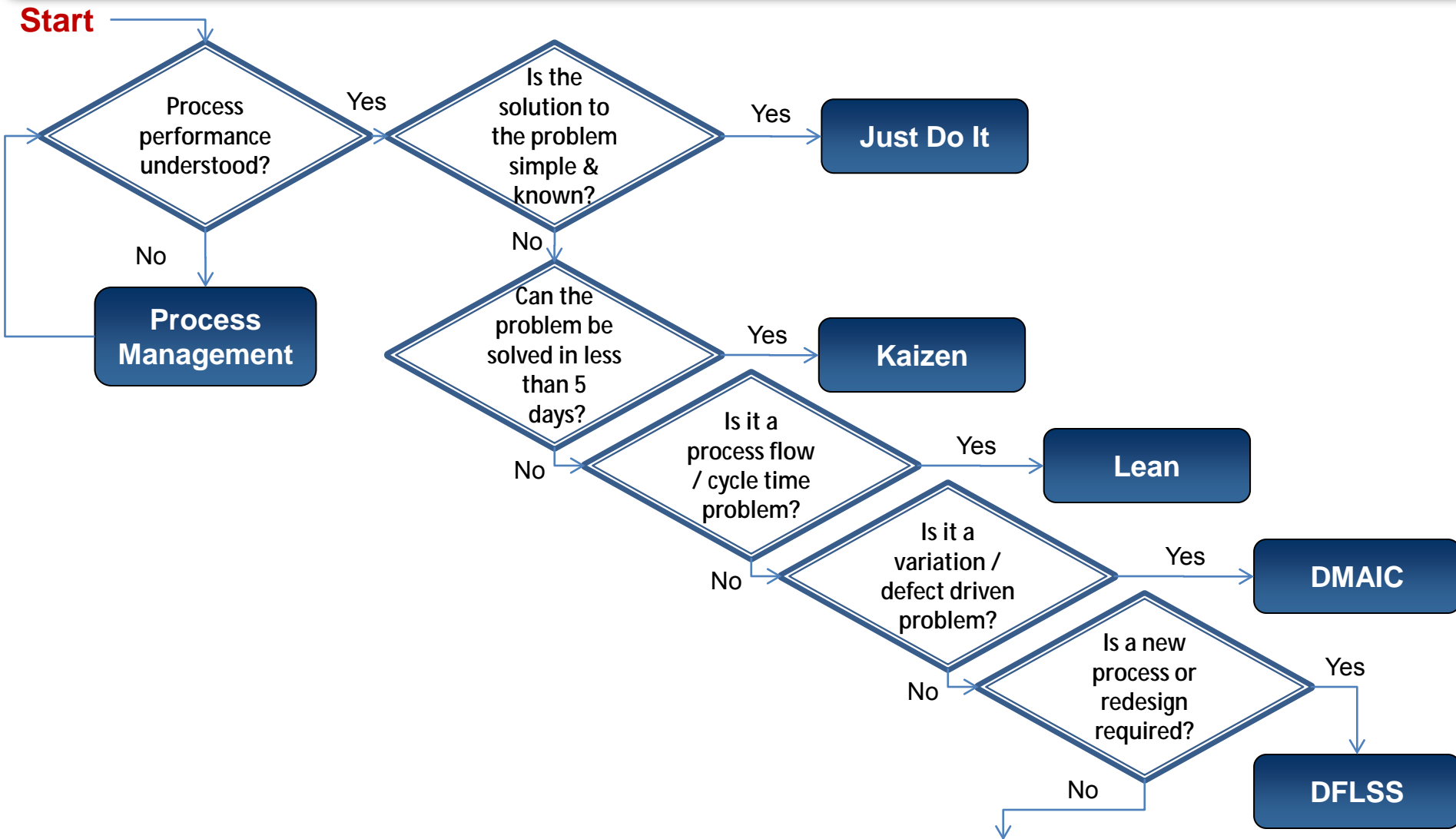
ID **Root Causes** that drive process performance

QFD



Optimized Design across processes

Selecting the Lean Six Sigma Methodology

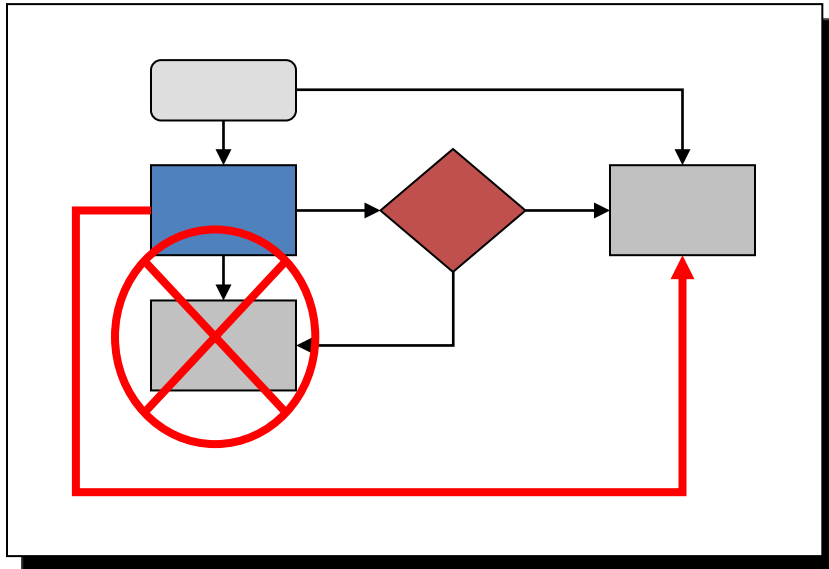


Explore Other Methodologies

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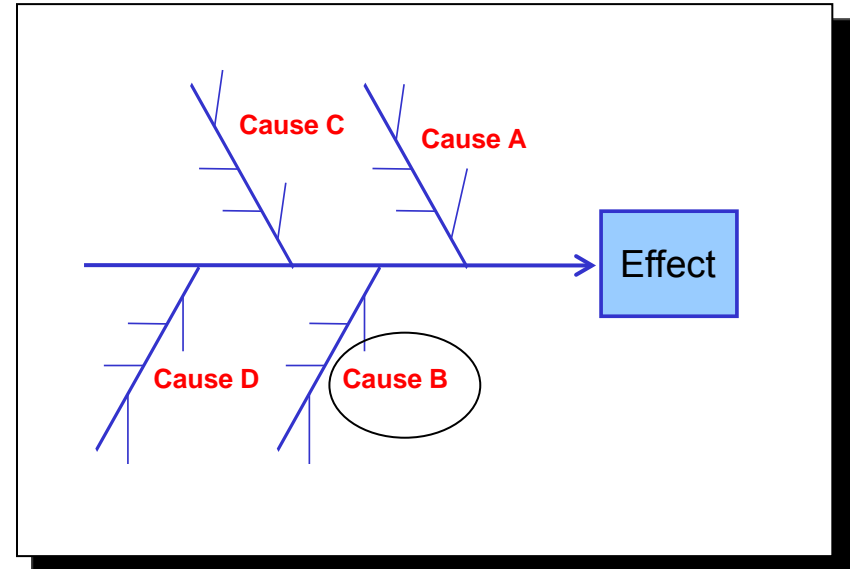
Improvement Techniques – Lean and Six Sigma

Lean



Efficiency
Improvement

Six Sigma

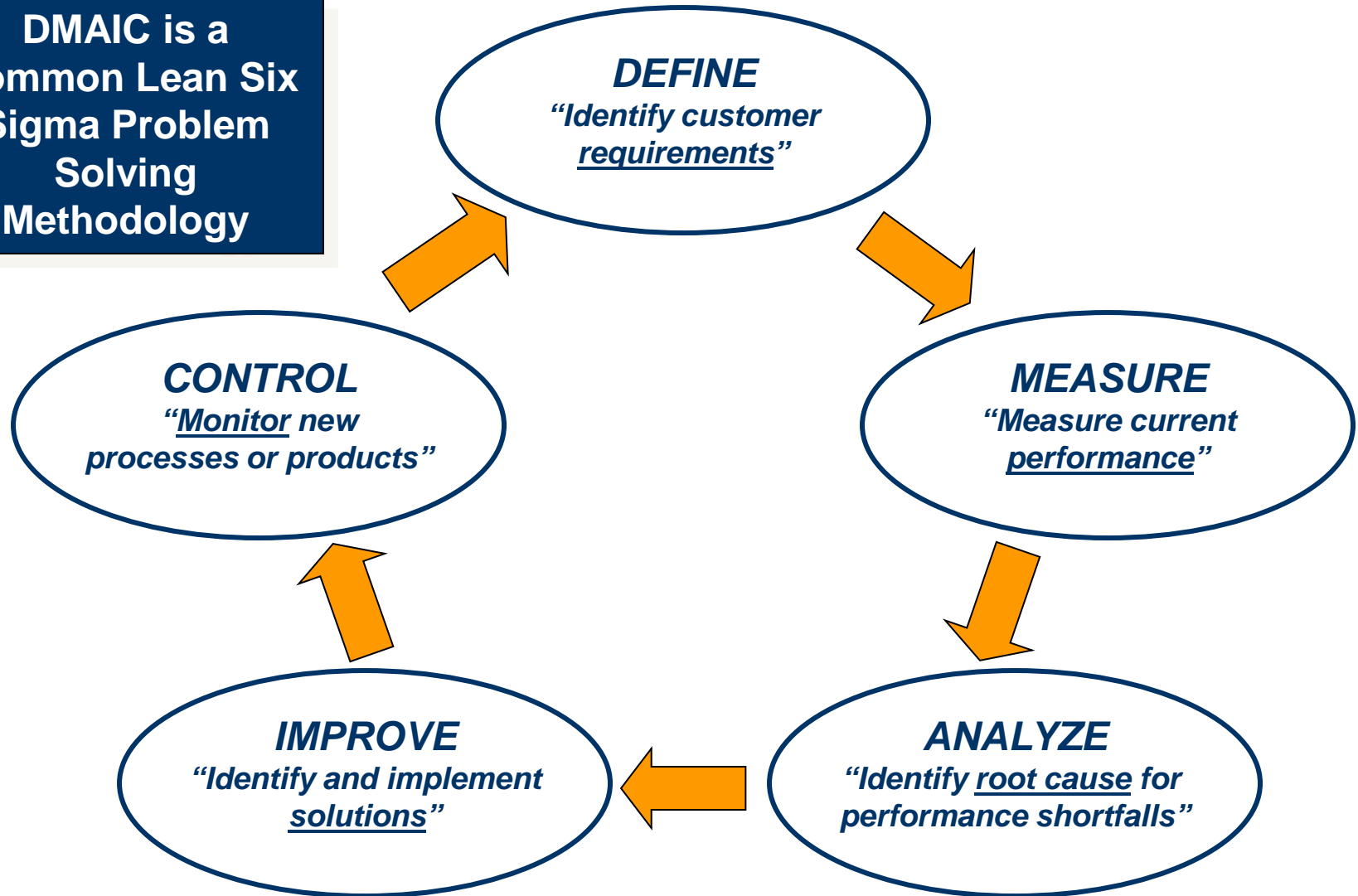


Quality and Efficiency
Improvement

Combining Lean and Six Sigma is Best in Class

Lean Six Sigma DMAIC Methodology Defined

**DMAIC is a
Common Lean Six
Sigma Problem
Solving
Methodology**



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Key DMAIC Project Deliverables

Define

Measure

Analyze

Improve

Control

- q Project Charter
- q Project Management
 - q Project Plan
- q Process Definition
 - q SIPOC
 - q As-Is Process Map
 - q Quick Win Identification
- q Stakeholder Management
 - q Stakeholder Map
 - q Stakeholder Management Plan
 - q Communication Plan
- q Voice of Customer
 - q Customer Identification
 - q VOC Research Plan
 - q Kano Analysis
 - q CTQ Identification

- q Identify Measures
 - q X/Y Matrix
- q Data Collection
 - q Operational Definitions
 - q Measurement Systems Analysis (MSA)
 - q Data Collection Plan
- q Describe and Display Data
 - q Histogram
 - q Pareto Chart
 - q Pie Chart
 - q Run Chart
 - q Control Charts
- q Baseline Performance
 - q Sigma Performance
 - q Yield
 - q Process Capability
- q Quick Win Identification

- q Root Cause Analysis
 - q Affinity Diagram
 - q Fishbone Diagram and/or 5 Why's
- q Lean Process Analysis
 - q Lean Tools and Measures
- q Graphical Data Analysis
 - q Histogram
 - q Pareto Chart
 - q Box Plots
 - q Correlation Analysis
- q Statistical Data Analysis
 - q Linear Regression
 - q Multiple Regression
- q Root Causes Identified
- q Quick Win Identification

- q Identify and Select Solutions
 - q Generate Solutions
 - q Benchmarking
 - q Solutions Prioritization Matrix
 - q Solution Selection Matrix
 - q To-Be Process Map
- q Financial Impact of Solutions
 - q Cost/Benefit Analysis
- q Risk Planning and Testing
 - q Failure Modes and Effects Analysis (FMEA)
 - q Pilot Plan
- q Implement Solutions
 - q Multi-Generational Project Plan (MGPP)
 - q Implementation Plan
 - q Stakeholder Management
 - q Project Storyboard

- q Process Control
 - q Control Charts
 - q Process Monitoring Plan
 - q Dashboard
- q Response Plan
- q Project Documentation
 - q Process Procedures
 - q Replication Opportunities
 - q Solution Transfer Plan

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Lean Six Sigma Training

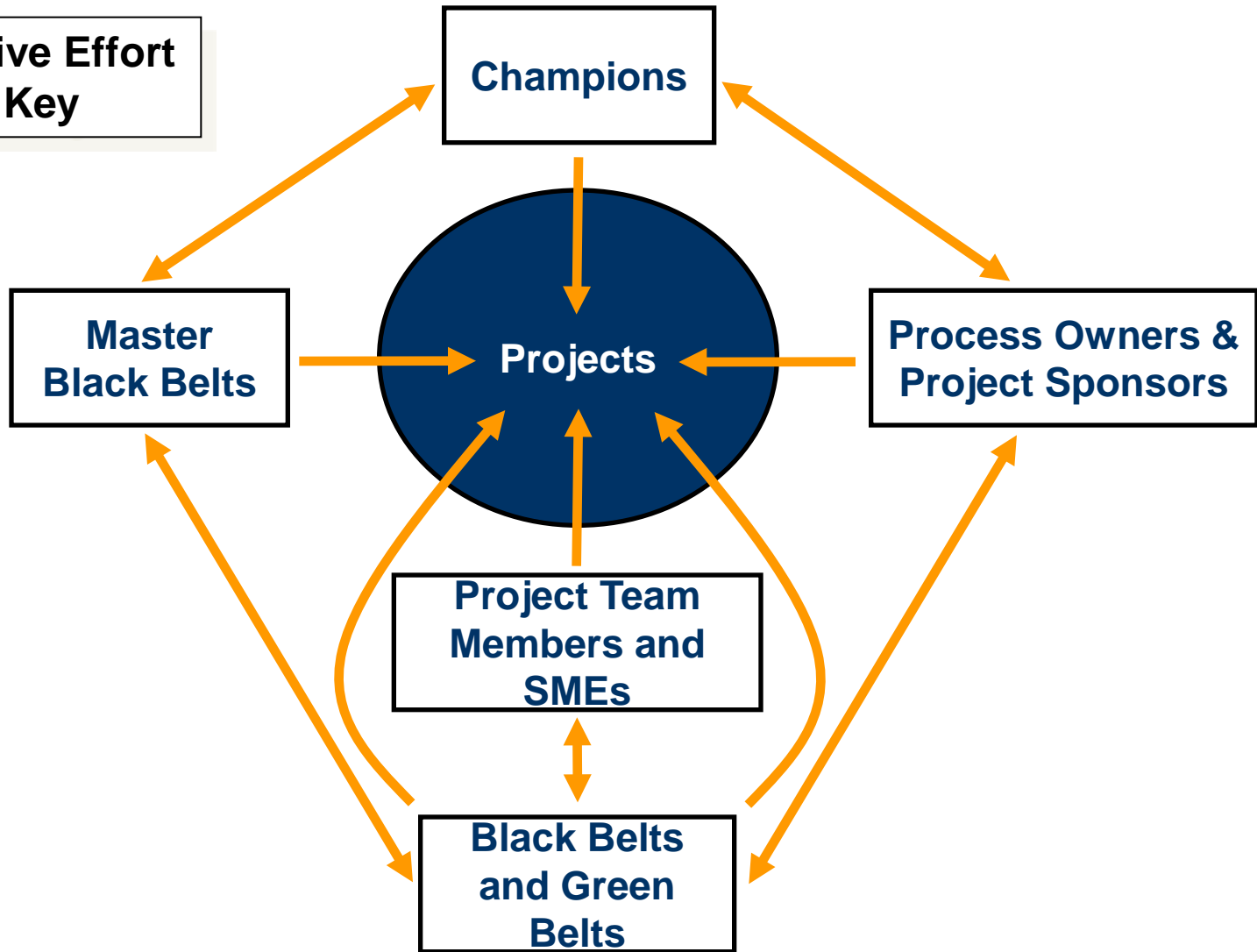
Lean Six Sigma Overview

Lean Six Sigma Improvement Methodologies

Lean Six Sigma Roles

Lean Six Sigma Roles

**Collaborative Effort
is the Key**



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Champions / Executive Leadership

- ✓ Monitors the external and internal factors affecting the business
- ✓ Defines business strategy
- ✓ Communicates the plan for business success
- ✓ Champions Lean Six Sigma vision
- ✓ Establishes improvement priorities and targets
- ✓ Provides and aligns resources (Sponsors, Black Belts / Green Belts), ensures cross-functional collaboration
- ✓ Establishes accountability for results
- ✓ Role modeling appropriate behaviors, change leader
- ✓ Integrates Lean Six Sigma into business direction & plan
- ✓ Markets Lean Six Sigma program and results

Process Owners

- ✓ Assists in identifying potential Lean Six Sigma projects
- ✓ Approves and supports projects
- ✓ Provides resources to serve as team members and subject matter experts (SMEs) on projects
- ✓ Approves changes in project scope and removes barriers
- ✓ Owns the solution delivered by the project team
- ✓ Responsible for supporting implementation of improvement actions

Project Sponsors

- ✓ Provides and aligns resources (Black Belts / Green Belts, Team Members), ensures cross-functional collaboration
- ✓ Establishes improvement priorities, targets and accountability for results
- ✓ Role modeling appropriate behaviors, change leader
- ✓ Ensures project is aligned with department and strategic objectives
- ✓ Approves all phases of Lean Six Sigma projects
- ✓ Ensures project deliverables are being maintained and project is on time and on budget
- ✓ Approves changes in scope of the project, removes barriers
- ✓ Markets Lean Six Sigma program and results

Master Black Belt

- ✓ Part-time or full-time position
- ✓ Provides expertise on Lean Six Sigma tools and techniques, including project management and change management
- ✓ Provides strategic direction to leadership and project team
- ✓ Identifies projects critical to achieving business goals
- ✓ Is ultimately accountable for project success
- ✓ Serves as main champion during change implementation
- ✓ Identifies, trains, coaches and evaluates Black Belts / Green Belts and Team Members
- ✓ Ensures cross-functional & cross-team collaboration
- ✓ Acts as Lean Six Sigma advisor to Champions, Sponsors and Process Owners

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Black Belt

- ✓ Full-time position
- ✓ Provides direction and leadership for project team, manages inter-project communications
- ✓ Delivers results through application of Lean Six Sigma methodologies
- ✓ Provides skills training when needed
- ✓ Accountable for reporting project progress and coordinating communication to project stakeholders
- ✓ Maintains all documentation from project, prepares and submits deliverables
- ✓ Manages implementation of solutions, ensures transition of improved process to the business
- ✓ Acts as a change catalyst

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Green Belt

- ✓ Part-time position
- ✓ Provides direction and leadership for project team, manages inter-project communications
- ✓ Delivers results through application of Lean Six Sigma methodologies
- ✓ Provides skills training when needed
- ✓ Accountable for reporting project progress and coordinating communication to project stakeholders
- ✓ Maintains all documentation from project, prepares and submits deliverables
- ✓ Manages implementation of solutions, ensures transition of improved process to the business
- ✓ Acts as a change catalyst

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Project Team Members

- ✓ Part-time position
- ✓ Team player in application of Lean Six Sigma methodologies
- ✓ Provides expertise and feedback to the project team
- ✓ Is responsible for tasks within the team action plan
- ✓ Delivers regular updates to team on status of action steps
- ✓ Acts as a change catalyst

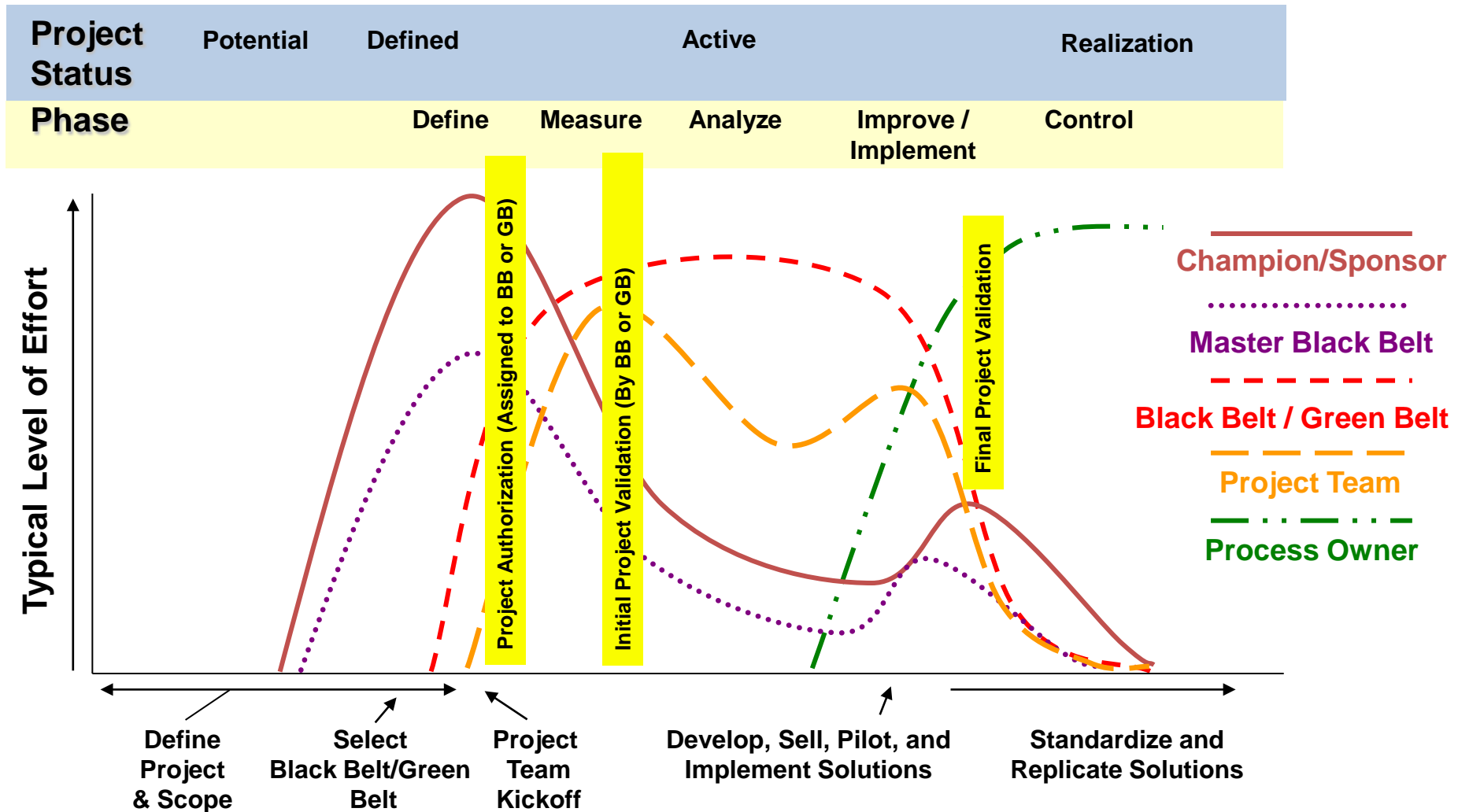
Subject Matter Experts (SME)

- ✓ As-needed position
- ✓ Provides subject matter expertise and feedback to the project team
- ✓ Acts as a change catalyst

Finance Analysts (also a SME)

- ✓ Part-time role
- ✓ Responsible for providing financial support to Lean Six Sigma deployment
- ✓ Provides standard, consistent guidelines for project valuation
- ✓ Provides financial savings forecast for potential projects
- ✓ Estimate project savings during the project execution
- ✓ Track / validate actual project savings after project closure

DMAIC Project Deployment Effort Required



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Summary of Lesson

What you learned during this lesson:

- ✓ Understanding what Lean Six Sigma is
- ✓ Introduction to the various Lean Six Sigma Improvement Methodologies
- ✓ Understanding of what the Lean Six Sigma Roles and Responsibilities are

Lean Six Sigma Training

End of Lesson: Lean Six Sigma Introduction



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Lean Six Sigma Green Belt

S i m c o



International

Simulated Project Workbook

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Simulated Project Overview

Welcome to the Lean Six Sigma Green Belt Simulated Project.

At Acuity Institute we recognize that not every individual has the opportunity to complete an actual Lean Six Sigma project while completing training, therefore we have created a real world simulated project that takes students from the beginning to the end of a problem and solution. The simulated project helps to build the students understanding of the concepts taught in training and provides practical application of the tools. Students complete the course better prepared to apply what they have learned in the real world.

The simulation is based on a hypothetical company (Simco International or “SI”) that faces many of the same problems companies are dealing with today. The simulation is designed to illustrate the entire business improvement effort through every phase of the Lean Six Sigma DMAIC methodology. Students complete challenging exercises (project deliverables) which build on previously learned tools and concepts taught in training. When complete, students have a significant perspective on what true business improvement means and a tangible “project story” that they can utilize throughout their process improvement journey.

There is no comparison to Acuity Institute’s Simulated Project in the marketplace.

Simulated Project Deliverables

Acuity Institute's Lean Six Sigma Green Belt Simulated Project includes 32 project deliverables which are introduced throughout the DMAIC Methodology.

Define

1. Project Charter Development
2. SIPOC
3. As-Is Process Mapping
4. Quick Win Opportunities
5. Identify Stakeholders
6. Develop Stakeholder Map
7. Stakeholder Management Plan
8. Communication Plan
9. VOC Questions
10. CTQ Determination

Measure

11. Operational Definitions
12. Data Collection Planning
13. Histogram
14. Run Chart
15. Control Chart
16. Sigma Performance (DPMO)

Analyze

17. Cause and Effect Analysis
18. Lean Process Analysis
19. Pareto
20. Box Plots
21. Correlation Analysis
22. Regression Analysis

Improve

23. Solution Selection Matrix
24. Cost/Benefit Analysis
25. Mitigating Risks (FMEA)
26. Pilot Plan
27. Implementation Planning
28. Storyboarding

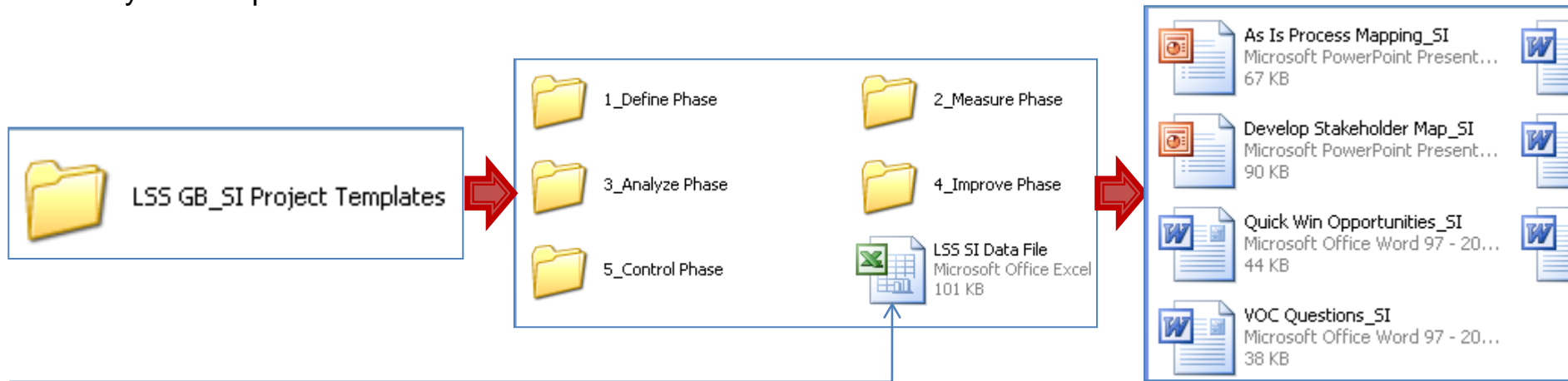
Control

29. Process Monitoring Plan
30. Dashboard Development
31. Response Planning
32. Final Project Storyboard

This is a sample version of the eBook. The sample version includes limited content. This eBook is for personal use only.

Simulated Project Templates

There are “blank” templates for you to complete for all 32 Simulated Project deliverables. The templates are located in the “LSS GB_SI Project Templates” file folder. The templates are developed in common formats (MS Word, MS Excel, or MS PowerPoint). To access the templates you will need to download this file folder onto your computer.



For your reference, the name of the specific template that you are to complete is included in the instructions of the project deliverable you are working on (example: “SI Project Template: Project Charter Development_SI”). Please note, answers are provided as a reference point for many of the project deliverables. In most cases we do not recommend updating your answers to match the answers provided. It is important for your answers to be authentic to your experience as you complete the Simulated Project.

In addition to the project templates, the “LSS GB_SI Project Templates” file folder also contains the MS Excel file “LSS SI Data File”. This file includes data to be used for various Simulated Project deliverables. This course includes step by step instructions on how to complete these deliverables using both SigmaXL and Minitab statistical analysis software.

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