

THE

Engage your employees
at all levels of the
organization with this
simplified approach!

LEAN

Simple Steps For 50+ Of The Most
Common Lean Sigma Tools
Along With Photos
Of Lean Sigma In Practice


SIX SIGMA

POCKET

GUIDE XL

Combining the Best of Both Worlds
Together to Eliminate Waste!

Rob Ptacek
Jaideep Motwani, Ph.D.



The Lean Six Sigma Pocket Guide XL

*Combining the Best of Both
Worlds Together to Eliminate
Waste!*

**Rob Ptacek
Jaideep Motwani, Ph.D.**

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Message to Black Belts

This book bridges the gap between a highly quantitative analysis of a process that requires extensive training (i.e., a Black Belt certification level) and a more simplified approach that can be used and understood by the masses. The goal of this book is to make the methods and tools of Six Sigma and Lean accessible to more people and take a commonsense approach to problem solving and continuous improvement. This pocket guide is intended to be used by Black Belts, Lean Senseis, Continuous Improvement Specialists, managers and supervisors of departments and work groups, and improvement team members, etc. in their efforts to improve the overall performance and costs for their organization. There are over 100 different types of tools, including charts, graphs, and various types of worksheets available in the continuous improvement "bag." This pocket guide takes the 50+ most common tools and presents them in a standard way in which the information can be used to assist you in your improvement activities.

The digital photos and examples contained in this pocket guide are from a wide range of industries and organizational functions to assist all team members to fully understand the tool's usage and purpose. If you have an example you would like to share, please contact us at info@theleanstore.com and we would be more than happy to consider your example.

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Publisher's Message

Looking for the latest and greatest methods or ideas in continuous improvement? Google "Lean," "Lean production," "continuous improvement methodologies," "Six Sigma methods," or "Lean Sigma" etc. and you will have pages and pages of links to solutions and promises to improve your productivity from a wide variety of educational institutions, non-profit and industry organizations, and consultants offering their services. Or, maybe you just want to find resources available that will enhance your current program. In either situation, this can be overwhelming. "Continuous improvement methodologies," "Lean production," "Six Sigma methods," or "Lean Sigma" etc. boils down to a simple process of identifying and eliminating waste through Total Employee Involvement (TEI).

We would like to thank the authors of the numerous outstanding books that have already been written on this topic of Lean Six Sigma. *Even though the Lean Six Sigma tools and the structured methodology discussed in this book are similar, we believe the focus on simple definitions, step-by-step procedures or guidelines, and digital photos and examples for each tool or concept makes this book unique from the others.* This should assist any type organization, from manufacturing to healthcare to financial services, etc. in the proper selection and use or application of over 50 Lean Six Sigma tools.

The premise of *The Lean Six Sigma Pocket Guide XL* is that most potential "improvement ideas" within an organization are closer than they appear. Many of these improvement "ideas" are already in your employee's thoughts - they just may need a little assistance in getting from "there" to actionable activities. *The Lean Six Sigma Pocket Guide XL* is meant to provide that "assistance" through the standard format provided.

The Lean Six Sigma Pocket Guide XL's format is similar to the premise of a popular TV show from the 1970s called Dragnet. One of Dragnet's main characters was Sgt. Joe Friday, who insistently asked female informants to provide "Just the facts ma'am" in an investigation of a crime. To follow on with that theme, this book is meant to provide you with "Just the facts." Therefore, we are presenting the Lean and Sigma tools within the Six Sigma methodology to better engage employees at all levels of the organization in getting those "ideas" into improved, more productive work processes.

It has to be acknowledged that there are projects that require a sophisticated problem solving and quantitative analysis approach; however, nearly 80% of the issues and problems from these author's experiences can be solved with the tools and methodology portrayed in this book.

We have over the years published many books specific to industries and at the end of the day, the Lean or Six Sigma tools and principles and how they are implemented, and in what type of environment or industry, are very similar. 5S is 5S, whether applying it to create better tooling access for an operator during a machine setup, or to better organize a filing system for paper-based customer orders, applications, files, etc., or to better organize electronic files and folders on an individual's C:/ drive or the company's shared network drive.

The Lean Six Sigma Pocket Guide XL is meant for the front-line employee and their supervisor as a quick-reference guide when working on a team-based continuous improvement project or individually implementing an improvement (i.e., *Today's Lean!* - *Jiffy Kaizen* book) initiative. *The Lean Six Sigma Pocket Guide XL* is meant for all level of employees to gain a working knowledge of the Lean tools within the Six Sigma structure (and its quantitative analysis tools) - bringing the best of both worlds together!

Don Tapping
Publisher

Author's Bios

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Mr. Ptacek is a Partner in the Global Lean Institute and President and CEO of Competitive Edge Training and Consulting, a firm specializing in leader and organizational development, and Lean Enterprise transformations. He is an Approved Scanlon Leadership Network Consultant. Mr. Ptacek holds a BS in Metallurgical Engineering from Michigan Technological University, Houghton, MI (USA), and a Masters of Management from Aquinas College, Grand Rapids, MI (USA).

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How to Use *The Lean Six Sigma Pocket Guide XL*

The Lean Six Sigma Pocket Guide XL is designed as a convenient and quick reference as you learn and implement the Lean and Six Sigma tools as they apply your business issues, problems, and performance gaps. You can put your finger on any tool within a matter of seconds!

Find the right tool for the right initiative by using the:

- ❖ Table of Contents offering a list of the tools organized by each of the D-M-A-I-C phases
- ❖ Lean Sigma Tool Usage Matrix organizing the Lean and Six Sigma tools and concepts relative to the D-M-A-I-C methodology (or phases)
- ❖ Index providing a quick access to a specific topic or tool
- ❖ Right-side book “bleeds” providing immediate access to each of the D-M-A-I-C phases

The tools are presented in a sequence that you would most likely first encounter using that particular tool. However, many tools are used repeatedly in the D-M-A-I-C Phases. For example, the Action Item Log is introduced in the Define Phase but will be most likely used in each of the phases, the Run Chart is introduced in the Measure Phase and will most likely be used (or updated) in the Control Phase, and so forth.

The Tour de France is an annual bicycle race held in France and nearby countries. We will be using that international event represented by the following icons to convey the various sections of each chapter:



Bike Racing icon - the *What is it?* is bold-italicized words used to define the tool or concept as well as the detailed characteristics, features, and salient points needed for an overall understanding of the tool or concept. This is similar to the beginning of the race, where everyone is poised and ready for the cycling event.



Jersey icon - the *How do you do it?* is the step-by-step procedures (or guidelines) and benefits of the tool or concept. This is similar to winning one of the stages in the cycling event where team strategies and adjustments may need to be made.



Champs-Élysées icon - the *Lessons Learned* is the application of the specific tool as a digital photo or worksheet example from a wide variety of industries - a picture is worth a thousand words. This is similar to completing the event at the historic Paris, France landmark and determining what went well and what needs to be improved at the next cycling event.

The information presented after each icon should provide sufficient knowledge to assist you in your continuous improvement opportunity.

Note: We have kept this book, for all intents and purposes, statistical-free. There will be times when more statistical analysis will be required in your project, if so, please consult additional materials, a Six Sigma Black Belt, or your quality department.

Note: All the forms, worksheets, charts, graphs, etc. described in this book can be easily created in Microsoft Office (Word, Excel, etc.). However, your organization also may have similar forms in the Customer Relationship Management (CRM) or some other application being used.

What is Lean?

Lean is a never-ending, systematic approach for identifying and eliminating waste, and improving flow for a process. Lean is a way of thinking that can fairly easily be applied to every type of organization. The entire focus of Lean is customer-driven and it is the customer who determines the value and the amount they are willing to pay for the product or service.

There are basically three reasons why Lean can be used with confidence. First of all, the training requirements and implementation time for Lean are minimal. Basic concepts of Lean can be taught very quickly and improvements can be implemented the same day. For example, when an individual understands that some of their daily activities are non value-added or waste (activities such as excess time spent walking, waiting, and moving), immediate changes can be made to improve the process. Waste reduction will become automatic for people as they become aware of waste. Improvements are continuously made at all stages of work. Often, the completion of one improvement stimulates the participants to think of other areas for improvement.

Secondly, Lean's application in an organization is broad. Six Sigma projects are more narrowly focused and typically have a direct correlation to strategic priorities and the bottom line. In Lean, tools such as 5S can get everyone engaged fairly quickly and easily with no additional resources required. 5S is a workplace organizational program that assists to improve efficiencies by having work (electronic and paper-based), supplies, or equipment for areas or processes in the right place.

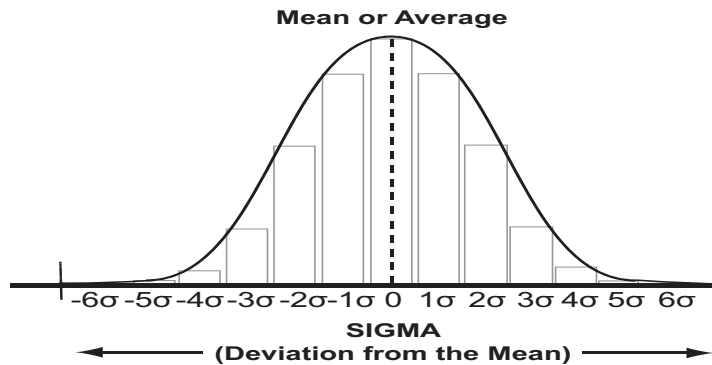
The third reason is that improvements made while utilizing Lean concepts can positively impact other areas of the organization as well as have a positive impact on the bottom line. Customers are more satisfied with the decreased wait times, reduction of duplicate documentation, and fewer errors or mix-ups. In Lean, employees are encouraged and empowered to improve their work processes.

Lean concepts and tools will greatly assist in a Lean Sigma transformation. It is essential that people at all levels be trained in and understand the Lean tools and concepts to facilitate a smooth and effective Lean Sigma transformation. Do not underestimate the power of these tools and concepts that will be explained in detail throughout this pocket guide.

What is Six Sigma?

Six Sigma is a statistical term. Sigma (σ) defines the variation or “spread” of a process. Six Sigma defines how much of the total process falls inside the normal process variation. Six Sigma, as a business tool, is a structured, quantitative, five phase approach to continuous improvement and problem solving. The five phases are: Define - Measure - Analyze - Improve - Control and are commonly referred to as the D-M-A-I-C process. Each of these phases will be explained in detail throughout this pocket guide.

The term Sigma refers to the number of standard deviations that are away from the mean in a bell-shaped normal distribution curve, as shown below:



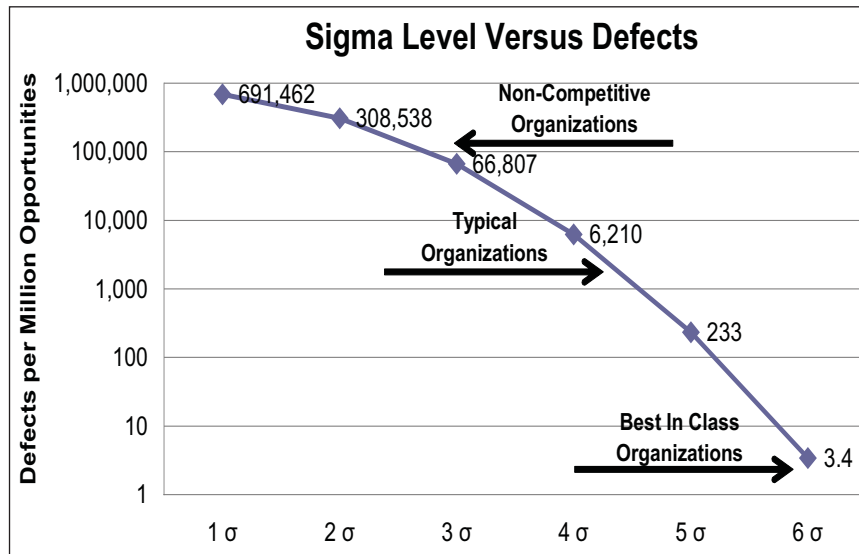
The goal of Six Sigma is to eliminate defects and minimize variability. In statistical terms, if an organization, department, or process achieves a Six Sigma level of performance, 99.99966% of its process outputs are defect-free and meet expectations. In other words, that organization, department, or process will have no more than 3.4 defects per million opportunities (of errors). The table below summarizes the sigma or variation level and error rate per million opportunities:

Process Capability or Sigma Level	Defects (or Errors) Per Million Opportunities (DPMO)	Percent Acceptable
6 σ	3.4	99.99966%
5 σ	233	99.9767%
4 σ	6,210	99.379%
3 σ	66,807	93.32%
2 σ	308,538	69.15%
1 σ	691,462	30.9%

Six Sigma forces organizations to pursue perfection by asking if 99% acceptability is good enough. If 99% acceptable is good enough, consider the following:

99% Good (3.8 Sigma)	99.99966% Good (6 Sigma)
20,000 lost articles of mail per hour (based on 2,000,000/hr)	Seven lost articles 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 daily at an airport with 200 flights/day	One short or long landing every five years
2,000,000 wrong drug prescriptions each year	680 wrong prescriptions per year
No electricity for seven hours each month	One hour without electricity every 34 years

The following Sigma Level Versus Defects chart below highlights the sigma levels for three broad categories of organizations:



What is Lean Six Sigma?

Lean Six Sigma (or Lean Sigma) is the combination of customer-focused and waste elimination efforts of Lean with the quantitative analysis and structured D-M-A-I-C methodology of Six Sigma. Lean Sigma can be, and is for many organizations, a very powerful business improvement tool. It systematically blends the best of the two approaches to eliminate all waste (i.e., non value-added activities) and variation from a process which subsequently lowers the cost and improves the quality of the process. The continued focus on the elimination of waste should be a daily, hourly, or minute-by-minute review. Lean Sigma is designed to use people and resources wisely to satisfy customer needs; work elements or job duties may need to be modified to accommodate a waste-free Lean Sigma environment. This will allow companies to remain globally competitive, develop a cross-trained workforce, and establish a safe workplace while pleasing the customer.

Lean Sigma tools are used to:

- ❖ Improve customer satisfaction
- ❖ Identify and eliminate waste quickly and efficiently
- ❖ Increase communication and speed of services and information at all levels of the organization
- ❖ Reduce costs, improve quality, and meet obligations of a product or service in a safe environment
- ❖ Initiate improvement activities and empower employees to make improvements themselves
- ❖ Track and monitor improvements to ensure sustainability

Lean Sigma is truly a compilation of world-class practices.



Lean Six Sigma Philosophies and Principles

The overriding theme for a solid foundation rests with understanding and practicing Lean Sigma Philosophies. The philosophies of a continuous (relentless) elimination of waste and non value-added activities in everything we do and the conservation of all resources, at every level of operation are key to a successful Lean Sigma transformation of any kind. Additionally, Lean Sigma philosophy calls for the simplification of all tasks and efforts to eliminate waste and improve flow. Absolute perfection is seen as the goal. Very few organizations embrace Lean Sigma Philosophies at this level. Toyota Motor Company has been practicing Lean (Sigma) for over 70 years, and due to their quality problems and brief lack of customer focus in 2009 - 2010, still need to improve!

Creating this foundation of Philosophies and Principles will ensure the required support is available as additional efforts in Lean Sigma Concepts and Lean Sigma Methods are applied through the use of Lean Sigma Tools.

Conceptually, these building blocks are illustrated in the diagram below. Starting with a strong foundation of Lean Sigma Philosophies and Lean Sigma Principles, these can be used to support an organization utilizing Lean and Sigma Concepts and Tools in providing the Methods to Delight Customers and (obtain) Profitable Growth.



* Not all inclusive of Lean Sigma tools

Lean Concepts

Lean Sigma Principles must also be present for Lean Sigma transformations. They provide the unchanging, solid foundation to build and improve upon. The three key Lean Sigma Principles, supported by Lean Sigma Philosophies, are:

1. Continuous Improvement in Processes and Results – Do not be “results or bottom-line only” focused. Instead, focus on processes that deliver consistent, waste-free results.
2. Focus on Customers and Value Streams – Focus on the entire process, from the customer pull or demand to demand fulfillment and customer satisfaction. Focus on how materials, information, or service requests flow through a process.
3. Employee Involvement – Organization leaders must make it safe and as easy as possible for people to engage in improvement activities.

Creating this foundation of Philosophies and Principles will require that management support this endeavor by making employee training robust, being sincerely involved when and where practical, and letting those closest to process be involved in any change. The fundamental Lean concepts that comprise the pillar of Lean Concepts are:

- ❖ Value and Waste
- ❖ Quality First
- ❖ Speak with Data and Facts
- ❖ Customer Focus
- ❖ Total Employee Involvement
- ❖ Plan-Do-Check-Act
- ❖ Flow
- ❖ Waste Elimination
- ❖ Performance Measures

Six Sigma Concepts

There are several Six Sigma concepts that will drive a Lean Sigma transformation. At the heart of Six Sigma is the Design-Measure-Analyze-Improve-Control (DMAIC) methodology and its statistical analysis for problem solving. Following each of these steps ensure the improvement project is completed in an orderly manner as well as will ensure it is sustained. It is essential that people at different levels be trained in and understand these Sigma concepts to facilitate a smooth and effective Lean Sigma transformation. The fundamental Six Sigma concepts that comprise the pillar of Lean Concepts are:

- ❖ Scientific Method
- ❖ Statistical Methods
- ❖ Focus on Variation
- ❖ Proven Methodology
- ❖ Look for Hidden Wastes
- ❖ D-M-A-I-C
- ❖ Quantitative Analysis
- ❖ Voice of the Customer
- ❖ Zero Defects
- ❖ Common Goal of Six Sigma

At the heart of applying the Lean and Six Sigma tools is the overall goal to understand, identify, and then eliminate (or reduce) waste. The following are the 12 wastes and are also referred to as The Dirty Dozen:

1. Overproduction
2. Inventory or Work In Process (WIP)
3. Waiting or Delays
4. Motion
5. Transport
6. Defects or Errors
7. Overprocessing
8. Skills and Knowledge
9. Unevenness
10. Overburden
11. Environmental Resources
12. Social Responsibility

For a detailed explanation of these wastes, please see the Waste Audit in the Appendix and the book, *Today's Lean - Learning About and Identifying Waste* available at www.theleanstore.com.

Lean Six Sigma Tool Usage Matrix

The Lean Six Sigma Tool Usage Matrix guides a facilitator in applying the right Lean or Six Sigma tool or concept at the right time. The matrix was created to provide an understanding that the tools of Lean and Six Sigma are very much interrelated. Many times a particular tool will be used in numerous Phases. The matrix provides the following:

1. Ensures tools are utilized with the right intent (e.g., you would not want to create standard work without having people involved in the data collection of process cycle times)
2. Raises awareness that many tools require process level information (Total Employee Involvement)
3. Creates an understanding of that the application of Lean Sigma follows a structured approach

The tools are presented in a logical method that the authors have found successful in their years of working in organizations. The measure of success is not whether you used all of the tools listed or followed this matrix tool-by-tool, but whether you used the right tools properly to correct and eliminate the problem.

	DEFINE - Chapter 4	MEASURE - Chapter 5	ANALYZE - Chapter 6	IMPROVE - Chapter 7	CONTROL - Chapter 8
Lean Sigma Tools					
Performance Dashboards	X				
Project Charter	X				
Teaming	X				
Effective Meetings	X				
Team Charter	X				
Project Planner	X				
Action Item Log	X				
Issues and Opportunities Log	X				
Voice of the Customer		X			
Quality Function Deployment		X			
Value Stream and Process Maps		X			
Supplier-Input-Process-Output-Customer (SIPOC)		X			
Key Metric Data Profiles		X			
Check Sheets and Frequency Charts		X			
Run Charts		X			
Measurement System Analysis		X			

	DEFINE - Chapter 4	MEASURE - Chapter 5	ANALYZE - Chapter 6	IMPROVE - Chapter 7	CONTROL - Chapter 8
Lean Sigma Tools					
Value-Added versus Non Value-Added Analysis			X		
Pareto and Pie Charts			X		
Constraint or Bottleneck Analysis			X		
Demand Analysis and Takt Time			X		
Histograms, Ogive Charts, and Cumulative Frequency			X		
Cause and Effect (or Fishbone) Diagrams			X		
Brainstorming			X		
5 Whys			X		
Radar Charts			X		
Scatter Plots			X		
Process Capability			X		
Force Field Analysis			X		
Interrelationship Diagrams			X		
Impact Maps			X		
Employee Balance Charts			X		
Rapid Improvement Events				X	
Plan-Do-Check-Act (PDCA) Process				X	
5S				X	
Visual Controls				X	
Mistake Proofing				X	
Standard Work				X	
Process or Work Area Layout				X	
Mass Customization				X	
Flow				X	
Quick Changeovers (QCO)				X	
Total Productive Maintenance (TPM)				X	
Cross-Training				X	
Project Management					X
Statistical Process Control (SPC)					X
Visual Management					X
Standard Work for Leaders					X
Performance Management					X
Problem Solving - Corrective and Preventative Actions					X
Layered Process Audits					X