Preface

*Lean Six Sigma Approaches in Manufacturing, Services, and Production* provides a synergistic view of Lean and Six Sigma to educators, quality management practitioners, and managers to fulfill customer’s demands through the knowledge of the most efficient use of resources that includes distribution capacity, inventory, and labor on a global scale. Various aspects of optimizing the supply chain by including lean principles in the processes are eliminating bottlenecks, sourcing strategically to strike a balance between lowest material cost and transportation, implementing JIT (Just In Time) techniques to optimize manufacturing flow, maintaining the right mix and location of factories and warehouses to serve customer markets, and using location/allocation, vehicle routing analysis, dynamic programming, and traditional logistics optimization to maximize the efficiency of the distribution side. Lean uses a systematic approach to eliminating non-value-added activities throughout a production system. Five basic principles characterize a lean production system: value definition, value stream mapping, flow optimization, pull production, and continuous improvement. Lean is all about speed and waste reduction. Lean is a methodology that can improve cycle time, throughput, and eliminate common types of process waste. Lean has a different focus from Six Sigma. It starts with defining value in terms of the benefits the customer gains from the goods and services produced via rapid improvement or kaizen events instead of “projects.” Lean professionals work with subject matter experts to understand the “value streams” (the end-to-end process tasks that when combined together add value to the good or service produced). The teams review and match processes with customer demand.

The book is a repertory of ways to improve the quality of process outputs by identifying and removing the causes of defects (errors), while minimizing variability in manufacturing and business processes. It uses a set of quality management methods, including statistical methods, and an infrastructure of people within the organization (“Champions,” “Black Belts,” “Green Belts,” “Orange Belts,” etc.) who are experts in these very complex methods. Each Six Sigma project follows a defined sequence of steps through quantified value targets, namely process cycle time reduction, customer satisfaction, reduction in pollution, cost reduction, and/or profit increase.
The book also illustrates approaches used by companies to achieve world-class performance and customer satisfaction. Through the utilization of principles and techniques specific to Lean Six Sigma, many organizations improved their ability to provide added customer value to their products. A six sigma quality level metric is an indicator of how often defects are likely to occur. The higher the sigma quality level describes a process, the less likely it is to create defects. Six Sigma projects focus on reducing variability in critical processes that are important to the customer. Six Sigma is typically associated with a process model that systematically applies statistical tools to reducing process variation and thereby eliminating defects. The goal most frequently identified with Six Sigma is reducing process output variation on a long-term basis, producing a maximum of 3.4 parts per million defective. Typical disciplined roadmaps are utilized for new products and processes and also for improvements to existing products and processes. As a business improvement methodology that maximizes shareholder value by achieving the fastest rate of improvement in customer and employee satisfaction, Lean Six Sigma achieves cost reduction, quality, process speed, and invested capital. Nowadays, there is a very high demand for individuals with Lean Six Sigma expertise.

Lean and Six Sigma as process improvement methodologies have delivered results, when successfully implemented, over countless times and thousands of projects across hundreds of businesses (e.g. General Electric, Toyota, Caterpillar, Lockheed Martin, Northrup Grumman, Raytheon, and many others). This has been well documented in multiple research publications and textbooks.

What is inconsistent, however, is the efficiency by which organizations attain their desired results in achieving major cost, inventory, and lead-time reductions. Dramatic success can be obtained in a year and often over multiple years depending on the deployed strategy, resource commitments, and top management support. Typically, the Project Leaders (Belts) and Teams reach solutions to problems under the guiding support of Consultants or Master Black Belts (MBB), but it is crucial to have an organizational approach to ensure top management provides support via roadblock removal and providing the right resources of dollars and time. Many companies, and maybe direct competitors, are improving at a very slow rate. This fact can be a great competitive advantage to companies if they find a way to exploit the opportunity.

The best Lean Six Sigma programs require:

- A deep enough experience of how to tackle specific problems with an efficient approach.
- A broad enough experience to use the approach to tackle multiple/different types of problems that could be addressed in an organization.
• Technical skills to be able to guide Lean Six Sigma personnel in specific tool usage.
• An unrelenting commitment to the methodology realizing that it can have a positive impact on organizations’ “quality culture” and improved customer satisfaction.
• Benchmarking the appropriate organizations and approaches that can provide the best solutions for the improvement process.

Any organization’s employees will benefit from the increased training and education opportunities. Businesses can utilize employees’ collective wisdom and knowledge to make the necessary operational improvements that are uncovered through the defined projects. This book is designed for professionals and researchers working in the field of supply chain, both from theoretical and practical points of view. It also provides insights to the executives responsible for understanding the technology and utilizing it to positively impact their businesses. The concepts introduced in this book fill the void created by the non-existence of an exhaustive source on the subject by demonstrating clearly how these key concepts and tools apply in decision making.

Practically, Six Sigma projects are selected by “Champions,” working with others, to align projects with organizational goals. The Champions gather information from organization stakeholders and customers to determine the projects to launch. Project nominations can come from many sources such as reviewing customer complaint data, customer feedback surveys, review of internal cost of poor quality metrics, audits, alignment of business plans, and existing projects (separated into smaller, more manageable projects). Often the best approach is to ask the frontline employees (customer service, sales, etc.) who often are the first to recognize opportunities for improvement.

Champions, leaders, MBB, or other experts can collect specific, objective data on how each identified problem may impact the organization. Some common areas to collect data include:

• Satisfying internal stakeholders and external customers;
• Achieving strategic goals;
• Reducing cost;
• Enhancing employee satisfaction; and
• Reducing cycle time.

The chapters show that Lean Six Sigma methodology can be one of the best available to complete a project. The Master Black Belt and or Black/Green belts assigned to the project can determine the best tool set depending on the problem
statement provided by the Champions. Many organizations start with a Six Sigma or just a Lean focus and ultimately find a convergence of the two approaches. No matter which one of the approaches is used to start—Lean or Six Sigma—it will eventually be driven to the other approach to achieve high quality, high speed, and low cost. When both Lean and Six Sigma are used simultaneously, improvements can be made across the organization much more rapidly, as shown by the formula below:

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\text{Six Sigma} = \text{Quality (variation reduction)} \quad \text{and} \quad \text{Lean} = \text{Speed. Therefore, Lean Six Sigma} = \text{Quality with Speed.}
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The audiences that will find this book valuable will be composed of the following:

- Process Improvement Project Leaders (Green or Black Belts) across all industries who are leading projects to improve processes using the tools and methodologies of Lean or Six Sigma.
- Project Champions or Sponsors pondering what questions to ask of project leaders and how to determine if the project is meeting objectives.
- Technical Leaders (Master Black Belts) looking to improve project and tool usage and mentoring skills.
- Deployment leaders seeking better project alignment and selection processes.
- Consultants seeking improvement in technical skills and strategy deployment of the methodologies.
- Senior Leaders who are looking for new approaches to “jump start” current improvement processes or to create an entirely different process within their organization.

The following is a brief description of each of the chapters.

Chapter 1 introduces the practices of Total Quality Management (TQM) in multinational corporations, thus explaining the history, overview, concept, and the various components of TQM. TQM practices and organizational culture, TQM practices and organizational performance (in terms of quality data and reporting, supplier quality management, product and service design, and process management), and the practical application of total quality management in service and manufacturing sectors are discussed. This calls for a change on the part of organization stakeholders to adopt these new practices through an effective in-service training for managers and staff to adequately put these principles into practice and by adopting an effective utilization of human resources to initialize and maintain the attempts to create a dynamic quality system. The chapter argues that applying total quality management practices in multinational corporations will significantly enhance organizational performance and achieve business goals in the global business environment.
Chapter 2 demonstrates how Enterprise Resource Planning (ERP) and Lean Six Sigma have been two of the hottest topics in business. The author affirms that companies have spent millions of dollars implementing both of these, and the resulting benefits have been mixed. In this chapter, the authors examine the basic foundation of ERP and what drives organizations to implement ERP systems that cost hundreds of millions of dollars. The chapter also explores the history of ERP and who was and are the major players in the marketplace.

Chapter 3 introduces a general framework for Nondestructive Evaluation (NDE) application in Supply Chain Management (SCM). With the support of emerging and existing technologies related to supply chain implementation, nondestructive evaluation provides an enabling platform to analyze the design, planning, and operational decisions within the upper and downstream ends of the supply chain system. This clarifies supply chain goals, supports making of efficient decisions without constraints, identifies managerial strategies that improve overall supply chain performance, competitive advantage, and profitability. Unfortunately, the desired attention has not been paid to how the numerous nondestructive evaluation technologies can be applied to supply chain management and implementation. This chapter, therefore, considers both technical and business perspectives of this application. It is from these viewpoints that an application framework is proposed. It covers the various nondestructive evaluation methods, operational scenarios for each method, and application issues and challenges within the supply chain.

Chapter 4 illustrates how models for evaluating and improving delivery performance play an important role in the management of supply chains. A review of supply chain delivery models that use Six Sigma methodologies indicate that the models are limited to only make-to-order supply chains where improvement in delivery performance occurs at a fixed (static) point in time. In this chapter, the authors present a generalized delivery performance model that overcomes these limitations. The model presented here can be used to measure delivery performance in both make-to-order and make-to-stock supply chains and supports improvement in delivery performance over a planned time horizon with definable milestones for attaining targeted levels of improvement. Numerical illustrations of the model are presented.

Chapter 5 defines communication as a sharing of information between individuals or groups to reach common understanding or goals. Ensuring effective and efficient communication is important when dealing with complex structures such as a nuclear power generation environment. This calls for a need for partnership and dialogue between major stakeholders in government, industry, employees, and the public at large. Even though communication can alarm people to seek safety, it can be used to calm employees as well as generate a sense of urgency. This chapter uses a survey to investigate the relationship between communication and 13 critical factors of lean
management principles in an organization where safety is the fundamental component of the process. Data was collected and analyzed using Pearson’s correlation coefficient and regression analysis. The results show that friendliness, willingness, guarantee, criticism, self-esteem, and acceptance are positive predictors of a lean communication and responsibility is negative.

Chapter 6 illustrates how the current management literature is replete with advocates for employee engagement. The author asserts that not many would argue that engendering ownership and responsibility along with the reported organizational benefits are worth aspiring to achieve. However, the actual results of workplace surveys report very little advancement towards widespread employee engagement. He continues arguing that disengagement appears to be more of the norm. In spite of management best efforts and desires to “do the right thing,” the general whine from the front-line trenches is that things are “good talk, but no real action.” The author demonstrates that assessments consistently shows as organizational success and growth come, things start falling apart, resulting in missed deliveries, waste, worker frustration, dissatisfied customers, and lower profit margins. Therefore, he clarifies that Lean best practices, heralded by many market-place leaders, demonstrate results-oriented and proven ways of gaining employee engagement along with extraordinary performance to everyone’s satisfaction (customers, owners, employees, and community). The author concludes that this chapter is a recording of the employee engagement characteristics. This cataloguing effort can be matched to prevalent Lean principles that are promoted as providing a mature and proven system for advancing engagement, while at the same time being less theoretical than much of the published employee engagement guidance.

Chapter 7 reports that global competition in manufacturing production companies is placing increasing pressure on CEOs to innovate. The author use as evidence SA8000, global manufacturing organizations that have a responsibility to use manufacturing systems that ethically produce the most bottom-line profit which increases productivity. The author implies that the level of productivity is the single most important determinant of a country’s standard of living. He defines Lean Six Sigma as a methodology that combines process speed with quality, which can enable manufacturing companies to continuously innovate, improve, and measure subsequent improvements for profitability globally. The author concludes that fostering industry, academic, and government relationships can prove to be an effective strategy for Lean Six Sigma innovation and implementation and that Lean Six Sigma principles must be taught and practiced if graduates are to be prepared to compete globally.

Chapter 8 analyzes several disaster events, such as September 11, 2001, Hurricane Katrina, and the Earthquake in Haiti, and the lessons they have taught America and the world about the importance of preparing for emergency response, both to natural and man-made disasters. The authors define a disaster as a condition or event
that requires an emergency response, and in any form that often occurs without any prediction. They imply that there are various levels of information uncertainties that are associated with a disaster. Because of these uncertainties, emergency response decision making often relies on incomplete information and imprecise data. However, decisions to respond to disasters must be made in a timely manner as well as accurately so as to minimize possible loss of lives and properties. The authors stipulate that in addition to information uncertainty, the domain of emergency response requires the interaction and collaboration of multiple stakeholders with different Standard Operating Procedures (SOP). They also affirm that including lean principles in the conception and design of any system to minimize failures in information management of these multifaceted stakeholders can avoid a response that is as equally devastating as the disaster itself. Therefore, the authors analyze the impacts of lean principles in the understanding, conception design, and implementation of a Command and Control (C2), its nature, and the characteristics of an emergency domain, providing better insight to the problems associated with information processing during an emergency response planning.

Chapter 9 clarifies emerging aspects and trends of Lean Six Sigma (LSS) in healthcare through the systematic examination of 162 peer-reviewed articles in business, management, and healthcare disciplines that have been published over a ten-year period from 2004 to January 2014. Every article is analyzed using a scheme of six distinct dimensions including year of publication, journal, applications areas, tools and techniques, benefits and improvements, and research type. The chapter provides significant insights into the state of the art of LSS in healthcare research and clarifies confusion in the literature as to what constitutes LSS role in improving healthcare context.

Chapter 10 identifies specific leadership traits for green and black belt Six Sigma leaders that have a statistical relationship with the success of Six Sigma projects. The author tests the reliability of a scale created from the Leadership Trait Questionnaire (LTQ) tool. With approximately five hundred (N = 500) Six Sigma leaders who were selected from a Tyco Electronics database called Tyco Electronics Business Improvement Tracking (TBIT), the criteria for participation were:

- They were master black belts, black belts, green belts, or lean practitioners;
- Their projects were related to Six Sigma;
- Their projects had a hard cost savings; and
- They work in North America, Asia or Europe, Middle East, Africa (EMEA).

The author uses the LTQ tool to measure personal characteristics or traits that are directly related to the nature and demands of leadership with participant leaders being asked to respond to each trait on a five-point scale ranging from Strongly Agree
to Strongly Disagree. Based on the results of the study, the author concludes that in times of economic uncertainty and increasing global competitiveness, managers need to be able to recognize the individuals who possess the needed traits to make the companies profitable.

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