

# Lean IT

**Enabling and Sustaining  
Your Lean Transformation**

**Steven C. Bell • Michael A. Orzen**



**CRC Press**  
Taylor & Francis Group

A PRODUCTIVITY PRESS BOOK



## PRAISE FOR *LEAN IT*

“A great read on how to apply Lean principles to IT. These tools really work to improve IT’s performance and credibility.”

— **Niel Nickolaisen, CIO Headwaters, Inc.; co-author of *Stand Back and Deliver: Accelerating Business Agility***

“A groundbreaking synthesis, examining IT operations, project management, software development, and governance through a Lean lens. Taut, subtly reasoned, and laced with the kind of brilliant insights that only come from practicing masters. Required reading for IT executives, architects, and project managers.”

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“A superb primer for anyone interested in learning about Lean. Their work will help business leaders understand the arcane machinations of IT while giving IT professionals a common language to talk to the business.”

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“Do most IT organizations waste effort? They do. Can this book transform your thinking and jumpstart your efforts to eliminate waste and optimize the business value of IT? You bet!”

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“Finally! A practical Lean transformation blueprint that includes information systems and the IT organization, while addressing the essential element of human engagement across the enterprise. You can easily digest their lessons and learn how to adapt and apply to your specific organization. This is the key to business alignment the IT industry has been searching for.”

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“A deft application of Lean concepts and techniques to a central challenge we all face: how to increase effectiveness of investments in IT people and systems and the value they bring to enterprise processes. Current and aspiring business and IT leaders and managers at all levels of the organization will benefit from their in-depth knowledge and broad perspective.”

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“Lean IT is an idea whose time has come, especially now that applications like electronic medical records may soon revolutionize health care. Bell and Orzen blend creativity and practicality as they show how to improve both information quality and ease—all the while acknowledging that more is not always better.”

**Naida Grunden, Author, *The Pittsburgh Way to Efficient Healthcare: Improving Patient Care Using Toyota Based Methods***

“This book is long overdue. The IT world needs tools and concepts to be structured in their language and approach so they can join the productivity push that manufacturing has already experienced.”

**Bill Baker, co-author, *Winning the Knowledge Transfer Race***

“This book is a must read for not only IT professionals, but business executives as it aligns information and information systems throughout the enterprise and supply chain, which improves organizational performance and agility.”

**Beth Cudney, Ph.D., Missouri University of Science and Technology;  
author of Using Hoshin Kanri to Improve the Value Stream**

“This work integrates the Lean work over the past century and brings it to focus on the IT organization to eradicate the very drivers of IT wastes, replacing them with a value driven approach based on Lean principles. This comprehensive book should be required reading for all levels in the IT organization.”

**Mark Swets and Tim Schipper, Lean Coaches, Steelcase;  
co-authors of Innovative Lean Development**

“From software development to help desk management, business leaders, IT professionals, and improvement teams finally have clear and concise answers to the question, ‘Yes, but, how does Lean apply to IT?’ Supported by compelling case studies, this outstanding book goes far beyond theory.

**Karen Martin, co-author of The Kaizen Event Planner: Achieving Rapid  
Improvement in Office, Service, and Technical Environments**

“Lean IT takes the game to a new level, particularly in the field of Lean Healthcare, where effective information systems are vital. I suppose I will have to buy multiple copies of this book -- So many IT managers in need of Lean education; so little time.”

**Tom Jackson, author of Hoshin Kanri for the Lean Enterprise: Developing Competitive  
Capabilities and Managing Profit, winner of the 2007 Shingo Research Prize**

“Read it! Learn it! Do it! These pages are meant to be dog-eared, high-lighted, and coffee-stained. Within these pages are the keys to unlocking the value of information and information systems.”

**Dennis E. Wells, Lean Evangelist, Oregon Department of Human Services**

“The authors clearly articulate and demystify the overwhelming challenge of enabling IT processes and organizations to embrace rapid change demanded by Lean transformation. Lean IT represents an important body of work Lean practitioners desperately need to break through the plateau of unending point improvements into sustainable system wide improvements impacting the bottom line.”

**Rajesh Solanki, Corporate Director for Continuous  
Improvement, RTI International Metals, Inc**

“Nearly every week, IT leaders ask me to help clarify their roles in their organizations’ process improvement efforts. This book not only answers how and why, it also gives great examples showing that it can be done in your organization too!”

**Steve Hoeft, Lean Six Sigma Director, Altarum Institute; Lead Instructor,  
Univ. of Michigan Lean Manufacturing, Lean Product Design and Lean  
Healthcare Certification courses; and author of Stories From My Sensei.**

“The gap from the implementation of Lean in production processes to office practices now has a bridge! Orzen and Bell are visionary showing the value of a fully integrated lean enterprise.”

**Elizabeth M. King, Executive Director Organizational Effectiveness, ESCO  
Corporation; Association for Manufacturing Excellence, Director**

# Lean IT

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Steven C. Bell • Michael A. Orzen



CRC Press

Taylor & Francis Group

Boca Raton London New York

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CRC Press is an imprint of the  
Taylor & Francis Group, an **informa** business

A PRODUCTIVITY PRESS BOOK

Productivity Press  
Taylor & Francis Group  
270 Madison Avenue  
New York, NY 10016

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Productivity Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Printed in the United States of America on acid-free paper  
10 9 8 7 6 5 4 3 2 1

International Standard Book Number-13: 978-1-4398-1757-5 (Ebook-PDF)

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*This book is dedicated to Morton and Rickie Orzen, and Bob and Betty Bell, our incredible parents who molded us with their unconditional love.*

*We also dedicate the concepts and practices within this book to the countless dedicated community volunteers, and aid workers with nonprofit and nongovernmental organizations around the world. We believe that Lean IT not only offers benefits to the industrialized countries, but to the billions of individuals in this world living at the bottom of the pyramid, who must do more with much less. We hope that Lean IT can help these compassionate individuals to harness the power and breadth of low-cost information technologies to raise the standard and quality of living for all.*

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*Barry-Wehmiller, Con-way, Group Health,  
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# Acknowledgments

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This book was born from our realization of the pressing need to effectively apply Lean thinking to information and information systems. We are grateful to the many people who provoked, challenged, and elevated our understanding of this fascinating and diverse subject. This book is a collection of experiences, lessons learned, and insights from the many people we have had the privilege of working with over the past 20 years.

Throughout this book, our friend, client, and colleague, Richard Carroll, has provided thoughtful feedback and, at times, very challenging reviews. His professional experience and insights inspired us to stress the practical application of many of the central themes in this book.

Our appreciation also goes to those individuals and organizations who supported us along the way. These include Jim Womack, Helen Zak, and Mark Graban at the Lean Enterprise Institute; Jake Raymer and Bob Miller at The Shingo Prize for Operational Excellence; and Dan Miklovic at Gartner.

Special thanks for the contribution and support we received from Scott Alldridge, Dave Almond, Scott Ambler, Valerie Arraj, Bill Baker, Jackie Barretta, John Bernard, Charlie Betz, John Bicheno, Aaron Brown, Stevie Champion, Steve Castellanos, Tim Costello, Phil Coy, Beth Cudney, Toni Doolen, Susan Duke, Troy DuMoulin, Ron Durham, Martin Erb, Dennis Feagin, Russell Field, Gwendolyn Galsworth, Manoj Garg, Naida Grunden, Lance Harris, Darren Hogg, Steve Hoeft, Nathan Holt, John Houlihan, Paul Imai, Ed Israel, Tom Jackson, Gene Kim, Elizabeth King, Susan Kirchoff, Dr. David Labby, Rick Lemieux, David Mann, Karen Martin, Brian Maskell, Kurt Milne, Niel Nickolaisen, Debbie Nightingale, Tom Perry, John Pierce, Travis Pierce, Tom and Mary Poppendieck, Carol Powers, John Price, Jack ReVelle, Patrick Roach, Andrew Rome, Terry Ross, Brandon Ruggles, Joe Rutz, James Scott, James Serazio, Praveen Sharabu, Bill Siemering, Rajesh Solanki, Damon Stoddard, Pete Stofle, Tom Vest, Mike Wegener, Brian Wellinghoff, Dennis Wells, Brett Wills, Dave Wilson, Stephen Wilson, and Colleen Young. We'd also like to thank Aurelia Navarro and Caralee Anley-Casares for their outstanding editing and coaching skills.

We are deeply in debt to those individuals and organizations who invested the time and patience to write, in their own words, actual case studies that illustrate real-world examples of the power of Lean IT. These include Brian Wellinghoff, Barry-Wehmiller; Richard Carroll and Aaron Brown, Con-way; Mike Manis and Bill Siemering, Group Health; Rajesh Solanki, Bill Kemerer, and Brent White, Ingersoll Rand Security Technologies; Mark Swets and Tim Schipper, Steelcase; John Houlihan and James Scott, Toyota Australia; Lee Darrow, John Eusek, and David Krause, Virginia Mason Medical Center.

And to the hundreds, or perhaps thousands, of individuals not listed here, with whom we have interacted over the past years during consulting, teaching, workshops, conferences, and research, we are grateful. Together we are forging ahead in a collaborative journey of discovery, learning, and knowledge sharing, as we collectively develop this new body of knowledge around Lean IT.

Finally, our heartfelt appreciation and admiration go to our wives, Karen and Lynda, who endured the many challenges that often accompany projects such as this. Your tireless faith, support, patience, understanding, acceptance, and love have helped us to become the people we are today.

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# Introduction

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Today's IT organization faces a clear imperative: reduce costs while improving service levels. At the same time, it must assume an active leadership role to drive change—continuous improvement, innovation, and agility—throughout the enterprise, enabling efficient yet flexible business processes that create value and establish preference in the eyes of each customer.

How can these potentially competing objectives be satisfied with limited resources? For the answer, we turn to the lessons learned from Lean, which emerged in manufacturing during the 1950s and has since been embraced across every industry. It is now the time for IT to adopt Lean thinking as well.

This is the first definitive and comprehensive text on the *Lean IT body of knowledge*, demonstrating how the various aspects of Lean can be applied to the continuous improvement of information and information systems in order to enable and sustain the Lean enterprise. Written by Lean IT pioneers Steve Bell and Mike Orzen, this book distills over 40 years of experience in applying Lean principles, systems, and tools to information technology across many industries.

This book was written to help you—whether you are a business executive, manager, IT professional, or member of an improvement team—to proactively improve, integrate, align, and synchronize information and information systems to enable breakthrough performance and agility.

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## WHAT IS LEAN IT?

Is business process improvement part of Lean IT? What about best practices and benchmarking? Is agile software development a Lean IT practice? What about IT operational excellence and the ITIL service management framework? How about performance management dashboards and scorecards? Is applying Lean techniques to project management considered a Lean IT practice? And is cloud computing relevant in a Lean IT world?

The answer to all these questions is *yes*. But Lean IT is much more than just a set of tools and practices; it is a deep behavioral and cultural transformation that encourages everyone in the organization to think differently about the role of quality information in the creation and delivery of value to the customer. Lean IT enables the IT organization to reach beyond alignment toward fundamental integration, cultivating an inseparable, collaborative partnership with the business.

Whether you are new to Lean, or a seasoned veteran, in this book you will find new insights into the power of Lean and the critical impact of an integrated IT function. In this book, Bell and Orzen explore all aspects of Lean IT within two primary dimensions:

1. *Outward-facing Lean IT*: Engaging information, information systems, and the IT organization in partnership with the business to continuously improve and innovate business processes and management systems
2. *Inward-facing Lean IT*: Helping the IT organization achieve operational excellence, applying the principles and tools of continuous improvement to IT operations, services, software development, and projects

These two dimensions are not separate but complementary, two sides of the same coin. They serve the ultimate objective of Lean transformation: creating value for the enterprise and its customers.

We begin in Part 1 by exploring the foundations of Lean, and how they apply to information, information systems, and the IT organization. Part 2 then explores the various outward-facing aspects of Lean IT applied to business process improvement, supported by an effective Lean management system that links strategy with daily work. Part 3 explores inward-facing issues: how Lean IT improves the performance of IT operations and services, software development, and project management, while considering the implications of a shift toward cloud computing. Part 4 brings it all together, with a comprehensive perspective on Lean management and governance, offering a Lean IT roadmap to help readers on their own transformation journey.

The book concludes with case studies from several Lean leaders: Barry-Wehmler, Con-way, Group Health, Ingersoll Rand, Steelcase, Toyota, and Virginia Mason Medical Center. Each offers, in their own words, a

practical example of how Lean IT can enable and sustain the Lean enterprise transformation.

An ancient proverb says that the best time to plant a tree is 20 years ago. The next best time is *right now*. So let's get started.



# **Section I**

## **Foundation**

*What Is Lean IT and  
Why Is it Important?*



# 1

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## *Why Does Lean IT Matter?*

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*Quality information and effective information systems* are vital to the success of the modern enterprise. But the magnitude of IT spending on ill-conceived or poorly implemented IT projects is staggering. And the dire consequences of unstable and inflexible systems, failed projects, and chronic misalignment of IT activities with business strategy are unacceptable—and unsustainable.

The portion of the global economy spent on IT is substantial. For example, banking and finance enterprises in 2008 spent an average of 6.9 percent of their revenue on IT; this figure is a staggering 4.7 percent in health care.<sup>1</sup> If you begin with a conservative assumption that just 20 percent of these investments do not add significant value to the customer, the numbers add up quickly. And beyond the direct waste of IT dollars spent that don't return expected benefits, even more staggering are the consequences of poor-quality information and ineffective information systems on the productivity and general health of each organization, and by extension to the global economy as a whole.

Much is at stake here—clearly IT and the business must significantly improve the way they work together toward shared outcomes if they're going to produce ongoing order-of-magnitude improvement. *Aligning IT with the business* has become an all-too-familiar slogan. But what does *alignment* really mean? And what are the consequences when alignment is lacking? Let's hear from both sides.

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### THE BUSINESS VIEW

Business responds to change every day. Customers increasingly want more choice, speed, and quality, all at a lower total cost, while competitors wage a

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perpetual battle to steal market share. In order to succeed in such a dynamic and demanding world, business processes and supporting information systems must be both stable and responsive to change, always focused on delivering value to the customer. Unfortunately they often fall short.

Business perceptions of IT and the IT organization often include the following concerns:

- *Complexity*: Information systems are often difficult to use, costly, and resistant to change.
- *Speed*: The IT organization is often perceived as slow moving and late in responding to high-priority requests.
- *Misdirection*: The IT organization is focused on technical issues rather than on solving business problems.
- *Foreign language*: IT speaks a language that business people don't understand, and IT often doesn't understand the language of the business.
- *Information overload*: IT generates an overabundance of information; many workers suffer from data, e-mail and document waste, losing countless productive hours each week.
- *Project failure*: IT projects are sometimes costly, time-consuming, late, and disruptive, while failing to deliver expected benefits.
- *Fragmentation*: There are often many disparate, disconnected systems involved in each business process.
- *Poor data quality*: Data and information are often inaccurate, unreliable, inconsistent, untimely, or, in the worst cases, counterproductive.
- *Inadequate decision support*: Users are often frustrated by having too much data but not enough useful information, at the right time and in the right format, to support informed decisions.
- *Systems anarchy*: Many users attempt to control their own information with workarounds, spreadsheets, and homegrown systems, further contributing to data fragmentation, redundancy, and poor quality.
- *Cost focus*: IT is often perceived as a back office cost center, not an enabler of value creation or a catalyst for innovation.
- *Unclear return on investment (ROI)*: The business is often unable to measure the ROI of information systems investments, and evaluate the quality and effectiveness of IT performance. This uncertainty leads to a vague understanding of IT's true value to the business, which in turn leads to uninformed investment decisions.

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## THE IT VIEW

Now let's consider the other perspective: the IT organization is often overloaded, and reactive crisis management behavior is all too common. Constant change, shifting priorities, new releases and upgrades, and the need to balance existing and emerging technologies, all contribute to an untenable mixture of complexity and volatility. There is usually more work than IT could ever complete; some companies report three to five-year backlogs. And through it all, IT is tasked with keeping information systems, and the business, up and running at all times, while rigorously controlling costs. This often creates the atmosphere of a no-win scenario within IT.

Common IT concerns and challenges include:

- *Endless “firefighting”*: The amount of unplanned work often exceeds planned work, which is unsatisfying, exhausting, and ultimately not sustainable.
- *Unclear system requirements*: End users can't always articulate what they want and often ask for more than they need.
- *Conflicting priorities*: Business stakeholders are often unable to agree on priorities, so IT is caught in the middle with unclear goals, budgets, and timelines, having no choice but to pragmatically make important priority decisions based on incomplete information.
- *Lack of engagement*: IT is often brought into projects after important strategic and tactical business decisions have already been made.
- *Resource thrashing*: Due to unpredictable demand, magnified by unclear and shifting priorities, IT staff are frequently switched between projects, causing changeover costs, lost productivity, quality problems, frustration, and fatigue.
- *Excessive automation*: Rather than eliminating or at least simplifying wasteful processes, they are often automated, creating additional layers of system complexity and increasing total cost of ownership.
- *Poor data quality*: This creates additional errors, rework, and other downstream consequences, and is often caused by lack of end user training and documentation, and inadequate process design and controls.

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- *Scheduling of shared resources and services:* A constant challenge, since specialized resources (human and other assets) are often shared among multiple projects and operations, each with competing priorities, causing bottlenecks and scheduling delays.
- *Regulatory requirements:* These can add layers of non-value-adding activity. The business often focuses on after-the-fact reporting and control measures, rather than creating high-quality, consistent, and naturally compliant processes to begin with.
- *Outsourcing:* The business may believe that outsourcing administrative processes and IT services will reduce costs. However, decision makers may not fully understand the distinction between commodity processes and those that offer competitive differentiation and strategic advantage, nor realize that outsourcing may have unintended consequences by restricting agility.
- *Budget constraints:* There is a natural tendency to focus on IT cost cutting, rather than waste reduction—emphasizing value creation, innovation, and enterprise performance improvement.

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### WHAT CAUSES IT AND BUSINESS MISALIGNMENT?

The business and IT organization each have a long list of concerns and challenges—pain they feel every day. While Lean thinking stresses that every problem is an opportunity for improvement, business and IT stakeholders often have difficulty finding common ground, or even speaking a common language. As a result, over the years we have observed that IT organizations are often not aligned or synchronized with the business in supporting the continuous improvement of business processes. In fact, IT organizations can become isolated from the business operations they support, losing trust and respect.

Furthermore, because of the complex, volatile, and often risky information systems environment, traditional IT change management moves at a slow pace. System changes are deployed in carefully planned test-and-release cycles in an effort to prevent unplanned downtime and business disruption. This cautious approach to change inhibits business agility, and hinders the rapid, iterative, and continuous improvement of business processes.

What is at the heart of this disconnect between IT and the business? In our experience, the lack of integration and synchronization between the business and IT is caused by *unnecessary complexity*.

The world is becoming increasingly complex, and large enterprises have been drawn into ever more intricate circumstances. Global supply chains, the Internet, intense competition, business combinations, regulation, and security have led to increased *necessary complexity*. Small and medium-sized businesses are not immune to this trend, as they are often drawn into these same global business networks. Their business processes are often no less complicated than those of their larger counterparts, yet they often lack the IT sophistication and budgets to address them.

Beyond the challenge of necessary complexity, there is an enormous amount of *unnecessary complexity*—self-inflicted pain—arising from the inappropriate design of business processes and supporting information systems. Lean practitioners call this the waste of *overprocessing*: excessive work where cost and complexity exceed the benefits. The human mind has a natural tendency to make things more complicated than they need to be. While business processes and supporting information systems are naturally complex to some degree, if stakeholders do not deliberately and continuously simplify and improve them, they naturally degenerate over time, becoming more and more complex, costly to maintain, and difficult to use.

Overdesign is often the result of a predisposition toward technology and automation, rather than exercising the discipline to first simplify and standardize underlying business processes. This tendency becomes magnified when system designers are eager to deploy the latest technology, or enthusiastically develop elaborate solutions to potentially simple problems. The problem is further aggravated when unnecessarily complex information systems are applied to unnecessarily complex business processes; a compounding effect of waste (*muda squared*)\* results. In this *perfect storm*, the unnecessary complexity of processes and their non-value-adding automation feed on each other—fueling a self-perpetuating cycle that can only be broken when business process owners and members of the IT organization work together as partners to simplify and improve processes before applying technology interventions.

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\* *Muda* is a common Lean term, the Japanese word for waste, and represents any non-value-adding activity or obstruction to the smooth flow of work processes.

Seasoned Lean practitioners know, often through firsthand experience, that many transformation efforts fail to sustain themselves over time, as organizations gradually fall back on old habits and familiar mediocrity. For a variety of reasons, the IT organization is often not proactively included in the Lean transformation process. Due to the interdependent nature of process improvement and IT change management, and because the execution of business processes frequently relies on technology, the lack of IT involvement in Lean initiatives is a common contributing factor for the deterioration of many otherwise sustainable improvements. Put another way, how could an enterprise successfully transform itself without addressing the role of quality information systems, and the active participation of the IT organization?

For this reason, we believe the next evolutionary step for many organizations, and the next frontier of Lean across all industries, is *the advancement of Lean IT practices to enable and sustain enterprise transformation.*

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## HOW LEAN IT ENCOURAGES ALIGNMENT AND CREATES VALUE

A Lean enterprise should empower teams to *simplify*, then when appropriate, *automate* routine tasks. Process improvement frees up capacity, providing individuals with more time and better information to exercise problem solving, creativity, and innovation in situations that are not routine. Early in the transformation effort, teams are often exhilarated when they realize they can streamline or even eliminate a frustrating process—one that has always been justified by saying, “That’s just the way we’ve always done it.”

Once improvement efforts gain momentum and the low-hanging fruit has been harvested, business and IT stakeholders work together to address the tougher issues that align strategy with daily activity throughout the organization. This naturally encourages the development of enterprise alignment in three dimensions:

1. *Vertically* aligning strategy up and down the hierarchal organization—from the boardroom through each geographic region, division, location, and department so everyone understands how their daily

activities support the shared mission, strategy, goals, and objectives of the organization.

2. *Horizontally* aligning stakeholders across every functional silo, process, and project—emphasizing the flow of value to the customer, rather than suboptimization of the individual process steps within traditional department or workgroup boundaries.
3. *Vertically and horizontally* aligning information systems—both manual and computerized—ensuring that IT enables the organization’s strategy and adds value to business processes, projects, and management systems. Synchronized vertical and horizontal alignment is the balance point for IT-enabled process improvement.

While opportunities for alignment may arise spontaneously during kaizen (continuous improvement) activities, orchestrating and sustaining alignment require a disciplined and systemic approach—a *Lean management system*, a topic we will describe and explore throughout this book. According to Womack and Jones in their classic *Lean Thinking*, “Our advice, based on years of experience, is that every organization should carefully team a system builder with each of its revolutionary change agents in order to sustain results.”<sup>2</sup>

More important than process improvement tools, lasting transformation requires effective management systems that prioritize work and align daily activities with those goals and objectives that are most important to the organization. In Lean, the focus of management is to create stable processes and standardized work which consistently deliver value to the customer. For a Lean management system framework to be effective, it must be simple to understand and execute, providing guidance while not getting in the way. It cannot be too controlling or rigid; otherwise, it will suppress creativity and learning, hindering improvement and innovation. And finally, an effective Lean management system must be supported by quality information.

Lean IT and sustainable Lean enterprise transformation are the result of collaborative problem solving guided by strategic intent. How is this lofty aspiration achieved? Let’s start with a working definition of *Lean IT* that we will build upon throughout this book:

*Lean IT* engages people, using a framework of Lean principles, systems, and tools, to integrate, align, and synchronize the IT organization with the

business to provide quality information and effective information systems, enabling and sustaining the continuous improvement and innovation of processes. Lean IT has two aspects: outward facing, supporting the continuous improvement of business processes, and inward-facing, improving the performance of IT processes and services.

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## MOVING FORWARD

For many years, Gartner (a global IT research firm) has been asking chief information officers (CIOs) to identify their top priorities. As you can see in Figure 1.1, businesses want IT to drive growth and value through alignment. But now, in the increasingly fast-paced and competitive global economy, organizations are turning to the IT organization as partners in *change leadership*.

Information, information systems, and the IT organization are tightly interwoven within the fabric of virtually every business process of the modern organization. IT *does* matter in the never-ending, always changing race for competitive advantage.

This is especially true as many IT infrastructure and commodity services shift to a scalable, low-cost, *cloud-computing* model. In this approach to information systems delivery, with utility-based infrastructure and service-based applications, the business will begin paying for functional utility rather than infrastructure. This will shift a significant portion of annual IT funding from the capital budget to variable expenditures, potentially making each investment decision more aligned with the business process it serves. Along with this shift, the business will expect change capability

Top 3 CIO Priorities	2006	2009	2012
Delivering projects that enable business growth	1	3	1
Linking business and IT strategies and plans	2	1	2
Leading enterprise change initiatives			3
Reducing the cost of IT		2	
Building business skills in the IT organization	3		

**FIGURE 1.1**  
Strategic priorities from the Gartner CIO Survey.<sup>3</sup>

to be more rapid, less disruptive, and at a lower cost. The IT organization must therefore cultivate a clear focus on business process leadership, maintaining the appropriate balance between efficiency and flexibility ... also known as *agility*.

Sustainable information systems improvement and innovation cannot be achieved with a focus on technology alone. The Lean IT journey depends on continuously improving *people, process, and technology, in that order*. Eiji Toyoda, who retired as chairman of Toyota in 1994, sponsored Toyota's legendary Lean transformation beginning in the 1950s. He succinctly explained the relationship of people, process, and technology in the Lean journey:

Society has reached the point where one can push a button and be immediately deluged with technical and managerial information. This is all very convenient, of course, but if one is not careful there is a danger of losing the ability to think. We must remember that in the end it is the individual human being who must solve the problems.<sup>4\*</sup>

## ENDNOTES

- 1 Gartner, "IT Spending and Staffing Report," November 2009, [www.gartner.com/it/products/consulting/itkmd/2008/index.jsp](http://www.gartner.com/it/products/consulting/itkmd/2008/index.jsp).
2. James P. Womack and Daniel T. Jones, *Lean thinking*, 2nd ed. (New York: Simon & Schuster, 2003), 314.
3. Gartner, Meeting the Challenge: the 2009 CIO Agenda, (Stamford, CT: Gartner, 2009).
4. Eiji Toyoda, *Creativity, challenge and courage* (Tokyo: Toyota Motor Corporation, 1983); quoted in Jeffrey K. Liker, *The Toyota way* (New York: McGraw-Hill, 2004), 159.

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\* Note to the reader: The introduction of Lean is chiefly attributed to the Toyota Production System, which emerged in post World War II Japan—for a more comprehensive timeline of continuous improvement evolution see Chapter 2. At the time of this publication, Toyota is under intense public scrutiny for quality and safety concerns. In late 2009, just as this issue found its way into the public spotlight, the new President, Akio Toyoda, admitted that Toyota had lost their way in the late 1990s. Their focus on quality and customer satisfaction gave way to ambition for growth, global market share and profitability. Throughout this book we focus on Lean principles, systems, and tools that helped Toyota through their 50-year ascendancy in the global auto market. These same principles and tools have helped many companies in other industries as well. It is clear that even the venerable Toyota cannot violate their own principles without consequences.



# 2

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## *Foundations of Lean*

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### CHAPTER OBJECTIVES

To create a shared foundation for our discussion of Lean IT, in this chapter we will:

- Review a brief history of business process improvement, culminating in Lean.
- Establish the foundational principles of a lasting transformation of culture and performance.
- Explore the concepts of value and waste in relation to Lean problem-solving tools, concepts, and terminology.

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### A BRIEF HISTORY OF CONTINUOUS IMPROVEMENT

Since its beginnings at the turn of the twentieth century, business process improvement has focused on solving problems to improve efficiency, productivity, and quality. We view the evolution of process improvement as occurring in three distinct stages: scientific management, engagement, and integration.

#### **The Age of Scientific Management: 1890–1940**

Beginning in the late 1800s, business pioneers Frederick Taylor, Frank and Lillian Gilbreth, Henry Ford, and others ushered in an era of efficiency and

productivity by introducing standardized manufacturing methods, simplified work, and division of labor. Beginning in 1918, Walter Shewhart pioneered the use of statistical control to improve quality. During this era, emphasis on output drove significant gains in productivity—for instance, Taylor at Midvale Steel Company (1878–1890) achieved gains greater than 300 percent—but also left workers uninspired with tedious, repetitive tasks.

During these early process improvement efforts, workers were considered to be property and treated as such. *Command and control* was the established management system, in which workers were seen as interchangeable resources, hired for their *hands*, not their *minds*. Those in management positions solved problems and were paid to think, while workers were expected to follow orders and meet output quotas.

### **The Age of Engagement: 1940–1995**

World War II necessitated a massive shift in industrial productivity that could not be achieved using the existing system of management or the prevailing methods of process improvement. The U.S. Department of War introduced an innovative program, Training within Industry (TWI), which promoted worker participation, productivity-driven problem solving, supervisor training, work process documentation, and ongoing improvement programs that accelerated output and enhanced quality.

During this period, the ideas of W. Edwards Deming, Joseph Juran, and Armand Feigenbaum broke new ground introducing respect for workers, quality at the source, employee development, team problem solving, and listening to customers to define value. The *Quality Movement*, as it became known, shifted the primary focus of process improvement from productive efficiency to delivering value to the customer. After the war, Taiichi Ohno and Shigeo Shingo at Toyota, and others in Japan, embraced the ideas of quality and continuous improvement and developed the Toyota Production System—laying the groundwork for modern-day Lean.

The 1980s were a time of competing methodologies as organizations experimented with various methods of continuous improvement. Six Sigma was introduced during this time and quickly became the poster child of process improvement, with successes at Motorola, Allied Signal, GE, and many other companies. Six Sigma applied statistical rigor to improvement processes and emphasized the quantification of results in

terms of dollar savings. With the publication of *The Goal* by Eli Goldratt in 1992,<sup>1</sup> the Theory of Constraints also became popular, demonstrating that bottlenecks could be exploited to pace production, focus improvement efforts, and significantly boost throughput. Then in 1990, *The Machine That Changed the World* was published by Womack, Jones, and Roos at MIT.<sup>2</sup> This book examined the Toyota Production System and introduced the term *Lean*. (For a detailed discussion of how Six Sigma and Lean can effectively work together, see Appendix B.)

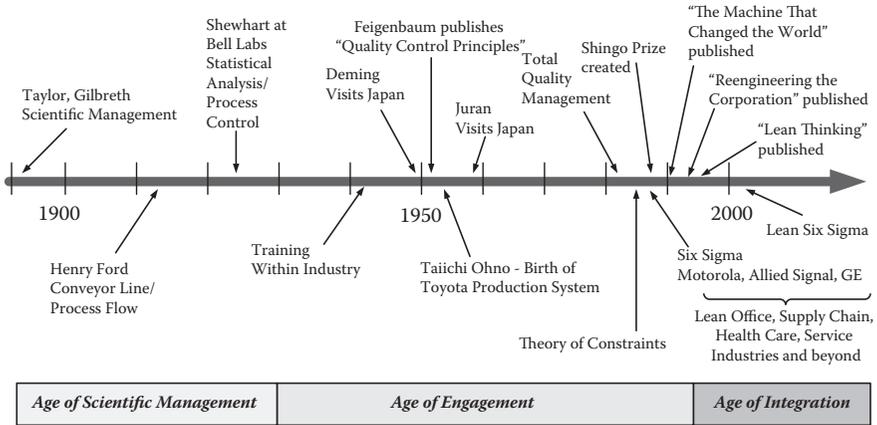
*Reengineering the Corporation*,<sup>3</sup> published in 1993, popularized business process reengineering (BPR) emphasizing process improvement and encouraging companies to abandon outdated systems, methods, and processes that no longer serve their purpose. While this was well intentioned, instead of engaging workers, it often was misunderstood and misapplied to justify downsizing. While the Age of Engagement experimented with the central idea of engaging people to drive continuous improvement, we still have a long way to go to achieve Deming's vision as too many companies still do not engage the hearts and minds of their people.

*Note to the reader:* For the remainder of this book, unless otherwise stated, we will use the term *continuous improvement* to embody all improvement disciplines, including Lean, Total Quality Management, Six Sigma, the Theory of Constraints, and the Toyota Production System.

## The Age of Integration: 1996–Present

By the mid-1990s, companies around the globe were beginning to apply Lean, Six Sigma, and other improvement methods beyond the factory floor to office and administration, supply chain, accounting, and software development. Nonmanufacturing industries quickly discovered that Lean manufacturing techniques could produce significant results. Trading partners were enlisted to develop integrated processes throughout the supply chain. Advances in computing functionality, speed, and cost further supported the integration of business systems and communications. In 1996, *Lean Thinking*<sup>4</sup> was published, emphasizing integration of improvement across value streams, unleashing the current age of integration of improvement methods across all functions of the business, and in all industries, including health care, insurance, banking, and nonprofits.

For an in-depth discussion of the history of continuous improvement, see Appendix A. For a timeline of continuous improvement, see Figure 2.1.



**FIGURE 2.1**  
Timeline of continuous improvement.

## LEAN PRINCIPLES

Many companies and individuals implementing Lean make the mistake of becoming preoccupied with specific tools. When properly applied, tools are performance enablers, but it is the principles embedded within the culture of an organization that compel long-term behavioral change. Without a clear grasp of Lean principles, focus on Lean tools is like sailing a ship without a rudder. Companies that fail to anchor their continuous improvement efforts with principles rather than tools may experience short-term localized results, but will not achieve the broad acceptance needed for sustained improvement. The Shingo Prize for Operational Excellence\* emphasizes this primacy of principles over tools:

As organizations begin a Lean transformation, it is usually at the Tools & Techniques level in specific areas of the organization. Ideally, the Lean journey then proceeds to the Systems level, creating a more integrated and sustained improvement model. Eventually all employees throughout all business processes develop a deeper understanding of principles (the

\* In 1988, the Shingo Prize for Operational Excellence was established to acknowledge Shigeo Shingo's contribution to continuous improvement, promote awareness of Lean concepts, and recognize companies that achieve world-class status in Lean manufacturing and business processes. The philosophy of the Shingo Prize is that world-class performance for quality, cost, and delivery can be achieved through consistent application of Lean principles and tools in all business processes. See [www.shingoprize.org](http://www.shingoprize.org).

‘know why’), empowering the organization to develop and deploy specific methodologies and practices unique to the organization.<sup>5</sup>

Principles are timeless, whereas tools evolve as needs change. Organizations which emphasize principles over tools significantly increase the likelihood of a successful transformation. By contrast, organizations that fall in love with certain tools (e.g., 5S and value stream mapping) may fail to establish the principles that form the bedrock of sustainable Lean performance. Eventually, the initial enthusiasm for Lean subsides, improvements become more challenging as the remaining problems get tougher, and there is nothing to fall back on to sustain long-term change.

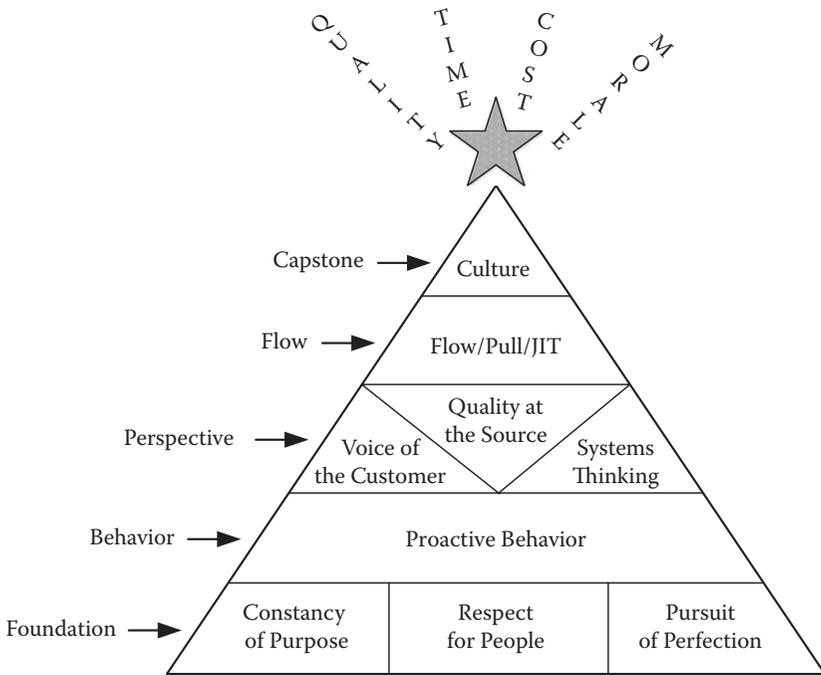
In *Principle-Centered Leadership*, Dr. Stephen Covey stresses the need for organizations to embrace core principles which serve as a compass, providing constancy of purpose and alignment of organizational goals and actions. According to Covey, the most successful companies establish objective, steadfast principles which reflect timeless values that guide behavior and foster a unique culture.<sup>6</sup> When principles are borrowed from another company, they are easily discarded as soon as they become inconvenient to live up to. Companies should develop their own principles based on shared values and beliefs, and nurture them as consistent attitudes and behaviors. The following ideas are a compilation of central tenets we have seen successfully applied in support of lasting Lean transformations. Our discussion of Lean principles begins at the base of the pyramid (see Figure 2.2), laying a solid foundation. Experience has shown three elements that support a strong social structure for a Lean enterprise.

## Constancy of Purpose

- *Theme:* Leadership provides the direction and clarity we need to focus on the things that matter most—what Deming called “Constancy of Purpose,” maintaining clarity on important long-term objectives. This is the cornerstone in the principles pyramid because it provides the persistent direction needed to influence behavior. When daily behaviors change, culture also changes.\*

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\* See *Out of the crisis* by W. Edwards Deming.



**FIGURE 2.2**  
Lean Enterprise Principles Pyramid.

- The issue:* In many organizations, there is a lack of clarity concerning *what matters most*. We like to ask various people at our client sites, “What are the goals of the company, and how do they influence your daily work?” We typically receive a variety of answers. Two important issues often become apparent: (1) there is a wide range of understanding of company goals, and (2) goals are at best indirectly aligned with the concerns and actions of individuals and workgroups. This manifests as a lack of coordination within departments and between various functional areas, accompanied by counterproductive or conflicting performance measures and incentives. Activity is often mistaken for productivity and is not necessarily effective in supporting the organization’s strategy or adding customer value.
- How does the principle address this challenge?* Constancy of purpose focuses thinking and behavior, aligning effort and getting everyone rowing in the same direction. Effective leaders lead by example, a

responsibility that cannot be delegated. Management should adopt a visible and active role in supporting change. As people are encouraged to challenge the *way we do things around here* and begin to perceive difficulties as opportunities for improvement, collaborative problem solving, and ownership of process quality starts to take root.

At this critical time, the way management reacts to setbacks either reinforces proactive behavior or discourages it. Effective leaders embrace an essential truth: poor processes—not people—are the cause of most problems. For most of his career, Deming put forth the *85/15 rule*, suggesting that 85 percent of problems were inherent to process design and not controlled by the people doing the work. He later revised the estimate to 96 percent.

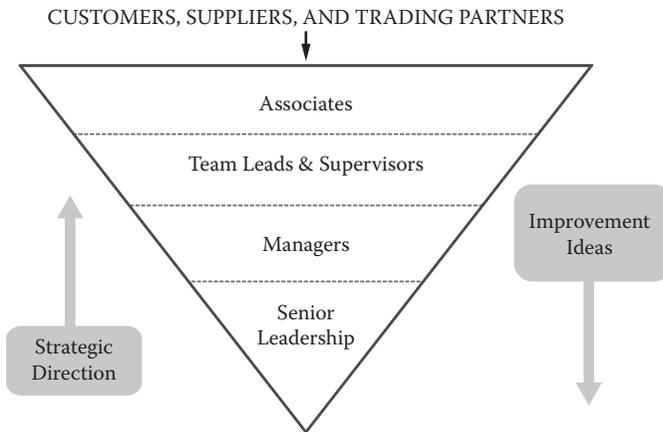
A clear understanding that Lean is about fixing processes, not people, creates the tone for fact-based improvement. In this atmosphere, people move out of their comfort zones, and actively seek out problems as opportunities to make things better. Every successful Lean transformation we have witnessed has been led by a champion who provided the focus, enthusiasm, and drive that inspired others to move beyond business as usual. This role can be filled by an executive sponsor, a program manager, or any person in your organization who possesses credibility and respect. Early successes inspire others to become involved and build momentum. Gandhi said it best: “Be the change you wish to see.”

To be effective, leadership should be balanced with employee-driven participation. In a process known as *strategy deployment*,\* leaders establish objectives (top-down) and employees determine how to best accomplish and measure them (bottom-up).

Some organizations often manage in a hierarchal, top-down manner with management at the top of the pyramid, issuing commands downward. Lean inverts this pyramid, as shown in Figure 2.3. At the very top are customers and business partners, since they define value and create demand pull signals that trigger work to be performed. Next are the workers, who most frequently interact with those customers, vendors, and

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\* Strategy deployment (also known as policy deployment, hoshin kanri, and hoshin planning) is a management system to align daily work with strategy. See Chapter 6.



**FIGURE 2.3**  
Lean Enterprise Inverted Managerial Pyramid.

trading partners and are, thus, in the best position to directly identify those actions that add the most value.

Management’s role is to translate and communicate purpose, strategy, and goals throughout the organization to teams and workers. Prioritization of improvements and consensus is achieved through a back-and-forth dialogue between management and employees that aligns strategy and action at each level, reconciling action plans with available resource capacity. Rather than being told what to do, the people closest to the customer and the work develop and implement ideas for improvement based on a clear understanding of how their actions support company objectives.

*Summary:* Executive leadership’s responsibility is to define strategic goals and create a constancy of purpose. Management’s role is to eliminate barriers to success, stabilize processes, and support employees to develop problem-solving skills, so they can take ownership of their work and assume responsibility for continuous improvement. When considering potential areas of improvement, the alternatives are almost endless, so an important enabler of effective leadership is a formal decision-making framework. This establishes clear priorities and ensures consistent choices are made when selecting improvement projects. Alignment and prioritization are consistent themes throughout this book, and we’ll revisit constancy of purpose in Chapter 10.

## Respect for People

- *Theme:* The second foundation principle is respect for people. All individuals possess a unique collection of experience and insight, and can make a distinctive contribution when they participate in process improvement. Cross-functional problem solving can only occur when respect for people is consistently applied throughout all levels of the organization. Respect drives employee development, encourages participation, and improves supplier, customer, and community relations.
- *The issue:* When people sense that their input is disregarded or not respected, they tend to withdraw their support, concern, and active participation. Even worse, they may become cynical or even confrontational from having been left out of the dialogue. If leaders don't engage the people doing the work with genuine respect, change for the better has little chance of succeeding. This is because those who have the knowledge and ability to create lasting improvement have no stake in the final outcome. Worse yet, organizations lose the creativity and innovative potential each person offers.
- *How does the principle address this challenge?* Respect for people unlocks personal excellence and creative potential. In a collaborative learning environment, people know their ideas are valued and appreciated. Those individuals actually doing the work see potential improvement opportunities at a deeper level than anyone else in the organization. They hold the insight, understanding, and passion to add value and drive daily improvement. In some workers, these skills are dormant from lack of use.

Good leaders tap into this inexhaustible resource by mentoring, coaching, and collaborating with their associates, seeking their opinions and respecting differing points of view. Lean transformation requires the input, support, and active participation of everyone in the organization. Lean organizations cultivate collaborative problem solving where people become scientific thinkers, learning from successes as well as *failing forward* from mistakes and setbacks. Questioning *the way we've always done it* is not only accepted, but also respected and positively acknowledged.

Humility is a very effective catalyst for a culture of continuous improvement, embodied in the Japanese term *hansei*, meaning mindfulness and self-reflection. Everyone in the organization must feel safe about sharing ideas and taking experimental risks, confident of not being ridiculed. Experimental risk is feeling comfortable enough to try new ways of doing things—approaching them as a means to validate new ideas, understanding, and predictions. Experiments never *fail* because they provide new evidence, clues to be used to develop further improvements! When we come to accept that every process can be improved, and that everyone brings a unique set of life experiences and perceptions to the table, people begin to appreciate that a good idea can come from anyone and that ideas have no rank.

*Summary:* Respect for people taps into an unlimited reserve of creativity by treating every individual with consideration and regard. Give your people a good reputation to live up to.

### **Continuous Improvement and the Pursuit of Perfection**

- *Theme:* The final building block in our foundation is the continuous pursuit of perfection. Today's solutions, while they may be adequate, are at best temporary. Change is relentless, and new ideas are needed whenever current standard work no longer produces acceptable results. In a Lean culture, workers embrace change as inescapable (and even desirable), proactively meeting challenges. Every individual should see his or her job as having two inseparable components: daily work and daily improvement.

Changing social norms and daily behavior involves shifting the tone of the workplace from reactive firefighting (a deeply ingrained reflex often based on emotion) to proactive problem solving (methodical rational behavior).

- *The issue:* We are all creatures of habit and naturally territorial. Most people like change, but they don't like being changed. Effective change is usually disruptive and uncomfortable. Left to our own human nature, we fall into patterns of thinking and behavior that actually avoid change and stifle creativity and innovation. When

Lean is perceived as a program or project (with a beginning and an end point), people may assume it is just another management *flavor of the month* that will blow over. They may then decide the best course of action is to *keep your head down and ride low in the middle of the pack* until the storm passes. Without active engagement and constant reinforcement, we naturally fall back on old habits of thinking and behavior.

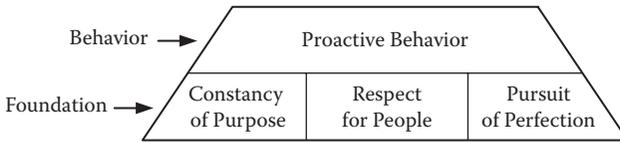
- *How does the principle address this challenge?* When we collectively recognize that if we are not improving we are falling behind, our understanding of daily work undergoes a radical shift. This realization breathes fresh ideas and energy into the organization, inspiring us to continually reinvent ourselves. With a constant focus on improvement, we avoid falling into patterns of stagnation in our daily behavior.

In *The Fifth Discipline*,<sup>7</sup> Peter Senge uses the term *learning organization* to describe an environment where people continually develop their abilities to understand complexity and improve shared understanding. Setbacks and failures are treated as opportunities to reflect and learn. Perhaps most importantly, learning organizations encourage systems thinking—the ability to comprehend and focus on the whole while understanding the interrelationship of the parts. Each individual must begin identifying with the organization’s overall purpose and mission as well as individual department, workgroup, project, and process-level goals. The pursuit of perfection requires companies to become learning organizations where a trial-and-discovery method of process improvement is embraced without fear of reprimand or ridicule.

The pursuit of perfection is often misunderstood—it’s an aspiration, but one that is never achieved. Voltaire said, “The perfect is the enemy of the good.” With Lean, whether in the factory, the office, or the IT organization, we should avoid over-automating or striving for the hyper-efficiency of a “perfect solution”—these ultimately create waste and rigidity, and resist further cycles of improvement.

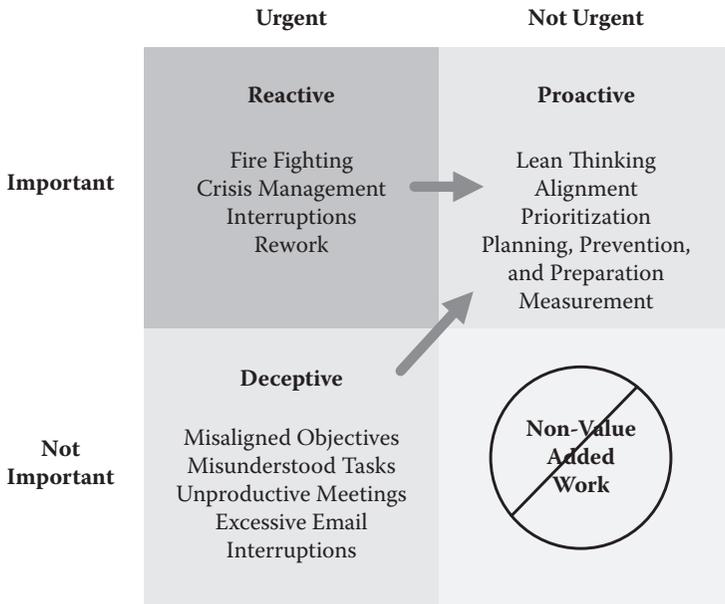
*Summary:* The endless quest for excellence stimulates everyone in the organization to make things better. People no longer see a difference between *performing* the work they do, *improving* the work they do, and improving themselves.

## Proactive Behavior



- *Theme:* Building on our foundation, proactive behavior means taking the initiative, assuming personal responsibility for the quality of our work and work environment. Being proactive means seizing the opportunity to make a difference *every day*.
- *The issue:* Why do the vast majority of companies fail to achieve a sustaining Lean transformation? Perhaps one reason is that many people in the business world tend to be seasoned firefighters but poor police officers. Stereotypically, firefighters *react* to problems\* by rushing into burning buildings and attacking everything that may be an issue (flames and smoke). They live on adrenaline during periods of intense focus until the crisis passes, and accept (even sometime enjoy) emergencies as part of normal operations. Police officers, by contrast, are methodical *proactive* problem solvers who walk the beat investigating the current situation to determine root causes of problems. Their focus is long term, systematic, preventative, and disciplined. They ask lots of questions and shoot only when necessary.
- *How does the principle address this challenge?* In *The 7 Habits of Highly Effective People*, Dr. Stephen Covey introduces a model called the *Time Management Matrix*, dividing work into four quadrants based on importance and urgency. He points out that the highest value-added work lies in the *Important but Not Urgent* quadrant, where proactive planning, prevention, preparation, learning, and development occur. Unplanned work focuses on issues that are either *Important and Urgent* (reactive firefighting) or *Not Important and Urgent* (deceptive activities that seem important due to their urgency). In either case, they steal time and resources that should be used to proactively address *Important but Not Urgent* work.

\* Our hats go off to real firefighters, some of the bravest and most proactive thinkers we know. In this example, we are talking about the common label of firefighting as a behavior.



**FIGURE 2.4**  
Lean perspective of the importance paradigm.

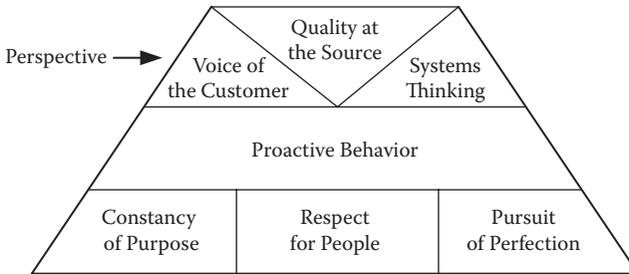
Established culture often reinforces reactive firefighting at the cost of disciplined problem solving. Because firefighting is highly rewarded, some firefighters become very good arsonists. This unconscious behavior creates a never-ending cycle of interruptions and interventions which introduce more instability. Cultural DNA<sup>8</sup> strongly influences organizations to revert to reactive behavior when problems arrive and the pressure is on. Ironically, reactive behavior usually introduces waste and creates more problems than it solves—actually preventing sustained progress.

As shown in Figure 2.4, Lean shifts the emphasis away from unplanned work to proactive continuous improvement. This approach is effective because it feeds itself: as more time is invested in process improvement efforts, less unplanned incidents occur, which frees additional time to work on more proactive improvements.

*Summary:* Deming described quality as “pride of workmanship.” Proactive behavior requires both personal and team pride combined with discipline. We then take responsibility for solving problems and strive for quality at the source.

The next level in our pyramid addresses awareness, with three essential perspectives embraced by the Lean enterprise: voice of the customer, quality at the source, and systems thinking.

### Voice of the Customer



- *Theme:* Lean thinkers always ask, “What does the customer value, want, and need?” By understanding how customers and information system users define value, they position themselves to *begin with the end in mind*.
- *The issue:* It is imperative that organizations develop a clear understanding of what customers care about most. Often they assume they know what customers desire, and as a result deliver products and services that fail to address real customer needs.
- *How does the principle address this challenge?* Most processes have both internal customers who receive work output and external customers (trading partners and end users) who receive products, services, and information. To clearly understand the voice of the customer, you must engage with your customers, whoever they are. Use customer segmentation, interviews, focus groups, surveys, sales and service data analysis, and point-of-use observation to develop *critical-to-quality* requirements. Then return regularly to the customer to ensure improvements and innovations deliver what the customer values most.

*Summary:* Consistently listening to the voice of the customer ensures you are focusing on the right issues and making improvements that will be valued by your current and future customers. Understanding customer needs and desires more clearly than your competition will

enable you to be more responsive and agile, creating competitive advantage and market leadership.

## Quality at the Source

- *Theme:* Quality at the source means doing it right the first time, every time: imperfect work is not sent to the next operation or to the customer.
- *The issue:* The *we'll fix it later* approach is accepted in many organizations due to time pressure, inadequate training, and a lack of understanding of the entire process. The best time to solve a problem is at the time it occurs because evidence is fresh, workers are engaged, and it prevents the release of additional defects until the root cause of the problem is corrected. The focus of daily work should be producing quality at the source. Solely focusing on quickly working through the backlog results in the same problems reemerging time and time again. Time-consuming corrections, clarifications, and completions become necessary when quality is poor, creating interruptions and delays which increase costs and aggravation.
- *How does the principle address this challenge?* In a Lean environment, there is an obligation to stop and fix problems, and a shared commitment to avoid passing known defects downstream toward the customer. By applying standardized work, training, and error proofing, every effort is made to ensure the problem or defect is prevented the next time. People assume responsibility for the quality of the work they pass on, regardless of where the problem originated. This fundamental change in attitude reduces waste and frustration. More importantly, problems become the evidence used to detect root causes and prevent their recurrence.

*Summary:* When quality at the source takes hold, more time is available to do the work customers are paying for, which in turn improves productivity, cost, quality, and morale.

## Systems Thinking

- *Theme:* The third element of awareness is systems thinking—the ability to view the interconnected processes that make up the entire

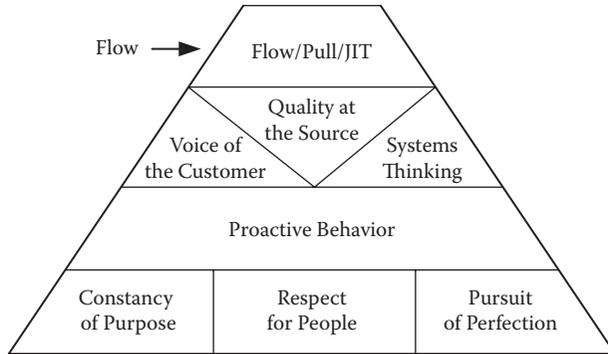
value stream while being aware of the cause-and-effect interdependencies that either add value or create waste. A value stream is comprised of all processes, tasks, and activities used to bring a product or service from concept to customer, and includes all information, work, and material flows.

- *The issue:* To avoid solutions that create localized optimization and silo behavior, Lean thinking requires an awareness of the simultaneously integrated and interdependent nature of all business functions and underlying information flows. This is not the way our minds and our organizations naturally work; we tend to focus on specific pieces of a puzzle rather than the entire picture. Inappropriate measures and incentives often reinforce this narrow focus.
- *How does the principle address this challenge?* When problem solving is founded on a clear understanding of the overall value stream and the customers it serves, companies avoid the common error of making local improvements which often transfer inefficiencies and waste from one area to another. Cross-functional teams provide the breadth of understanding required for systems thinking, spanning the value stream by connecting the expertise and understanding of each team member.

The holistic perspective needed here may be unfamiliar to many professionals because they have spent their careers honing skills in a specialized area (e.g., engineering, IT, finance, and human resources). A systems mind-set stimulates the creative potential of employees by broadening their horizons and challenging the breadth of their perception. To make improvements that impact external customers, a value stream must be viewed as a system. Value stream mapping and systems thinking are complementary, helping people to view business processes in a new context: flow.

*Summary:* Systems thinking enables us to *see the whole*, creating a smooth flow of value to the customer.

## Flow, Pull, and Just in Time



- *Theme:* The next level of the pyramid focuses on flow—the uninterrupted progression of materials, services, and information. As Jeffrey Liker emphasizes in *The Toyota Way*, “Flow where you can, pull where you must.”<sup>9</sup> Allow work to flow whenever you can; when flow is interrupted, use pull signals to initiate work.
- *The issue:* Poor flow of work manifests as interruptions, delays, rework, and cost. Deficient information flow causes even more irregular flow of materials, work in process, and finished work inventory where it is common to have too much (overstock) or too little (shortage). In an office environment, inventory is usually composed of paper and electronic documents, including e-mail. *Work in process* is all work started but not finished plus work queued up for the next process. As a general rule, the more work in process there is, the less work is able to flow, and the more slowly work is completed. Work in process inventory causes congestion, confusion, and delays; hides problems; must be managed and tracked; often becomes obsolete; and is often reworked or discarded. This in turn creates further interruptions, delays, rework, and cost.
- *How does the principle address the issue?* Flow is achieved through eliminating delays and interruptions throughout the entire value stream. Value stream mapping is an effective tool for identifying, quantifying, and eliminating waste. The smooth flow of information produces the transparency and visibility needed to coordinate efficient flow of work. When information is used to level demand,

balance capacity, and improve quality, flow is improved and value is delivered to the customer sooner.

When there are no interruptions in a series of tasks, work flows smoothly. Typically, work will flow until it encounters a barrier that prevents it from continuing (e.g., physical or electronic transportation to another location). When work cannot be designed to flow, it needs to be connected to the next series of tasks that do flow using a pull mechanism.

Pull removes the opportunity for overproduction\* and supports flow by regulating work activity. In a pull system, all work is performed just-in-time triggered by a customer demand signal (kanban). The sequence of the pull signals establishes clear priorities, the receiver of the signal is directly accountable, and the signal itself provides visibility.

As overproduction decreases, work-in-process inventory decreases and flow is improved; work stoppages and delays happen less frequently, further reducing work in process, response time, and backlogs.

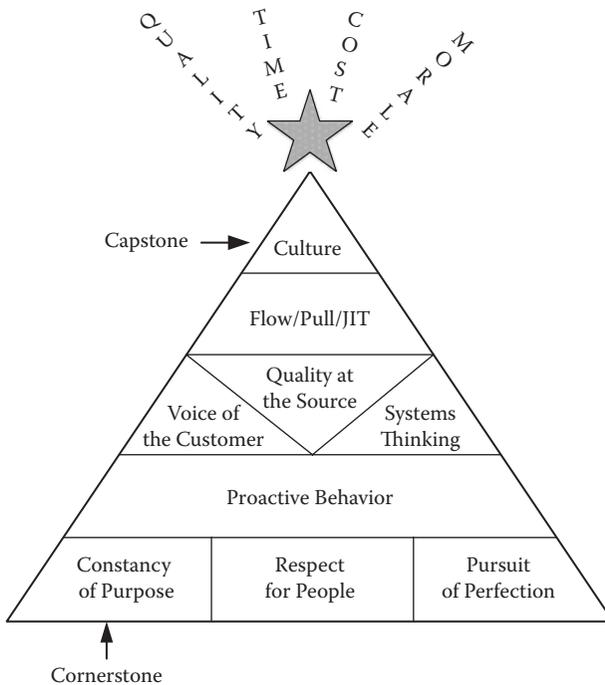
*Summary:* As flow improves, information and work product are received earlier by both internal and external customers. Flow releases pent-up, committed time and resources, effectively increasing an organization's capacity to respond to change with limited disruptions. This translates to better quality, response time, customer service, inventory turns, and ultimately cash flow.

## Culture

- *Theme:* The capstone on our principles pyramid is culture, which represents an organization's shared beliefs and values, manifested as attitude and behavior. Culture is an outcome of behavioral change. (See Figure 2.5) A Lean culture of continuous improvement creates a *shared capability* which enables people to proactively seek out and solve problems, resulting in superior performance, competitive advantage, and bottom-line financial results.
- *The challenge:* Sustained Lean transformation is only possible when culture evolves to reinforce new behaviors. The vast majority of companies

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\* Overproduction was considered the most harmful form of waste by Taiichi Ohno because it generates other additional forms of waste (inventory, transportation, etc.).

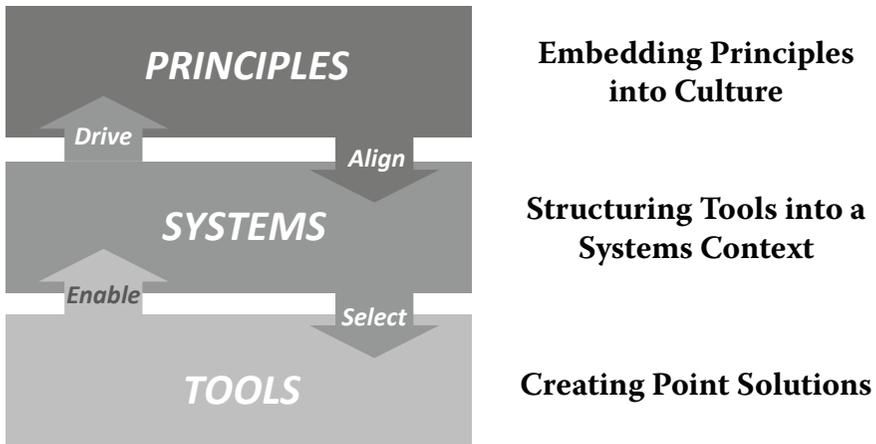


**FIGURE 2.5**  
Lean Enterprise Principles Pyramid.

that have embarked on a journey of continuous improvement (Lean, Six Sigma, or another discipline) have not realized long-term breakthrough results—having failed to transform their daily behavior and culture. The hearts and minds of their people are not engaged nor committed.

- *How does the principle address the issue?* We are often asked, “How do we create a Lean culture?” Our belief is that a Lean culture is developed over time by changing the way people perceive their roles and perform their daily work. In *Who Says Elephants Can’t Dance?* Lou Gerstner, former CEO of IBM, emphasizes the importance of culture:

I came to see, in my time at IBM, that culture isn’t just one aspect of the game—it is the game. In the end, an organization is nothing more than the collective capacity of its people to create value.<sup>10</sup>



**FIGURE 2.6**  
Stages of Lean transformation.

The evolution of a Lean culture often begins with the adoption of continuous improvement tools, followed by the formation of behavior-driven systems, guided by shared values and principles. Tools provide structure and capability, systems\* develop common practices and procedures, and principles provide a foundation which reinforces cultural standards and daily behaviors. (See Figure 2.6.)<sup>11</sup>

It's one thing to create a mission statement and clever slogans articulating strategic objectives of the organization, and an entirely different thing to have a deeply shared vision and constancy of purpose by all employees. Shared beliefs are reflected in self-created social systems that become *the way we get things done around here*. As organizations evolve, certain behaviors become the norm and are reinforced by daily actions.

When it is customary for people to take personal responsibility for the quality of their work, actively solve problems in a collaborative spirit, and give their very best, the energy and excitement of the workplace are palpable. The satisfaction of being part of an effective team accomplishing clear objectives is contagious. When actions are aligned with the principles we've discussed, they reinforce the strategic direction of the

\* Systems, in this context, are collections of tools and procedures which form a standard way of doing things. Examples of Lean systems include kaizen process, A3 thinking, standard work, 5S, level loading, measurement, the visual workplace, and strategy deployment.

organization while creating a constancy of purpose in support of unrelenting improvement.

*Summary:* Aristotle said over 2,000 years ago, “We are what we repeatedly do. Excellence, then, is not an act, but a habit.” Shared values and principles will serve as a compass throughout your Lean journey. Develop a solid foundation of main beliefs that inspire respect, proactive behavior, innovation, and constant learning, and you will be well on your way toward sustainable operational excellence.

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## THE CENTRAL CONCEPTS OF VALUE AND WASTE

The principal focus of Lean is problem solving for the primary purpose of delivering value to the customer, achieved by the systematic elimination of waste throughout the value stream. While many people we meet feel they understand these concepts, often we discover their grasp of these terms varies greatly. Let’s begin by defining *value stream*, *value*, and *waste*.

### Value Stream

A value stream is composed of all the life cycle processes required to bring services, products, and information from concept to customer. This includes all current activities, whether or not they create value, carried out for internal and external customers. Value stream improvement requires a cross-functional perspective, drawing individuals, workgroups, and departments away from local optimization and silo thinking. Systems thinking enables people to see the whole process and understand value from the customer’s perspective.

### Value

Value is what the customer wants and is willing to pay for. Intuitively, we all know some activities add value for the customer while others do not. Surprisingly, value stream mapping analysis reveals that, for most value streams, processes add value only 5 percent of the time it takes to deliver the product, service, or information to the customer. To put it another way, no value is created at least 95 percent of the time!

### **Value-Added Work: VA, NVA, and NNVA**

All components of work can be characterized as value-added (VA), non-value-added (NVA), or necessary but non-value-added (NNVA) work. The assessment process of whether an activity is adding value is straightforward but not always easy to answer: if they knew about it, would customers be willing to pay for it? Alternatively, would the customer judge the product or service as less valuable if the task was not performed?

NNVA work includes tasks the customer may not choose to pay for but the company is legally or ethically compelled to do (e.g., filing tax returns, Sarbanes-Oxley Act [SOX] compliance, supporting the local community, and other acts of corporate social responsibility).

### **The Three Ms**

Wasteful practices can be divided into three categories known as the *three Ms*: *mura*, *muri*, and *muda*. The differences and similarities among these terms lead to a deeper understanding of the impact of wasteful practices and the need for their methodical elimination.

#### ***Unevenness: Mura***

Unevenness and variation (*mura* in Japanese) represent inconsistency in the flow of work, caused by changes in volume (uneven demand), mix (variation), and quality. Customers desire variety and flexibility, but these should be achieved while avoiding unnecessary complexity and chaotic behavior. It is the responsibility of management to minimize the impact of variation by encouraging standardized product and process design, leveling demand, and introducing flow, pull, and just-in-time production control and delivery systems.

#### ***Overburden: Muri***

Overburden (*muri* in Japanese) represents placing unrealistic workloads on people and equipment, which leads to stress, mistakes, rework, and poor morale. It is the job of management to remove overburden by

making use of work design,\* training, standardized work, and demand management† to support a smooth flow of products, services, and information.

### **Waste: *Muda***

Waste (*muda* in Japanese) is any NVA work (defined earlier). In the mid-1950s, Taiichi Ohno introduced the concept of systematic elimination of waste at Toyota. This evolved into the Toyota Production System's seven wastes found in production (see also Chapter 3 and Appendix C):

1. *Overproduction*: producing more or sooner than is needed by the customer (this contributes to the other wastes)
2. *Inventory*: having more than the minimum levels of raw materials, work in process, and finished goods required to support flow and pull (excess inventory disguises other wastes)
3. *Waiting*: stopping or slowing down for work to arrive
4. *Transportation*: movement of work product, information, and materials
5. *Overprocessing*: excessive or unnecessary work
6. *Motion*: unnecessary physical movement
7. *Correction*: reworking defects and mistakes, inspection, and scrap

Often an eighth major waste is included in the list: unused human creativity and potential. Recently many Lean practitioners have also begun to add environmental waste to the list. Every type of waste mentioned is found in all business environments, not exclusively manufacturing.

By learning to see those activities that consume time, materials, and effort while failing to add value, individuals and teams identify and remove *muda* from the value stream. While simple in theory, it requires practice to develop *beginner's mind*—the ability to look at a familiar process as if for the first time and really *see* what is happening.

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\* Work design centers on creating work procedures and environments that support efficient execution of tasks and smooth throughput of work by focusing on the difficulty of tasks, job stress, and employee satisfaction.

† Demand management is the practice of matching available capacity to a prioritized backlog of work to support an even flow of attainable work. See Chapter 5.

### ***The Power of the Three Ms***

The three Ms bring a comprehensive perspective to waste reduction and reinforce a cycle of continuous improvement.

Managers are responsible for addressing the systemic conditions of *mura* and *muri*. Variability (*mura*) reduction is achieved through selecting markets, product design, and pricing, which supports level demand. Overburden (*muri*) reduction focuses on designing processes for workflow and consistent quality, standard work, cross-training, and balancing resources to create stable capacity conditions that support the smooth flow of information and work. When management reduces the systemic wastes of variability and overburden, levels demand, and frees capacity, workers then have the time, energy, and focus to continuously improve their activities to eliminate waste (*muda*), while simultaneously engaging in their daily work.

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## **LEAN TOOLS OVERVIEW**

Lean offers a wide variety of problem-solving tools which provide structure and consistency to identify and quantify NVA tasks, analyze problems, discover root causes, develop countermeasures, implement improvements, and measure results. In this section, we provide a brief description of the most commonly used Lean tools.\*

A tool is anything that enables us to accomplish a task more easily and effectively. We discovered long ago that, if you start out with just a handful of tools and then hone your process improvement skills, you will be in a much better position to learn and apply additional tools as you need them.

### **A3 Thinking, the Scientific Method, and PDCA**

At the heart of Lean is the A3, a single piece of paper used to summarize the definition, scope, discovery process, findings, proposed countermeasures,

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\* For an in-depth discussion of Lean tools, see Pascal Dennis, *Lean production simplified* (New York: Productivity Press, 2007); John Bicheno and Matthias Holweg, *The Lean toolbox*, 4th rev. ed. (Johannesburg, South Africa: Picsie Books, 2008); and Chet Marchwinski and John Shook, *Lean lexicon* (Cambridge, MA: Lean Enterprise Institute, 2008). For an in-depth review of Six Sigma tools, see Thomas Pyzdek and Paul Keller, *The Six Sigma handbook*, 3rd ed. (New York: McGraw-Hill, 2009).

and results of a problem-solving exercise. A3 is an international paper size approximately 11 × 17 inches (297 × 420 millimeters), suggesting that a person or team be able to communicate the essential elements of a problem-solving effort summarized on a single sheet of paper.

An A3 can also be employed as a proposal or status report. But the A3 is much more than a form; A3 thinking is a mental framework used to reinforce the scientific method of solving problems: Plan-Do-Check-Act (PDCA\*). The scientific method is a structured approach to problem solving which includes observation, development of a tentative description of cause and effect (hypothesis), prediction, testing, and evaluation. More often than not, attempts at problem solving lack structure and method. People naturally jump to solutions, focusing on symptoms instead of root causes, and failing to fully understand, let alone solve, the problem at hand.

Benefits from applying A3 thinking include fact-based decision making, consensus building, clearly documented assumptions, defined targets, faster results, and follow-up to ensure that improvements are sustained.† Although there are many different formats for an A3, the specific form design is not important—but the disciplined A3 thinking process is. For an example of an A3, see Appendix D.

## Value Stream Mapping

Many people have experience with process mapping (as shown in Figure 2.7), which provides a detailed view of the tasks and decisions contained in a specific process. While process mapping is very effective at providing a detailed step-by-step view of a specific procedure, it does not attempt to capture information about flow, elapsed time, cost, or quality at the value stream level.

Value stream mapping visually depicts the flow of information, materials, and work across functional silos with an emphasis on quantifying wastes, including time and quality. As shown in Figure 2.8, however, a value stream map can also illustrate a lower level of detail. Typically, the focus is at a more macro level than process mapping and does not include individual tasks and decisions.

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\* In healthcare this is commonly known as PDSA, Plan-Do-Study-Act.

† For an in-depth example of A3 thinking and PDCA, see John Shook, *Managing to learn* (Cambridge, MA: Lean Enterprise Institute, 2008).

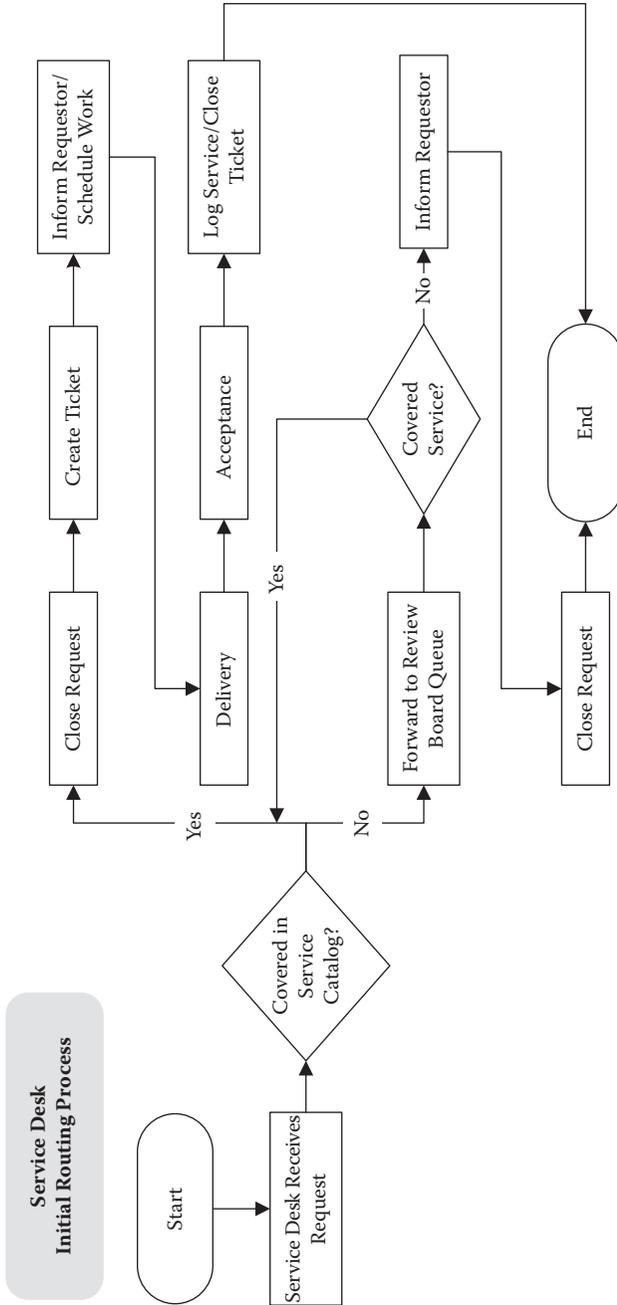


FIGURE 2.7  
Process map example.

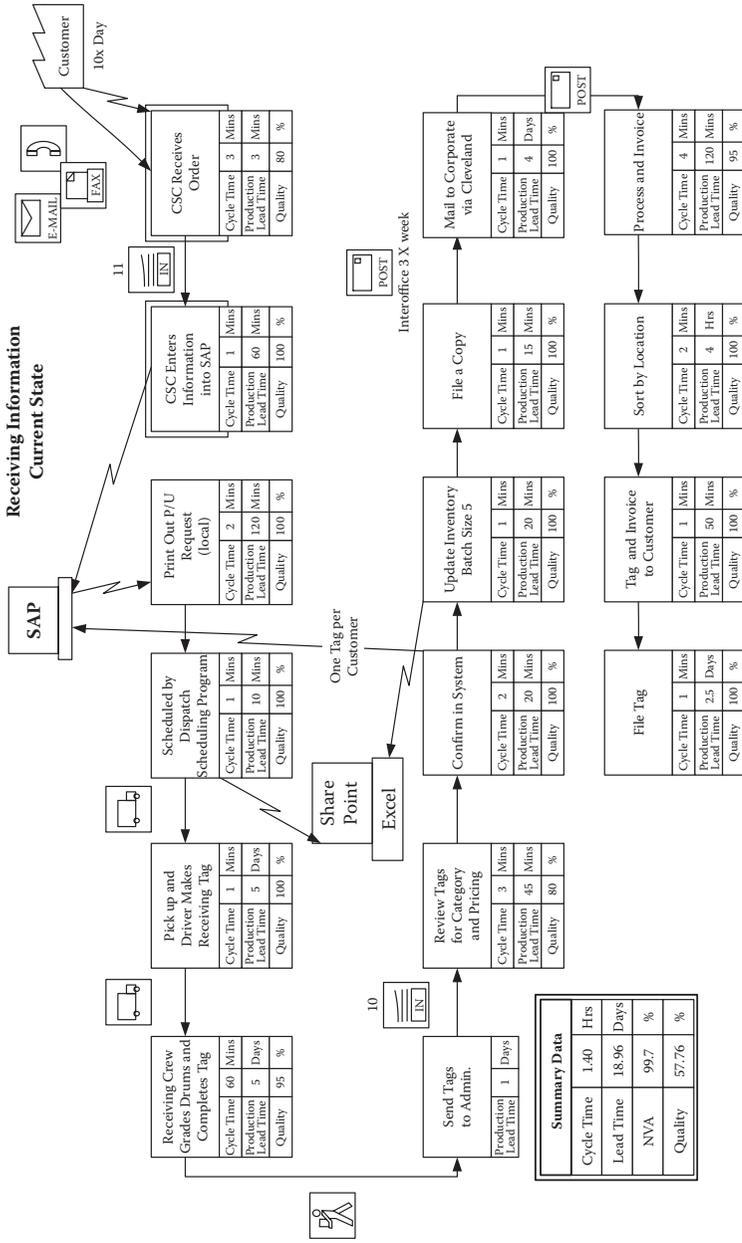


FIGURE 2.8 Value stream map example.

Beyond the physical map itself, the activity of value stream mapping helps to bring a multidisciplinary team together to see the whole process from a work and information flow perspective. When a cross-functional team is assembled (ideally including a representative from IT) to map a process, a picture of the current state emerges through rounds of discussion and discovery. Once the team agrees that the current-state value stream map accurately depicts the situation, they are in a position to make data-supported predictions on which improvements will yield the greatest results. Developing a current-state value stream map brings a shared understanding and consensus to the cross-functional team, representing stakeholders—including in-house resources, internal and external customers, vendors, and suppliers—from various parts of the organization that may seldom otherwise interact. As the team reaches agreement on the current state of the process and the waste it contains, they create a baseline for developing a future *blueprint* of the improved value stream, in order to highlight gaps between the current and target future state, prioritize activities, and establish metrics.\* Maintaining an updated current and future-state value stream map keeps the team focused, enabling targeted continuous improvement that delivers meaningful and quantifiable results.

## **Kaizen**

Kaizen<sup>†</sup> (Japanese for *continuous improvement*) is a systematic improvement methodology that is central to Lean. Kaizen involves many small incremental improvements and provides structure to process improvement.

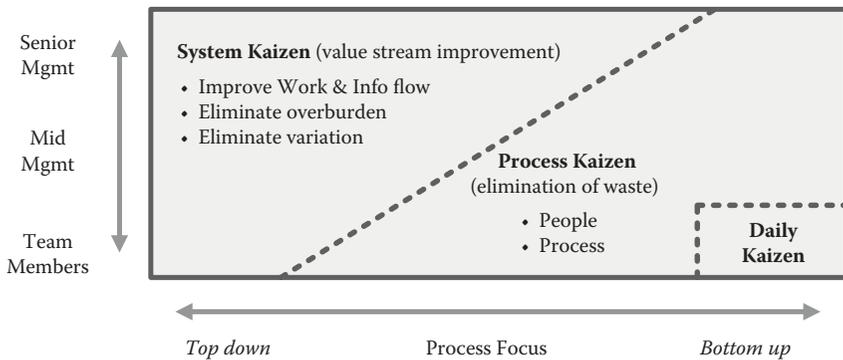
### ***System and Process Kaizen***

There are two kinds of kaizen: system (also called flow) and process (Figure 2.9). System kaizen attempts to improve the overall value stream by enhancing material and information flow, and is the focus of management. Process kaizen, performed by teams and individuals, concentrates on reducing waste in specific focus areas within the value stream. Improvement in one type of kaizen positively impacts the other.

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\* See Beau Keyte and Drew Locher, *The complete Lean enterprise: Value stream mapping for administrative and office processes* (New York: Productivity Press, 2004); and Mike Rother and John Shook, *Learning to see* (Cambridge, MA: Lean Enterprise Institute, 1999).

† See Masaaki Imai, *Kaizen: The key to Japan's competitive success* (New York: McGraw-Hill, 1986).



**FIGURE 2.9**  
Kaizen types

### ***Kaizen Events, Projects and Daily Improvement***

The duration of kaizen activity ranges from a few minutes to several months. The degree of rigor and formality varies with the nature of the undertaking. *Kaizen events* are focused short-term improvement efforts that usually involve a cross-functional team and last from three to five days. Although the Kaizen event lasts just a few days, preparation can take place over several months prior to the activity.

Some Lean efforts require more time to plan and execute; these *kaizen projects* last from several weeks to up to three months. To maintain focus and deliver improvements as quickly as possible, we recommend that no kaizen activity last longer than 90 days. If the scope is larger than that, decompose the project into smaller phases (see Lean Project Management in Chapter 9).

For Lean to become a part of daily culture, every individual should be inspired to drive improvement on a daily basis. *Daily kaizen* (a form of process kaizen also known as a kaizen blitz) is spontaneous improvement performed as a need is identified. For example, when a problem is encountered, an individual or small group stops working to identify the problem, analyze it, develop potential countermeasures, select the most promising solution, make the improvement, and assess the impact. In a Lean enterprise, the highest proportion of problem solving occurs at the daily kaizen level.

## **Kaikaku**

Organizations also take on strategic breakthrough initiatives. *Kaikaku*, typically initiated by senior leadership, is system kaizen focused on achieving radical improvement, as contrasted with kaizen which is gradual and continuous. Kaikaku is strategically focused and represents a leap forward, not incremental change. Wisdom and experience suggest an organization should undertake only a few kaikaku projects at one time.

## **Standardized Work**

Standardized work defines and documents the most effective method to accomplish a task. There are usually a variety of ways to perform the same work, depending on who is doing it. Variation in work practices creates variation in time, quality, and cost. First a team establishes a current standard to which they all agree to adhere. As work improvements are developed, tested, approved, and implemented (PDCA), they become the newest version of standardized work.\* As variation and waste are reduced, process quality and stability are enhanced, and cost reduction is often a natural by-product.

Rather than being dictated by management, standard work is established and owned by the people performing the work, converting *tribal knowledge* known only by a few to a documented method consistently performed by all. Shared understanding of how work is done also supports rapid learning, skills transfer, cross-training, and load balancing.

Standard work also applies to managers, supervisors, and team leaders. Using a *Lean management system*, leaders combine standard work, visual controls, gemba walks, daily accountability, and discipline to support their people and generate measurable results. *Gemba* is Japanese for “real or actual place” and highlights the need to leave the comfort of your office or cubicle and go where the internal or external customer is using the product or service to witness what is really occurring and verify your understanding. There is no substitute for personal observation.

For some people, the word *standard* implies rigidity and inflexibility—barriers to innovation. But in fact, the process stability created by standard

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\* For a comprehensive study, see David Mann, *Creating a Lean culture: Tools to sustain Lean conversions* (New York: Productivity Press, 2005).

work encourages innovation. Why? It is virtually impossible to improve a process that is unstable or not consistently performed. As work procedures are standardized, employees experience stable work processes upon which they can build.

## 5S and the Visual Workplace

5S is a workplace organization method. Roughly translated to English from Japanese, 5S stands for “Sort, Set in Order, Shine, Standardize, and Sustain.”\* 5S provides a systematic approach for cleaning up, organizing, and maintaining an orderly workplace. Disorganized work environments encourage wasteful business practices and hide underlying problems. They also create mental clutter and chaos. Companies often begin their Lean journey with 5S, not only to establish a foundation of order, but also to raise awareness of business processes, sources of waste, and opportunities for improvement (see the Con-way Virtual 5S case study).

5S also lays the groundwork for the visual workplace,<sup>†</sup> eliminating visual and mental noise—creating an environment where the status of work is so self-apparent that emerging problems call attention to themselves. By actively displaying the information that needs to be shared, the visual workplace provides people with the information they need to know without having to ask for it. A great deal of time is wasted on interruptions to answer questions such as “What is the status of ...?” Most status inquiries are no longer necessary in a visual workplace, since the answers to such queries are constantly displayed, updated, and accessible to all.

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## LET’S GET STARTED!

We have established our foundation, discussing the central principles and tools of Lean. In the next chapter, we build on these ideas by describing Lean IT and its importance in creating and sustaining a Lean transformation.

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\* See Thomas Fabrizio and Don Tapping, *5S for the office* (New York: Productivity Press, 2006).

† See Gwendolyn Galsworth, *Visual workplace, visual thinking* (Portland, OR: Visual-Lean Enterprise Press, 2005); and Hiroyuki Hirano, *5 Pillars of the Visual Workplace* (New York: Productivity Press, 1995).

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1. Eliyahu Goldratt, *The Goal*, (Great Barrington: North River Press, 1984).
2. James P. Womack, Daniel T. Jones, and Daniel Roos, *The machine that changed the world* (New York: HarperCollins, 1990).
3. Michael Hammer and James Champy, *Reengineering the corporation* (New York: HarperCollins, 2003).
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8. Steven Spear and H. Kent Bowen, *Decoding the DNA of the Toyota Production System* (Boston: Harvard Business Press, 2007).
9. Jeffrey K. Liker, *The Toyota way* (New York: McGraw-Hill, 2004), 108.
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11. Diagram supplied by The Shingo Prize for Operational Excellence (Logan: Utah State University, Jon M. Huntsman School of Business, 2009).

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## *The Lean IT and Business Partnership*

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### CHAPTER OBJECTIVES

Having established the fundamentals of Lean, we turn our focus to information and information systems as an often untapped source of value. We will:

- Explore why IT has traditionally been overlooked in Lean initiatives.
- Search for IT's "burning platform" for change.
- Consider information wastes and their consequences.
- Explore how Lean tools apply to information and information systems.

The most important, and indeed the truly unique contribution of management in the 20th century was the fifty-fold increase in the productivity of the manual worker in manufacturing. The most important contribution management needs to make in the 21st century is similarly to increase the productivity of knowledge work and knowledge workers.

—Peter Drucker

We can all agree that quality information is an essential business asset that guides behavior and supports good decisions.

Every business process relies on quality information and effective information systems, whether manual or electronic, as the flow of information supports the flow of work and the creation of value. And most organizations in this modern age have no choice but to rely heavily on electronic information systems due to the volume, complexity, or global reach of their activities.

Many IT organizations have gone beyond traditional business process improvement, investing in self-service applications, enabling their customers to help themselves, and improving speed, quality, and customer satisfaction, all while reducing operating costs.

And beyond the improvement of processes, some organizations are learning to differentiate themselves through innovative *information value* incorporated within, or delivered through, their products and services. For example:

- In 2008, 70 percent of BMW's production was made to customer order, and each one of those customers was invited to watch their car's assembly on the factory floor through an interactive website, creating an exciting customer experience even before they climbed into the driver's seat.
- GE Healthcare provides abundant information on their advanced medical products (MRI, radiography, molecular imaging, etc.) helping health care providers use these sophisticated devices more effectively to improve the health and quality of life for their patients.
- Years ago Amazon.com redefined the role of a bookseller, and now they (along with Barnes & Noble, Apple, Microsoft, and many others) hope their electronic books and tablet PCs will redefine the traditional *book*.
- Many providers now offer outsourced information-oriented services, from accounting to medical chart review and IT services, around the globe.

The possibilities seem endless, with new innovations appearing daily. Skillful and innovative application of information and information systems can add value—speed, quality, cost, differentiation, customer intimacy, and more—to the enterprise and its customers.

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## WHY HASN'T IT BEEN A FOCUS OF LEAN?

Despite its clear importance, however, IT\* has received little attention from the Lean community. In our opinion, the IT organizations'

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\* The term "IT" is used broadly throughout this book, but it can mean many things: information, information systems, the IT organization, the tangible, intangible and intellectual assets, policies and procedures related to information and information systems management

historical disengagement from Lean efforts is one of the root causes behind the failure of many enterprises to achieve a *sustainable* Lean transformation.

In fact, IT associates often have a better understanding of the company's processes and current limitations than the users, because it's their job to grapple with the intricacies of maintaining and supporting the underlying systems. But their ability to improve the system may be constrained by countless factors.

While preparing for a Lean IT workshop for a large global enterprise, we were presented with a list of questions the participants asked us to address, asking "How can IT ...

- Work in partnership with the business on improving process and system effectiveness?
- Drive faster and more dramatic improvement and innovation for the business?
- Improve its ability to deliver projects on time, within budget, with desired results?
- Place creativity before capital, process improvement before system investment?
- Help simplify IT operations and improve time, quality, and cost of our services to the business?
- Become more engaged to seek out and solve root causes of problems?
- Achieve greater employee engagement and satisfaction through Lean thinking?"

This list, their *voice of the customer*, was on their collective minds that week, and nicely frames the essential value proposition we will explore throughout this book. Clearly, if Lean IT can address these issues, it will be a tremendous catalyst for positive change, overcoming inertia and resistance that has prevented many organizations from advancing further in their journey of continuous improvement.

But as we all know, such breakthrough change is often disruptive, threatening, and uncomfortable. Most individuals and organizations need a compelling reason to change, a *burning platform* from which they have no choice but to jump.

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## WHAT IS IT'S BURNING PLATFORM FOR TRANSFORMATION?

We once heard that managing an IT organization is like juggling alligators and chain saws—this may not be far from the truth. Business requirements are constantly changing. End users are often unable to articulate exactly what they need, yet they often seem insistent about what they *don't* want ... once they see it.

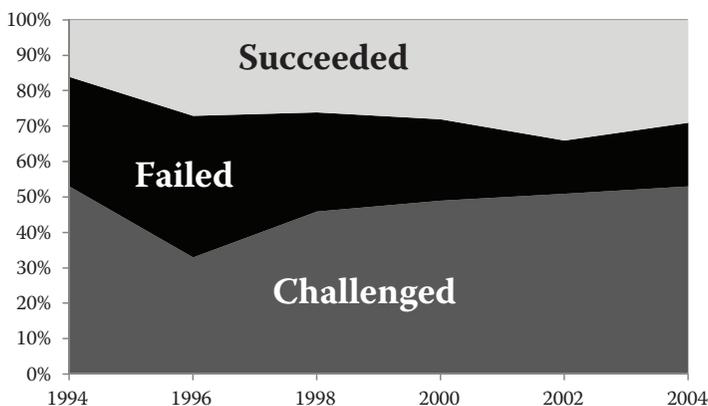
Software, hardware, and Internet technologies are constantly changing, becoming more complex, and the interdependencies among multiple systems make the change, upgrade, or replacement of any single component a risky proposition. The cost of complexity is not linear but exponential, and it eventually comes to dominate all other costs in most software systems.<sup>1</sup> Combine this complexity and volatility with resource and capacity management challenges, conflicting priorities, and frequent interruptions, and IT leadership has more than a few alligators and chainsaws to contend with.

The number of distinct business software applications used in a mid-sized company can easily measure more than 100, and in a large global enterprise, thousands of applications may be in play, causing tremendous integration and software life cycle management challenges. Changes to this loosely woven fabric of software and data are especially risky and potentially disruptive to the business when they impact enterprise-wide, mission-critical systems like enterprise resource planning (ERP), supply chain management (SCM), or customer relationship management (CRM).

The Standish Group has been conducting surveys on IT projects since 1994. Their annual *CHAOS Report* reveals that roughly 20 percent of IT projects fail,\* 50 percent of projects are challenged, and only 30 percent succeed. Over the years, the survey results have improved slightly (Figure 3.1), which is somewhat encouraging. Nevertheless, if any other department within an organization consistently produced similar results, the managers would be updating their résumés.

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\* The Standish Group defines success as on time, on budget, and meeting the specifications. There is some debate whether these are useful and measurable guidelines—for example, a cancelled project may be an indication of good governance rather than faulty project management, and a successful project may not add value if the specifications don't properly address customer requirements or business problems at the root cause.



**FIGURE 3.1**  
Standish Group CHAOS 20-Year Trend.<sup>2</sup>

But IT is not like other departments; managing this degree of complexity, volatility, and risk requires a balance of professionalism, technical know-how, artful prioritization, and a little magic. And through it all the business must keep running, so the IT staff is charged with maintaining order, stability, and performance, while steadfastly preventing unplanned downtime.

### **Lean versus Traditional IT: A Natural Tension?**

Perhaps there is a conflict arising from the very nature of traditional IT and Lean practices, as suggested by the table in Figure 3.2.

As you can see from this comparison, traditional IT organizational practices typically move slowly and carefully to avoid instability and business disruption, while Lean encourages every individual to notice and fix problems by making small improvements each and every day. This difference creates a tension that permeates the daily activities and interactions among business and IT associates. We are not suggesting these are irreconcilable differences leading to constant conflict and confrontation, though that seems to happen within some organizations. We are simply calling attention to natural tendencies that, left unaddressed, may create friction, causing the IT organization to disengage or even resist the ongoing improvement of business processes.

	Lean	Traditional IT
Change Management	Organic, incremental, and continuous	Engineered and planned large events
Organization	Cross-functional teams	Central command and control
Measures	Top-down and bottom-up performance measures linking improvement initiatives to strategic goals	Cost containment and uptime
Knowledge Management	Generalization	Specialization
Education	Process focus	Task focus
Definition of Success	Speed and Agility	Stability

**FIGURE 3.2**  
Contrasting attributes of Lean IT and traditional IT.<sup>3</sup>

## Legacy Systems

A common example of ineffective IT and business coordination is the existence of a significant *legacy* information system—homegrown or extensively modified software that remains in place long past its useful life cycle. A legacy system may persist for a number of reasons, among them: unique or unusual business processes are dependent upon it, it may rely on obsolete or obscure technology, those who designed and built it have long since left the company, and the system has been patched repeatedly but the changes are poorly documented. As a result, most IT associates are reluctant to tinker with a legacy system unless it's absolutely necessary.

Legacy systems are like organizational scar tissue—they form around injuries in the business processes, building layer upon layer of hardened procedures, and limiting flexibility of the process while causing pain. And each time business requirements change, a new layer of reactive changes and patches are added. Over the years the legacy system becomes increasingly fragile, the user workarounds more contrived, and the business processes more ineffective and resistant to change. This degenerative process causes the accumulation of *technical debt*, a liability that extracts daily payments in the form of waste and inefficiency, until the debt is liquidated.

For example, one client was replacing a 20-year-old legacy system that had been extensively customized to fit their unique requirements, like a well-fitting but worn-out old glove. Over the years the 100-year-old

company had devised elaborate pricing agreements with many customers. Some of these agreements predated the legacy system and were very difficult for both the company and its customers to administer.

There is no doubt that renegotiating these pricing agreements would have been difficult. On the other hand, the impending system replacement provided a golden opportunity to revisit the customer relationships, and re-assess their value proposition, standardizing delivery services and pricing structures. Instead, the executives decided to transfer the existing agreements to their new ERP system. This created millions of distinct pricing records in the database. The added complexity caused countless errors and exceptions, while requiring two full-time employees to maintain the system and chase the problems. No value was added here.

Removing layers of systemic scar tissue can be uncomfortable, requiring discipline and effort, so it is often neglected. As a result, entangled systems, inflexible users, and overly complex designs can smother an improvement effort. In such cases, members of the IT organization may feel like they are the scapegoat for deeply rooted problems within the overall enterprise that are beyond their control.

## **What about Process Maturity Models?**

IT professionals are naturally process-oriented, structured thinkers. So it's no surprise that over the years they have participated in the development of an alphabet soup of *process maturity models* to guide the evolution of the process-oriented enterprise. Popular models include CMM, ISO, ITIL, and SCOR.\*

However popular these models may be, often they are not effectively implemented or sustained. For example, over the past two decades or more, ISO 9000 resulted in many compliance-driven implementations that didn't improve the fundamental behavior or performance of the organization.†

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\* Acronym alert! CMM: Capability Maturity Model; ISO 9000, 14000, 22000, 27000 and others: International Standards Organization standards for quality management systems; ITIL: Information Technology Infrastructure Library; and SCOR: Supply Chain Operations Reference Model.

† The same can be said for many other compliance-driven improvements across many industries, including the Sarbanes-Oxley Act for publicly traded companies, The Joint Commission (JCAHO) for health care, the U.S. Food and Drug Administration (FDA) Good Manufacturing Practices, and so on.

These process models provide general frameworks for industry *best practices* (or at least *acceptable* practices), describing the target state of key processes. In other words, these process models usually describe the *what* but not the *how*. This approach is typically a *top-down* process, where leadership selects a model, an implementation methodology, and perhaps an outside consulting firm to drive the implementation.

This authoritative approach can be rapid but may result in superficial adoption of new practices, while lacking employee buy-in and the subtle nuances that accommodate the company's culture. This in turn may lead to resistance, and the inability to sustain the improvements without constant management oversight and arm twisting. Under these circumstances, compliance often appears, and only temporarily, soon before the auditors are scheduled to arrive

By contrast, consider a *bottom-up* approach, where cross-functional teams identify and solve problems and improve processes as a natural evolution. Each incremental step is defined according to the teams' perspectives and priorities. While this results in individuals and teams driving process improvement and innovation through hands-on problem solving, it may also create a slow and somewhat random approach to achieving strategic goals of the enterprise.

The ideal approach to using a process model may be found as a hybrid of top-down and bottom-up. Teams apply A3 thinking, solving problems according to the specific circumstances and culture of the organization, while the general future-state direction is guided by strategic input from leadership, supported (in some situations) by a mature process model or framework, such as ITIL (see Chapter 7). In this way, the organization leverages industry practices to envision and target a desired future state. In doing so, the organization can adopt best practices for *supporting processes* (see Chapter 4), focusing its creative energy on innovative practices that will provide distinction and competitive advantage.

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## WHAT IS INFORMATION WASTE?

Data is of course important, but I put greater emphasis on facts.

—Taiichi Ohno, Toyota

The many benefits of electronic information systems are often offset by the waste they generate. Too many times we have witnessed Lean teams attempt to improve a process, but the moment they return to their keyboards, they're forced to act out the same old familiar and wasteful practices in their daily work. Information waste produces many harmful consequences, including lost productivity, costly delays and errors, and unnecessary complexity. Often manifesting as confusion and frustration, information waste is felt by everyone who interacts with the organization.

### **Excess Information Inventory Waste**

In an office or manufacturing context, excess inventory is a highly visible symptom, a beacon to illuminate the search for root causes of wasteful activity. From a Lean IT perspective, what is excess *information inventory*? It is too much *virtual stuff* ... in your inbox, your local hard drive, shared drives, intranet sites, and data warehouses. Excess information inventory is work backlog waiting to be done, unnecessary e-mails in your inbox, unused features in software applications, local spreadsheets impeding the flow of work as a process skips across departmental boundaries, and so on. Excess information inventory causes congestion, delays, inefficiency, errors, and rework. Everyone in the enterprise struggles against info-glut.

Most people naturally hoard inventory; it's a primal instinct that goes back to our hunting-and-gathering days. Having too much stuff buffers you from variability, since you always have enough even when your supply runs out for a while. For this reason, excess *information inventory* is important to seek out because it indicates that the process itself, the *flow* of work that the information supports, is unreliable. More information (e.g., additional data, better software, and more automation) alone is unlikely to fix the problem.

Just like excess physical inventory is stored in warehouses, excess data and documents are stored in data warehouses and repositories throughout the organization. The effort required to capture, store, search, and manage these data just in case they might be needed is wasteful, even if storage space is abundant and inexpensive. This waste is compounded by data fragmentation, version control challenges, excessive security controls, and other flow inhibitors caused by excess information inventory.

## Information Overprocessing Waste

Another form of information waste is *overprocessing*, of doing more work than necessary. A common form of overprocessing is the overdesign of a software application, creating unnecessary navigation, keystrokes, and other forms of complexity. Less than half of software features are typically used, but once implemented, they must all be maintained and supported. This non-value-added effort creates a burden for users and IT staff alike.

Unnecessary transactions are another common form of information overprocessing, including unnecessary approval steps, and excessive data capture to feed calculations and reports that don't support efficient workflow or effective decision making.

Multitasking is a pandemic form of overprocessing waste in the business world. At one time we all considered multitasking a virtue to be cultivated, but now we realize that constant interruptions and task switching are unproductive. In the *Harvard Business Review* article "Manage Your Energy, Not Your Time," Tony Schwartz and Catherine McCarthy suggest that,

Distractions are costly: a temporary shift in attention from one task to another—stopping to answer an e-mail or take a phone call, for instance—increases the amount of time necessary to finish the primary task by as much as 25 percent, a phenomenon known as "switching time." It's far more efficient to fully focus for 90 to 120 minutes, take a true break, and then fully focus on the next activity.<sup>4</sup>

Most people require about 15 minutes to productively resume a challenging task when they are interrupted even by something as innocuous as an e-mail alert, scientists at Microsoft Research and the University of Illinois found in a 2007 study.<sup>5</sup> While 15 minutes may not seem like much time, if interruptions occur several times a day, this can add up to serious performance degradation ... or worse.

Interruptions seem to be a fact of life, but they are costly in terms of time, concentration, and quality. Awareness of this fact can, over time, lead to changing work patterns and communication practices, and setting aside uninterrupted time and space to tackle difficult tasks. In our experience, especially in the office environment, many interruptions are for simple *status inquiries* such as "Where is this?" "When will that be done?" and "What do you need from me now?" The effective use of simple visuals to communicate status and priority of work can significantly reduce

interruptions, improving the quality and efficiency of work while creating a more enjoyable workplace.

### **Poor Data Quality Waste**

Yet another type of information waste is *poor data quality*. Often a sleeping giant within the databases and spreadsheets spanning the enterprise, poor data quality is both a cause and a consequence of poor process design and operational execution.

The Lean principle of *quality at the source* means that data quality is everyone's responsibility. Ideally, data should be captured once at the source, with the appropriate time and effort invested in getting them right the first time. Ultimately, the process owners (not the IT organization) should take responsibility for data quality, establishing standard work and error-proofing methods, accompanied by supportive measurements. High-volume transactional processes with data quality problems are often well suited for the rigorous analytical techniques emphasized by Six Sigma (see the Ingersoll Rand Case Study).

As you can see from this brief exploration, there are many forms of information waste—see Figure 3.3, and for a more comprehensive listing see Appendix C. More importantly, once individuals and teams begin to understand the many forms that information waste can take, how do they methodically identify, quantify, prioritize, and eliminate it?

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## **LEARNING TO SEE INFORMATION WASTE**

To *learn to see* waste you must first understand clearly the degree to which a process creates value from the customer's perspective. Any Lean journey must begin with this simple question: "What does the customer define as value?" So from the IT organization's perspective, *who is the customer?*

In our experience, kaizen teams are often surprised at how many customers they have and how little they understand what each really values. Every step of every process has at least one customer—the recipient of the work flow, the next downstream step. In most business processes, activities are primarily performed by internal resources, serving downstream internal customers. This is the case with internal functions such

## HEALTH CARE INFORMATION QUALITY

Perhaps no industry suffers greater information fragmentation than health care. One registered nurse described 33 separate forms she completed by hand each time she admitted a patient into home care services. Each form contained overlapping information such as patient name, address, medical condition, and so on. Not only does this waste scarce nursing time (an hour to complete the forms while visiting the patient in the home), but also consider the implications of 33 distinct information systems that interface with this single process of admitting a new patient. And the chances are high that at least some data will be captured incorrectly into at least one of these systems, causing not only redundancy but also incorrect and conflicting information. This not only causes many forms of downstream waste, but also in some cases may endanger the health of the patient.

The solution to such fragmentation? Electronic Medical Records (EMR) may help, but they're not enough—and if improperly implemented experience and research\* have shown they may even make matters worse. From a clinical perspective, integrated medical teams are learning to facilitate shared assessment findings, resulting in improved overall care for the patient and family. From a process perspective, interdisciplinary systems thinking, enabled by A3 problem solving and value stream mapping, have become popular within health care organizations in both business and clinical settings. Cross-functional teams of physicians, nurses, administrators, and other stakeholders come together to identify and solve problems, with a focus on value to the customer: time, cost, patient health and safety. Over time, as processes are simplified, redundant applications can also be simplified, normalized, integrated ... and eventually eliminated.

\* Electronic Medical Records, Nurse Staffing, and Nurse-Sensitive Patient Outcomes: Evidence from California Hospitals, 1998–2007, Michael F. Furukawa, T. S. Raghu, and Benjamin B. M. Shao, Health Research and Educational Trust.

<b>Waste</b>	<b>Manufacturing</b>	<b>Office</b>	<b>IT</b>
Inventory	Excess raw material, work in process, and finished goods	Work accumulating in physical and virtual inboxes, excess physical files	Excessive information causing searching and version control problems, excessive backlog and work in progress
Overproduction	Producing more or sooner than the customer needs	Producing documents before they are needed, doing a large batch of paperwork that the downstream worker can't handle all at once	Excessive email, reports, system alerts, etc., that are not read or acted upon
Delays	Waiting for materials from the upstream workcenter	Waiting for unnecessary signature or approval or monthly closing processes, time wasted in unproductive meetings	System downtime, unnecessary workflow steps
Transportation	Moving materials from one location to another	Physical or virtual transportation of documents	Handoff of information across organization boundaries and multiple systems, security barriers to information flow
Over processing	Doing more work than the customer wants (e.g., unnecessary product features)	Producing reports that nobody reads, overuse of the email "reply all" button, expediting	Redundant data, unnecessary transactions, unused reports, software features that users don't need
Motion	Bending, lifting, twisting, walking, packing/unpacking, searching for stuff	Walking, copying, filing, searching for materials and information	Searching for information, reentering data, excessive keystrokes, frequently shifting priorities
Defects	Defects that require correction or cause scrap	Work passed on that is incomplete, incorrect, or requires clarification	Incorrect, untimely, and confusing information that causes bad decisions

**FIGURE 3.3**  
Comparing waste in manufacturing, office, and IT.

Value Stream: Sales to Cash

Who is the Customer?	Internal or External?	How well do we understand them?	What information do they value?
Finance department	Internal	High	Accurate data, available to support timely financial close
Product development team	Internal	Low	Not sure, something to do with accurate sales history; action item: schedule department stakeholder interviews
Top ten customers by sales \$	External	Medium	Accurate invoicing, prompt response to questions, what else would differentiate us? Action item: interview sales and marketing, consider focus group

**FIGURE 3.4**

Simple voice-of-customer exercise.

as Human Resources, the IT Service Desk (help desk), or the employee cafeteria, processes that rarely touch the ultimate end customer of the business.

External processes, such as the customer order processing-to-billing cycle, involve external customers when they request a quote or submit an order, and again when they receive an invoice as the final process output. But most of the work in between is still performed by internal resources serving their internal customers. Any of these steps that do not add value to the external customer (and are not mandatory for compliance) should be targeted for elimination, rather than improvement.

Since the focus of Lean is adding value to the customer (internal and external), improvement activity should include a *voice-of-customer* (VOC) exercise focusing the team on who the customers are and what they value. Figure 3.4 shows a simple VOC brainstorming exercise format focusing on information value.

Once a team understands what the customer values, it has a basis for assessing the severity of the waste it discovers, evaluating its impact on the value stream, and prioritizing its elimination. To eliminate a particular wasteful activity, the team then determines the underlying

causes, conditions, assumptions, and habitual behaviors that perpetuate it. Lean offers many tools and techniques to get to the root cause—brainstorming, cause-and-effect diagrams and the perennial favorite: the five whys—where after someone suggests the cause of a problem, keep asking, “Why?” This persistent inquiry usually leads to some interesting places, as you probe for underlying causes to explain why things *really* happen the way they do. This technique is explored in Chapter 9.

During a kaizen event aimed at identifying and aligning IT value streams,\* Con-way Enterprise Services developed the cause and effect (fishbone) diagram shown in Figure 3.5. While this diagram illustrates the underlying complexity of information waste, this is just the beginning—for each contributing factor identified on this diagram, another “Why?” awaits.

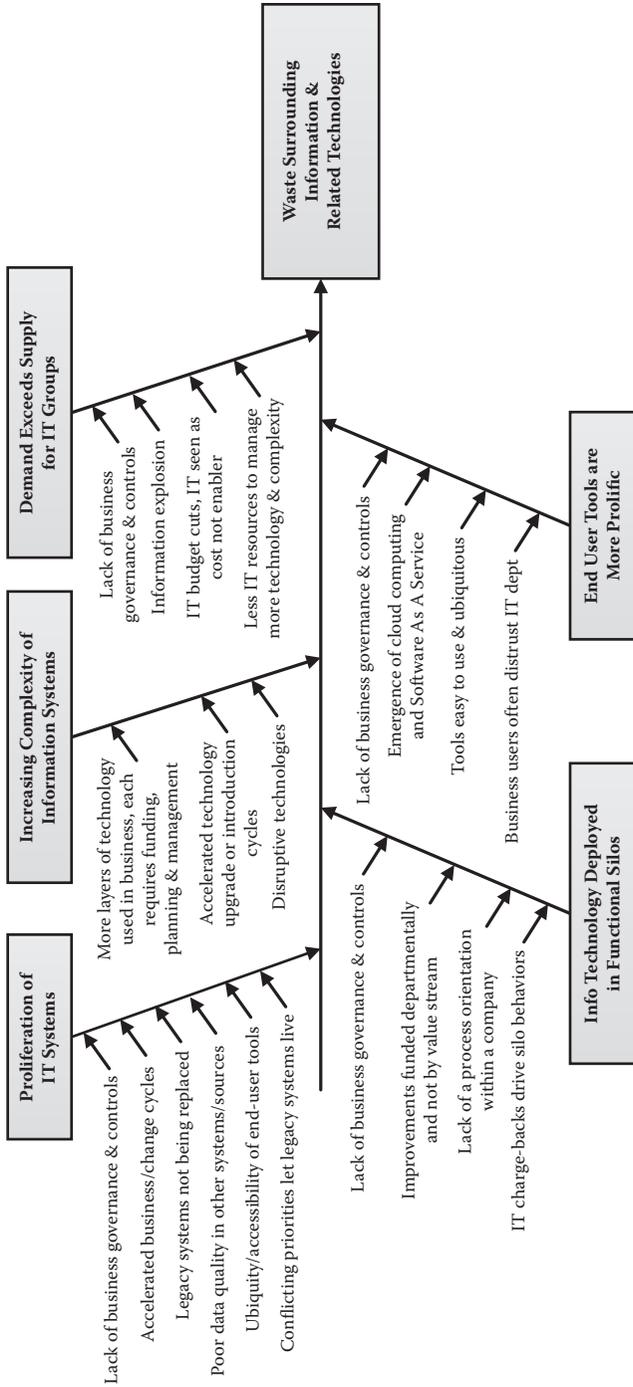
Value stream mapping is an essential tool for identifying and measuring the impact of information waste on process outcomes. According to Mike Rother and John Shook, who introduced value stream mapping, “Material and information flow are two sides of the same coin. You must map both of them.”<sup>6</sup>

In a value stream map, work and supporting information flows are illustrated and quantified, so sources of waste may be prioritized and targeted for elimination based on their impact to overall process performance. Quantification of the impact of waste (time, quality, and cost) in the current-state map, compared to the intended outcome in the future-state map, provides measurement-based justification for change and investment proposals.

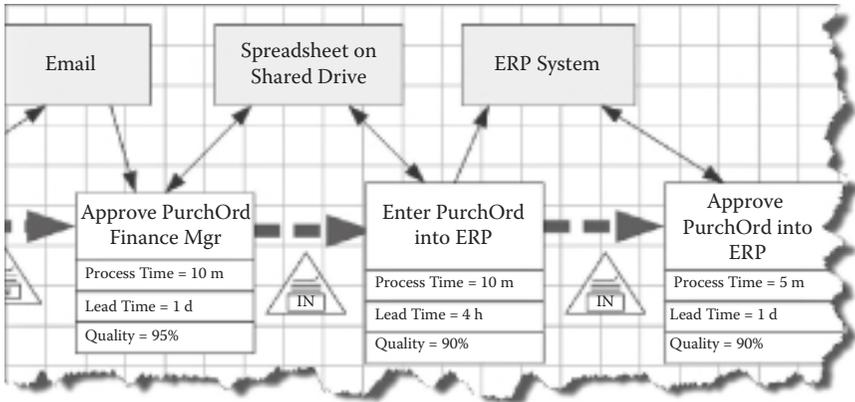
It is not uncommon, particularly in an office environment, for there to be more *information boxes* than process boxes on a value stream map (shown in Figure 3.6). Information proliferation and fragmentation (disintegration) across the enterprise are common causes of waste, and inhibitors to workflow. With spreadsheets on every desktop and data repositories in every department, fractured and incorrect data slip between the cracks as the process is handed off from one siloed workgroup to the next. Data fragmentation and process misalignment lead to overprocessing, delays, process rigidity, errors, rework, worker frustration, and ultimately customer dissatisfaction.

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\* See the Con-way Focused Value Streams case study.



**FIGURE 3-5** One client's view: Cause-and-effect diagram of information waste.<sup>7</sup>



**FIGURE 3.6**  
Information and process boxes in a value stream map.

## LEAN AND GREEN IT

In this age of global environmental consequences, it's important to emphasize the role that the IT organization can play in reducing *environmental waste*. Lean IT and Green IT are certainly complementary; in fact, many environmental benefits are realized simply as by-products of ongoing Lean IT improvement efforts.

When concentrating on green improvements, the issue that most IT associates consider first is the environmental waste caused by IT operations:

1. Data center energy efficiency\*
2. End user computing energy efficiency
3. Toner and paper consumption
4. Ethical handling of electronic waste†

Additional environmental waste reduction opportunities can often be found in business operations improvement, which can be enabled or enhanced by use of technology. In fact, the U.S. Environmental Protection Agency ([www.epa.gov/lean/toolkit](http://www.epa.gov/lean/toolkit)) promotes kaizen activity and value

\* EPA reports data centers consumed 1.5 percent of total US energy consumption in 2006, this demand is expected to grow by 12 percent each year.

† This list was provided by the Nike, Inc. IT sustainability team.

stream mapping to focus attention and action on energy and environmental impact.

Significant environmental improvements are often achieved by evaluating the overall flow of materials and transportation from source to customer. For example, United Parcel Service's (UPS) investment in package flow software improved the performance of their fleet of 95,000 trucks (including the amount of time they spend idling in left-hand-turn lanes), and UPS reported an annual reduction of 28.5 million miles from their delivery routes, saving 3 million gallons of gas and reducing CO<sup>2</sup> emissions by 31,000 metric tons.<sup>8</sup>

Then there is the ability of information systems to provide feedback on the effectiveness of environmental sustainability initiatives throughout the enterprise. This includes not only reporting on direct environmental improvement initiatives, but also accumulating data from process improvements where environmental benefits are a by-product;\* this requires a reporting system that can reach into a variety of internal and external data sources (such as internal ERP systems, external supply chain systems, and regulatory agency websites), sifting through large volumes of data, and building aggregated views and reports of cost reductions and environmental outcomes that are used as feedback to guide ongoing activities.†

Such a reporting system would offer the additional benefit of automating much of the data collection and reporting overhead that will likely be required by various regulatory agencies for cap-and-trade and other environmental programs. And the existence of such a reporting system, to measure and provide direct feedback on a company's carbon footprint and other environmental consequences, would add value to support the company's fact-based decision making on environmental issues (see *Green Intentions* by Brett Wills).<sup>9</sup>

Lean IT is in a strong position to support green initiatives as companies extend their focus to the *triple bottom line*: people, planet, and profits.

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\* One client, during a kaizen to improve a customer billing and collection process, discovered they could avoid printing and archiving billing documents. This eliminated the printing of over 100,000 pages per year, plus the storage space (plus the electricity for heating and lighting) required to archive these documents for several years.

† We expect this opportunity will create a growing market for software developers; two early market pioneers in integrated sustainability dashboards are Microsoft ([www.microsoft.com/dynamics/environment.mspx](http://www.microsoft.com/dynamics/environment.mspx)) and Future State Solutions ([www.futurestatesolutions.com/sustainability.aspx](http://www.futurestatesolutions.com/sustainability.aspx)). See also [www.iisd.org/cgsdi/dashboard.asp](http://www.iisd.org/cgsdi/dashboard.asp).

While not a central theme of this book, we encourage the reader to explore all potential direct and indirect benefits to the environment that may result from Lean waste reduction, both within IT operations and through technology-enabled business process improvement.

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## THE TOOLS OF LEAN IT

In Chapter 2, we explored the basic tools of Lean; now we'll revisit several of these tools, highlighting their relevance to Lean IT. We will continue to explore these tools in various IT contexts throughout this book:

- *A3 thinking*: While IT professionals are natural system thinkers and problem solvers, they are usually under intense time and budget pressure. As a result, they often jump to quick workaround solutions that do not address root causes, creating a technical debt: a continuing liability of inefficiency and frustration. Lean offers tools that help IT and businesspeople slow down and take the time to assess a situation properly. In the realm of Six Sigma, problem solving often includes rigorous collection and analysis of data.
- *Go look, go see (genchi genbutsu, go to gemba)*: People should make decisions by fact, not by feeling, so every team must go to gemba (where the work is performed) to see the situation for themselves. Gemba can be a physical place, or a virtual space such as a business intelligence system that represents the inputs and outputs of a transactional process. Ultimately, though, gemba means the people and the place where the work is done, not the data that represent this work.
- *Teamwork*: In order to align business and IT activities and investments, they must work together as partners—solving problems and simplifying processes first, then carefully applying information systems as appropriate (people, process, and technology—in that order).
- *Value stream mapping*: As we explored earlier in this chapter, value stream mapping can help to identify and quantify information waste within every value stream and supporting process.
- *Standardized work*: Work standards are developed, documented, and continuously improved by the team members, providing input for software requirements, documentation, training, testing, and

support. Knowledge management tools serve to standardize, disseminate, and manage standard work instructions across the enterprise. The work of the IT organization itself should also be standardized to encourage quality and consistency, avoiding pockets of specialized knowledge that create a dependency on specific individuals.

- *Measurement*: The keys to a sustainable Lean transformation are standardized work, accompanied by good measures that provide feedback to ensure the continuing effectiveness of currently defined processes, and to identify new opportunities for improvement. Reporting and analyses are derived from data generated by the organization's manual and electronic information systems, so IT associates are often called on to assist with the design of measurement systems.
- *Workplace organization (5S)*: Sort, Straighten, Shine, Standardize, and Sustain your IT assets: storage, hardware, software, licenses, workspaces, processes, data, knowledge, and intellectual property.
- *Visual workplace*: Make IT process and project flow and status visible to everyone, calling attention to impending problems and avoiding status inquiry interruptions. Visual process measures and alerts are often automated, providing proactive notification of exceptions to identify problems and initiate immediate corrective and preventative action.
- *Cellular organization*: People and equipment supporting all or part of a process are co-located (either physically or virtually using online tools) to encourage smooth workflow, collaborative problem solving, knowledge sharing, and continuous improvement.
- *Demand management*: IT organizations commonly have backlogs that are years long, and are often lacking clear prioritization or decision-making processes. Chaotic demand (*mura*)—variation from sudden spikes, frequent interruptions, and priority changes—contributes to overburden (*mura*), which leads to wasteful activity (*muda*). By working with the business to manage priorities and create level demand, matching it to available capacity to create a steady pace of work (*flow*), an IT organization can become more responsive, giving customers exactly what they want, when they want it.
- *Strategy deployment (also known as hoshin kanri)*: Articulate strategy and align daily work through all levels and dimensions of the organization, ensuring that process improvement and supporting

information systems deliver meaningful and measurable results. Skillful application of information systems can aid in the deployment of an effective strategy deployment system (see the Toyota electronic hoshin kanri case study).

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## **HOW DO WE *DO* LEAN IT?**

Lean IT enables a manageable, synchronized pace for business process change throughout the organization, focused on delivering value to the customer.

Lean IT is accomplished through people, process, and technology—in that order. People (working in cross-functional teams) identify the problems and their root causes, which are often found in the process itself and not the technology. When the process is improved (and often simplified), the people may find that the supporting systems can also be streamlined or removed altogether. And when system changes are required to support the process improvement, the future state of the process (defined by the team) helps to articulate system requirements, while the team guides their design, selection, development, implementation, maintenance, and support.

Lean IT thus encourages team-driven, iterative, small, and rapid changes to business processes and the supporting information systems. IT and business associates work together, orchestrating change and rigorously applying A3 thinking to every situation.

Throughout the rest of this book, we will systematically explore the many aspects of Lean IT. We will focus inward, exploring how Lean techniques can help improve IT operational excellence. And we will focus outward, exploring how the IT organization can integrate, align, and synchronize with the business, supporting (and playing a leadership role in) process improvement and innovation. Then in the final chapters we will bring it all together, providing leadership guidance and a Lean IT transformation roadmap, showing the way to a sustainable enterprise transformation.

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## **Section II**

### **Integration**

#### *Aligning Lean IT and the Business*



# 4

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## *Lean IT and Business Process Improvement*

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### CHAPTER OBJECTIVES

In this chapter we discover how an expanded role for an IT organization that embraces Lean can support and promote business process improvement. We will:

- Establish IT's role as a catalyst of business process improvement, leading the way in bridging functional silos.
- Consider the unintended complexities created by the reengineering trend of the 1990s.
- Explore the convergence of strategic alignment, information systems, Lean thinking, and the lessons learned from enterprise-wide system implementations.
- Examine how a Lean IT organization can deliver agility, best practices, and effective measurements throughout an organization.
- Consider the role of strategy in clarifying priorities, aligning effort, and driving innovation.

The command-and-control organization that first emerged in the 1870s might be compared to an organism held together by its shell. The corporation that is now emerging is being designed around a skeleton: *information*, both the corporation's new integrating system and its articulation.<sup>1</sup>

—Peter Drucker

The power of Lean IT includes knowing when *not* to use technology, because the vast majority of problems are caused by faulty processes, not people or technology. Unfortunately, organizations often lead with a technology solution prior to improving processes, all but guaranteeing the installation of new technology on bad processes. Michael Hammer,<sup>2</sup> a pioneer of business process reengineering, called this “paving cow paths.” People should initially focus on root causes, creatively improving processes *before* considering investments in information systems.

Because existing technology can entrench bad practices, it may even be appropriate to remove rather than add technology as a first step. Applying *creativity before capital* eradicates the habitual crutch of rushing to buy or build *big bang* solutions, encouraging ingenuity and resourcefulness from within. If the team eventually discovers that a major investment in technology is needed, a sound business case can be made based on their assessment, lessening internal resistance to change.

At Toyota, the introduction of new technology is considered only after processes have been fine-tuned by cross-functional teams. Technology interventions are evaluated on their ability to support work processes while not distracting attention from value-added activities. In *The Toyota Way*, Jeffrey Liker explains the value of a team-based approach:

Once Toyota has thoroughly gone through this process, it will quickly implement the new technology. Because of this painstaking process, Toyota will typically implement the new technology smoothly without the employee resistance and process disruption that other companies often experience.<sup>3</sup>

People, process, and technology—in that order. Although managers and stakeholders are not always comfortable with the patience and discipline required, applying the tools and principles of Lean IT mitigates the risks and challenges of enterprise systems. When cross-functional teams (including IT participants) define system requirements, they share ownership and the resulting systems are more likely to succeed.

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## THE COORDINATING FUNCTION OF INFORMATION, IT, AND THE LEAN OFFICE

Most organizations struggle to coordinate behavior throughout the enterprise. In the past, management directed workers, assigned specific tasks,

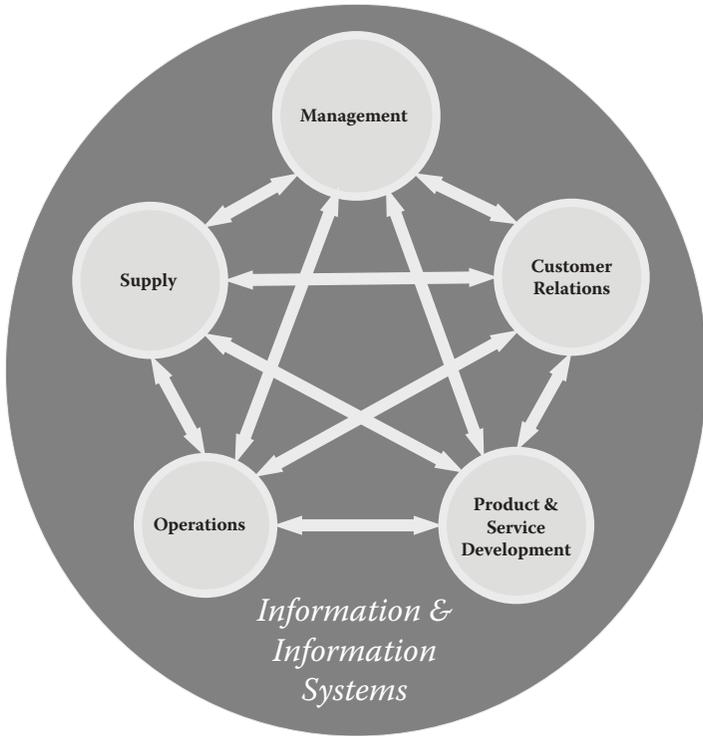
controlled activities, and checked results. As workers have become more knowledgeable and organizations more complex, this approach has failed to consistently deliver productive outcomes.

Today, many companies employ a blend of top-down management and bottom-up participation to engage the workforce and address the intricacies and rapid pace of change in modern business. All organizations are composed of core functional areas (usually structured as departments) that work with one another to deliver a service or product to their customers. Organizational effectiveness, which often varies dramatically from one company to the next, is determined by the degree of coordination and alignment of its parts—the greater the coordination and alignment, the greater the likelihood that targeted results will be achieved and sustained.

The Shingo Prize for Operational Excellence endorses a transformational model that characterizes the enterprise as five business systems. Customer relations, product and service development, operations, and supply all directly create value for the customer. These four functional areas execute business processes and provide supporting infrastructure which create the organization's value streams. These functional segments comprise the components of a value stream but often function in silos. Management, the fifth business system, though not directly creating value to the external customer, orchestrates the activities of the other four groups.

From a Lean IT perspective, we view information and information systems as encompassing this network, because information integrates and enables all value streams and supporting processes. Figure 4.1 shows information and information systems as a framework, a collection of shared and integrating services bringing together the parts to make a whole. Information systems play a critical role enabling the coordination of activities throughout the enterprise, synergistically providing the means by which information and knowledge are collected, processed, stored, secured, analyzed, accessed, and shared. The IT organization serves as a catalyst for change, an *agent* that enables, accelerates, and facilitates communication and coordination. Note that we describe IT as an enabler, one that enables another to achieve a specific end. It is a misperception to think IT “owns” information, when in fact business owners themselves are responsible for data quality, and for determining what information is needed to run the business.

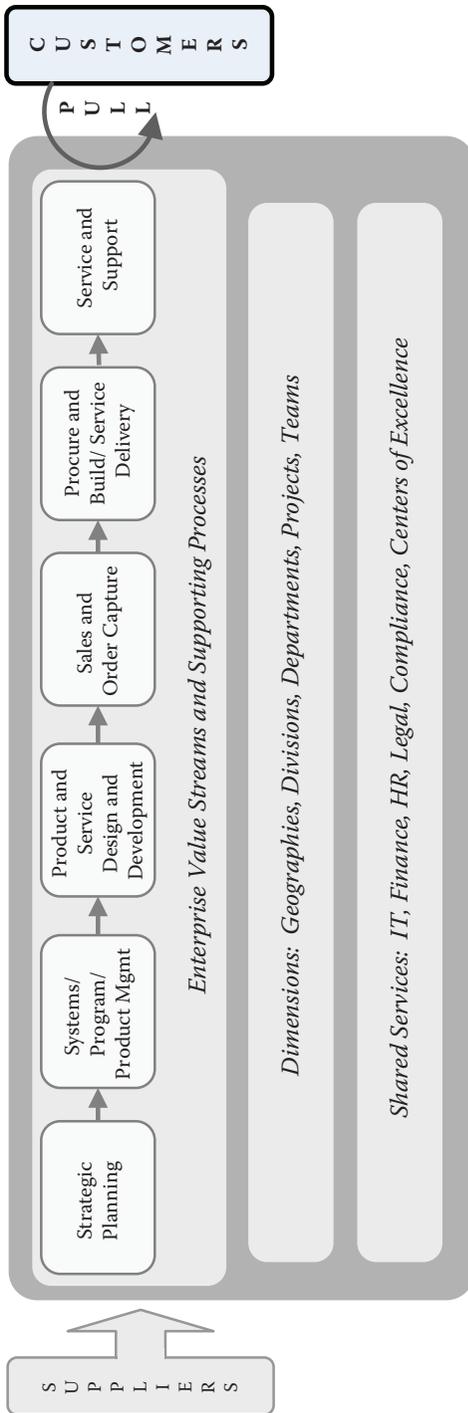
Beyond these five basic functional groups, the typical enterprise is composed of many more dimensions: business units, divisions, regions, shared



**FIGURE 4.1**  
Information’s essential supporting role in value streams.

services, as well as ad hoc teams formed for projects and improvement initiatives. Figure 4.2 illustrates this more complex set of interrelationships supporting enterprise value streams. The degree to which functions and shared services are synchronized directly impacts the performance of the value streams. Management and associates, equipped with *actionable information*, coordinate functions to create value which flows to the customer. Lean IT, the discipline of Lean applied to information, information systems, and the IT organization, enables organizational performance by improving information quality, flow, and accessibility.

Figure 4.2 can be used to illustrate the basic function of any organization, in any industry: finance, health care, hospitality, and so on. In manufacturing supply chain organizations, information supports the flow of work—usually in the form of physical materials. But for many service organizations (e.g., insurance and banking) as well as some office functions within manufacturing supply chain organizations, information



**FIGURE 4.2**  
Enterprise value streams.

is the work product. In any case, because information enables behavior, there is direct bottom-line impact from improvements made to information systems when these changes reinforce appropriate behaviors.

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## THE INTANGIBLE NATURE OF INFORMATION VALUE AND WASTE

In today's economy, profitability and market share are driven in large part by intangible (often intellectual) assets: information. As Baruch Lev explains in *Intangibles: Management, Measurement, and Reporting*,

Corporate success today is not based any more on production facilities, financial capital and ownership, but on invisible and untouchable values—intangible assets—such as relationships with business partners, brands, ideas, business processes, corporate culture, know-how and innovation force.<sup>4</sup>

The intangible nature of information presents unique challenges for Lean, particularly in the office. Information waste is less apparent than production waste, where errors manifest as increased inventory, wrong parts made, increased scrap, and other physical problems. In an office, information mistakes are often invisible even as they create the hidden costs of corrections and rework. Waste is often disguised as useful, normal work.

When communication (electronic, written, or verbal) is not *clear, complete, and correct* (the three Cs), work and the supporting information must flow backward to its source for clarifications, completions, and corrections. Correcting information mistakes steals precious time, robbing attention from the work at hand and disrupting flow. In many organizations, however, people have become so accustomed to correcting mistakes that they no longer question them or seek their root cause—plodding through their days in quiet frustration. There is a painful truth to the old adage, “We never have time to do it right the first time, but we always make the time to fix the problem later.” However, the downstream consequences of a single information defect can proliferate widely throughout the enterprise and its information systems, and often cannot entirely be identified and corrected.

When kaizen teams perform value stream mapping, they often discover that over 95 percent of the time, no value is added to products and services as they move through the value stream. Information waste<sup>7</sup> is frequently discovered to be a major cause. While some complexity is inherent to the nature of business processes, much complexity is unnecessary and self-imposed. We believe much of the unnecessary complexity is an outcome of the reengineering trend of the 1990s. While significant productivity gains were achieved during this period, the relentless pursuit of hyper-efficiency and automation in some cases introduced overdesign and over-processing. Aggressively pursuing automation limited flexibility and ability to change. Over time, new products, services, and their supporting systems generated a seemingly endless collection of intricately interwoven processes and software, resulting in layers of non-value-adding activity. The psychological inertia that was created remains very strong and resistant to change.

For example, during a kaizen project to improve information flow, one client discovered that its billing department used a seven-part invoice which required an elaborate physical filing system. The team asked when the invoicing system was implemented and why. They were surprised to learn that the elaborate paper-shuffling system had been in use for 15 years to fulfill a NASA (National Aeronautics and Space Administration) record-keeping requirement, but that NASA had not placed an order in 10 years. As this story illustrates, wasteful processes are often indistinguishable after becoming entrenched as tribal knowledge: *the unexamined way things have always been done around here*.

## **IT Brings Systems Perspective to Business Process Improvement**

Responsibility for coordinating process improvement efforts lies with *process owners*: those individuals accountable for process outcomes. Ideally, process owners have the authority and ability to make necessary changes. However, they aren't always authorized to oversee improvements at a process level because traditional silo organization structures often fail to support *matrix management*, that is, management that creates a horizontal flow of authority by drawing people from different functional disciplines to support department-spanning processes without removing them from their respective positions.<sup>5</sup>

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\* Various forms of information waste are discussed in Chapter 3 and Appendix C.

Local optimization of departmental goals rarely, if ever, lead to systemic value stream improvements that impact end customers. For example, reducing the error rate in an insurance claim intake process seems to be a worthy goal, at least to those in the claims department. However, if downstream processes (damage estimates, appraisals, settlements, etc.) are not taken into account, the impact of improving the intake process alone may not be realized by the customer in terms of time, quality, or cost.

Although people understand that process improvements *should* span functional boundaries, most organizations naturally operate in functional silos focusing on localized objectives. Measurements are the primary reason for this shortsightedness, since they create incentives that influence localized perspective and behavior. “Look at my numbers. My area is OK, so it must be you!” is an indication that silo thinking is alive and well. When measures center on departmental financial performance, efficiency, and cost control, people shift their focus away from what counts most to the customer: performance of the entire value stream. To sustain Lean improvement, existing measures and incentives must be revisited with a systems thinking perspective and a focus on customer value.

To make matters worse, process owners may not have the experience or point of view to see information waste and assess information flows. IT professionals, equipped with the principles and tools of Lean IT, bring a systems perspective to problem solving, and an understanding of the underlying information system functions and interrelationships that are hidden from most users. IT associates can thus contribute to process improvement by providing a systems perspective on business problems, and participating in seemingly nontechnical improvement activities, while informing the team of technical considerations.

A clear understanding of roles is necessary for overall value stream improvement. By working in cross-functional teams and creating value stream maps which reveal the entire process, all participants learn to see how their individual functions support (or hinder) the flow of value to the customer. The IT organization, as a shared service playing a supporting role, sits outside the functional silos, possessing a bird’s-eye perspective that enables it to see information flow from end to end. IT staff are therefore in a unique position to understand the interdependencies, complexities, redundancies, and inefficiencies of information flow and information systems—understanding the weaknesses of the current state is the first step to improving a process.

## Enterprise Software Applications and the Ghosts of Projects Past

Given the volume and intricacy of transactions in a typical office environment (consider procurement, accounting, and customer service), electronic information systems have been developed to address the effective management of information throughout the enterprise. Common enterprise systems include enterprise resource planning (ERP), customer relationship management (CRM), and product lifecycle management (PLM). Many industries have their own specialized core information systems, such as healthcare information systems (HCIS), banking and insurance transactional systems, hospitality reservation systems, and airline ticketing and scheduling systems. When successfully implemented, such large-scale, integrated, enterprise-wide systems enable continuous improvement by automating and error-proofing routine tasks, centralizing data, and supporting the smooth and uninterrupted flow of information and work across all dimensions of the enterprise. Such applications are the *operating system* of the organization.

However, the benefits of enterprise-wide systems come at a price. Such massive software applications are inherently complex, expensive, risky, and resistant to change. When poorly implemented, organizations experience a frustrating drain of energy and focus from wrestling with the system and expending precious creativity on workarounds. In fact, studies show\* that the majority of large-scale software implementations fall short of delivering anticipated benefits and return on investment (ROI). This happens for many reasons: lack of leadership involvement, misalignment of objectives, poorly designed processes, resistance to change, extensive customization, and poor project management, just to name a few. One organization invested over \$50M in a global ERP system only to discover after going live that process improvement efforts had become significantly more difficult due to the inflexibility of the new system. In fact, staff had to be hired to support additional data entry requirements!

When witnessing the aftermath of ERP and other enterprise-wide implementations, we often discover an underlying assumption that the new system would deliver *best practices* and effectively address broken or missing processes. Some mistakenly expect these applications to be a silver

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\* See the CHAOS report, Figure 3.1

bullet that will remedy years of undocumented processes, workarounds, and fragmented information systems. As a result, they lead with a technology solution before defining and improving core processes—a recipe for disaster. Ironically, during implementation many companies can't resist the temptation to customize the new enterprise system to mimic old procedures, repeating the old bad practices.

So what is the correct approach? Our first experience with the convergence of strategic alignment, information systems, and Lean thinking came nearly 15 years ago, with our involvement in ERP selection and implementation projects, reaching a crescendo during the Year 2000 (Y2K)\* market frenzy. Popular software selection methodologies led many companies to pursue ERP software suppliers with excessively detailed “request for proposal” documents followed by exhaustive demonstrations which often explored every system capability, regardless of their relevance. The most qualified vendors and consultants were already quite busy, and this wasteful approach would often just scare them away.

Without a solid grasp of specifically targeted outcomes, or a clear understanding of the strategic intent of the new system, selection teams were susceptible to choosing the most persuasive sales presentation, rather than the best match to their requirements. The resulting systems were often unnecessarily complex, highly customized, and eerily similar to the legacy systems they had just replaced. This was because selection teams rarely left their comfort zones, and so their selection requirements were incremental enhancements, based on mental models of their current system. As a result, many of these very expensive, large-scale systems failed to deliver *breakthrough* improvements; these organizations settled for new systems that were only slightly better than those they replaced. Unfortunately, these new systems often cemented current business processes into place for many years to follow.

Early in our practice we engaged cross-functional teams in improvement of key enterprise processes, emphasizing a *critical differentiators* approach, helping the company to identify a handful of key issues (strategic drivers) that would successfully guide the selection among dozens of ERP candidates. Not only did this streamline the selection process, making it less time-consuming and costly, but it also helped the team

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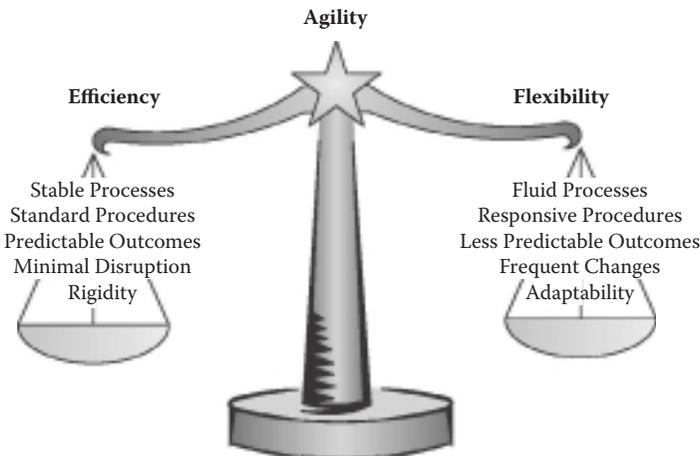
\* The Year 2000 (Y2K) market frenzy occurred when many organizations hastily replaced deeply entrenched legacy systems prior to January 1, 2000, for fear these systems would fail.

focus on the critical drivers for success, what the system would do *differently* to actually improve the performance of the company in ways that really mattered. Strategic objectives, when understood by the team, naturally began to blend with enterprise software selection and implementation practices.

### The Efficiency–Flexibility Trade-Off: Agility

The necessity to operate efficiently is a given, but it's also important to be responsive and adaptive as customer needs change and new opportunities emerge. Organizations should strive for *agility*: an appropriate balance between efficiency and flexibility. Efficiency means performing work well without wasted effort (using fewer resources), while flexibility entails responding to change quickly with limited disruption. This relationship is illustrated in Figure 4.3.

At one end of the continuum is efficiency, where Lean focuses on waste reduction, visual management, standard work, and ongoing process improvement. At the other end of the continuum is flexibility, where Lean applies the voice of the customer, demand management, just-in-time, level scheduling, small lot sizes, mixed model production, cross-training, and other techniques to create flow (see Chapter 5). Efficiency minimizes costs, while flexibility creates value by maximizing responsiveness; agility is the



**FIGURE 4.3**

Agility: Balancing efficiency and flexibility.

balance point between these two capabilities. In *Business Agility*, Michael Hugo explains,

Efficiency provides us with basic products and services at the lowest price. Responsiveness wraps those products and services in a blanket of value-added services that customize them to our particular needs, and in doing so, makes them more valuable to each of us.<sup>6</sup>

IT professionals, as well as all process owners and knowledge workers, should be aware of this trade-off between cost and value when improving processes, in order to sustain the appropriate balance. Another useful way of looking at the efficiency–flexibility continuum is through the distinction between *process* and *practice*.

### **Process versus Practice**

At its core, Lean IT supports process improvement by providing the right information, at the right time, in the right format, to the right audience. The usefulness of information is determined by the nature of work being performed. In this regard, it's helpful to differentiate work as either *process* or *practice* to better understand what type of information is needed. Throughout this book, we use the term *process* to describe a series of actions or operations supported by structured information. Processes are activities that are generally repetitive, well-defined, routine, controllable, and standardized. In contrast, *practices* are nonroutine, highly variable, loosely defined, and require a degree of judgment and experience to carry out.

To illustrate the distinction, consider a visit to your doctor. The nurse visits you first and performs standard, routine procedures (takes your blood pressure, temperature, etc.)—this is process work. When the doctor arrives, she reviews your chart and asks how you are feeling. Then she proceeds to examine, diagnose, and prescribe based on your symptoms and medical history, supported by her experience and professional judgment—this is practice work. Society tends to describe professions (such as legal, accounting, and medical) that depend on a great deal of education, judgment, and unstructured information processing as *practices*.

The difference between process and practice influences how improvements should be approached and what type of information best supports

the work. In *Product Lifecycle Management*, Michael Grieves explains the important difference, as well as a common pitfall that leads to hyper-efficiency at the expense of flexibility:

The information requirements are different for practices than those of processes. With processes, the focus is on the movement from state to state as quickly as possible. With practices, the focus is on collecting data and information at each state in order to build a pool of information to improve the recognition of patterns in the future. However, when processes and practices are both part of a task or procedure that is being automated, the information goals of the practice often get minor attention.<sup>7</sup>

The better defined a process is, the more efficiently it can be executed. Process standardization creates efficiencies, and information systems should be designed to reinforce explicitly defined procedures. Efficient processes are fortified when information systems automate routine tasks, such as mistake-proofing data entry, and providing feedback for ongoing improvement. Applying the 80/20 rule, simplifying and automating the 20 percent of core processes that account for 80 percent of the volume and burden can make a significant and immediate impact on efficiency, freeing up human capacity for practices that require experience and judgment

On the other hand, information used in *practice* work is typically unstructured, difficult to define, and often experiential. When improving practices, the focus is on supporting a learning organization through an accessible collection of knowledge of past experiences to enable situation-specific decision making. To support practice work, knowledge management systems should be designed to manage both unstructured data (searchable content, documents, and images) and structured data (information in transactional databases, drilldown reports, trend analyses, etc.). They may also provide access to collaborative social networks, forums, blogs, wikis, and other sources of free-form knowledge sharing.

Over time, some of the elements of practice work may be simplified and standardized into processes, effectively creating more efficiency without sacrificing agility. Successful organizations attempt to achieve an optimal balance between process and practice which has been described as *mass customization*: the ability to produce products and services with the flexibility to meet a wide range of customer needs while maintaining mass

production efficiency (discussed in Chapter 5). With a clear understanding of the differences between process and practice, IT associates (working with the business) are better able to provide appropriate information, contributing to the evolution of business processes and practices.

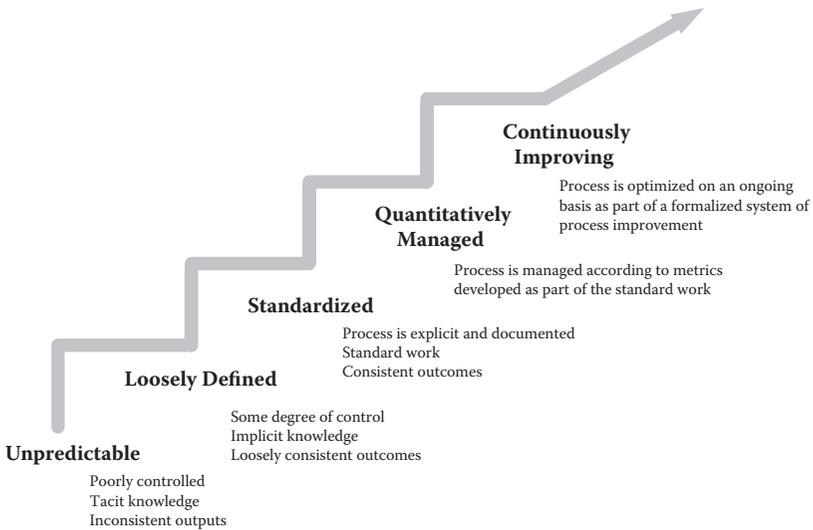
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## WHAT PROCESSES AND PRACTICES ARE “BEST”?

Individuals and organizations need clear targets to focus improvement efforts, assess progress, and motivate change. The term *best practice* is often used to describe what companies are seeking from process improvement and information systems. But what are best practices, and how are they applied to effectively guide ongoing improvement? In *Winning the Knowledge Transfer Race*, Michael English and William Baker define a best practice as one that “fully satisfies customers, produces superior results in one operation, performs as reliably as any alternative, and can be adopted elsewhere.”<sup>8</sup>

A common misperception is that best practices create competitive advantage. In fact, best practices create parity among organizations as they conform to the same standards. Competitive advantage comes from differentiating your organization through continuous learning, improvement, and innovation.

The majority of knowledge is stored typically inside the minds of workers and not explicitly documented, causing everyone to perform the same work differently. Inconsistent behavior, by definition, cannot be consistently improved, since there is no established stable baseline from which to start. When process and practice knowledge belongs only to certain people, outcomes remain inconsistent, and knowledge is lost when they leave. But once tribal knowledge becomes stabilized, standardized, documented, and shared with others, processes can be continuously improved and meaningfully measured. As organizations purposely identify core processes, assess their effectiveness, and document procedures, they make knowledge management a natural part of work. As best practices are documented, they secure the value of the organization’s intangible, intellectual assets. These are *process assets* that consistently add value to the customer and create a foundation for continuous improvement and inno-



**FIGURE 4.4**  
The Capability Maturity Model.

vation, providing distinction, competitive differentiation, and advantage to the organization.

The Capability Maturity Model (CMM),<sup>9\*</sup> shown in Figure 4.4, helps an organization assess how well processes are defined and systematically improved. The model provides a framework for assessing process capability, progressing from unpredictable process outcomes to stable, continuously improving processes.

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## BENCHMARKING: NO NEED TO REINVENT THE WHEEL

Learning organizations are constantly searching for ways to do things better (continuous improvement) and to do better things (innovation). Rather than reinventing the wheel, they often look internally as well as externally for best practices they can readily apply. Benchmarking identifies and evaluates best practices within the organization as well

\* Originally developed in the field of software development and introduced in 1989 by Watts Humphrey in *Managing the software process*, the Capability Maturity Model can be applied to assess the quality and impact of business processes in any discipline or industry.

as across other organizations and industries to assess performance and set improvement targets and long-range goals. As companies embark on an ongoing search for better ways of doing work, they develop innovative future-state possibilities and targets. The basic steps of benchmarking include:

1. *Understand* your current processes in terms of effectiveness (measures and current levels of performance) and maturity (use value stream mapping to identify waste and determine where to focus improvement efforts).
2. *Set your focus* by determining what business process you are investigating.
3. *Identify* what organizations and industries have similar processes and are potential leaders.
4. *Research and contact* leading companies to identify best practices and performance metrics (through the American Productivity and Quality Center [APQC], the Global Benchmarking Council, trade journals, conferences, and so on).
5. *Collaborate* with these organizations to share best practice information. (This works best when companies agree to exchange information beneficial to all parties within a benchmarking group.)
6. *Identify gaps and opportunities* for improvement, feed these ideas as suggestions and potential countermeasures into the kaizen process.
7. *Implement* improved business practices with realistic metrics, goals, and targets applying PDCA.

Internal benchmarking involves assessing operations from within the organization (e.g., business units in different countries or other divisions). These groups are often more accessible and willing to share proprietary information. And if practices are adopted across the same organization, there may be less resistance to change. However, the best innovations often come from exploring the best practices of seemingly unrelated industries; organizations can use benchmarking to break out of their industry paradigms to discover breakthrough ideas. For example, an airline might benchmark a leading hotel chain to discover best practices regarding check-in and baggage-handling procedures. A hospital could investigate a leading restaurant franchise to gain knowledge of order-processing best practices. And a surgical team could observe a NASCAR pit

crew to gather best-practice ideas relating to speed, accuracy, safety, and economy of motion. External benchmarking can help a team break away from existing assumptions and thought patterns to discover entirely new ways of approaching work.

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## USING MEASUREMENT EFFECTIVELY

Tracking actual performance against planned targets, workers preemptively respond to potential problems by applying *management by fact*—basing priorities and future improvement initiatives on quantifiable, objective outcomes. Although we all know measurements are important, organizations often struggle to find good measurements that influence desired behavior. Michael Hammer described seven common, deadly sins<sup>10</sup> of performance measures (paraphrased below):

1. Measuring only what you are good at
2. Measuring departmental process, not the entire process
3. Measuring corporate goals, not customer satisfaction
4. Not investing adequate effort to determine what should be measured
5. Measuring only small pieces of the process
6. Not considering the impact of measurements on behavior
7. Not taking measurements seriously

We've all heard the saying, "Show me how you'll measure me and I'll tell you how I'll perform." Effective measurements focus people's attention on the right things. Sustained improvement requires appropriate performance measures, monitoring, and management. Without appropriate measures and the actionable information they provide, it's just a matter of time before behaviors revert to the old ways of getting work done. Measures guard against backsliding by focusing improvement efforts as well as daily activities, emphasizing targeted results.

Often measures are taken, posted, and filed, but not utilized to drive behavior. Effective organizations use constant goal setting supported by a continuous measurement feedback loop to reinforce daily behavior which drives positive change. If measurements do not enable people to *move the*

*dial*, they become a burden and detract from value-added work, and are ultimately rejected.

Measures play an essential role in the Plan-Do-Check-Act cycle, providing the check with which teams act and adjust based on process results. When used properly, they serve as an early warning system, notifying the right people when *course corrections and adjustments* are required before serious problems occur, often triggering the next cycle of improvement activity.

Measurements also validate whether process improvements have generated expected results. Because of their influence on daily behavior, we suggest using 30-, 60-, and 90-day post-kaizen reviews to make certain that process improvements have delivered as expected, and to prevent backsliding to old patterns of behavior.

Organizations often focus on *results measures* to assess performance and guide decision making. These are often strategic and track *end-of-pipe* outcomes such as revenue and customer satisfaction. While important, results measurements provide lagging indicators of performance, offering little predictive value. Exclusively using results measures is like driving forward while only looking through the rearview mirror. *Process measures* are leading indicators which focus on tactical activities that directly or indirectly influence results measures. Figure 4.5 shows some examples of process and results measures.

Teams should develop an appropriate balance between process and results measures for each value stream. They should also give attention to

Process Measures	→	Results Measures
Wait Time and Transaction Accuracy		Banking Experience
On-Time Delivery		Customer Satisfaction
First Pass Quality		Warranty Claims
Cycle Time (Check in and Treatment)		Patient Experience
Accurate and Speedy Check Out		Retail Experience

**FIGURE 4.5**

Process versus results measures.

*what* is measured. Many companies focus predominantly on revenue and operating expenses. While these are important, revenue and expenses are indirectly controlled by other factors. The *balanced scorecard* framework\* emphasizes a healthy balance of internal and external perspectives, applying financial and operational performance, customer satisfaction, and employee development and innovation measures.

The IT organization plays a key role, helping the rest of the organization to access data, summarize information, and present measurements, providing clear feedback to the individuals and teams responsible for performing and improving business processes. IT associates provide the enabling tools and access to data sources, working with the organization's knowledge workers so they can develop meaningful measurements and analytics (see Chapter 6).

### **Compliance: A Special Form of Measurement**

The burden of complying with regulations can be overwhelming, especially in heavily regulated industries such as banking, health care, insurance, and transportation. In many organizations, compliance represents *necessary but non-value-added* activity that consumes massive amounts of resources and mindshare. In their attempt to quickly conform to regulatory requirements, companies often build a maze of stand-alone "end-of-pipe" solutions, each with a unique results focus exclusive to a functional silo of the business.

While these point solutions monitor certain activities and compliance data, they seldom address root causes of compliance problems, and thus do not enable continuous improvement. Compliance of this sort delivers marginal and temporary value at best, while adding layers of complexity and non-value-added work; this reduces agility, making the processes more resistant to improvement.

Dr. W. Edwards Deming, perhaps the most influential quality pioneer of our time, used to say that "you can't *inspect* quality into a process," knowing that quality must instead be *built into* a process. In the same way, you can't inspect sustainable compliance into a process; you must stabilize and improve processes so that compliance is a natural outcome. The tools and principles of Lean enable organizations to take control of business

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\* See Robert Kaplan and David Norton, *The balanced scorecard: Translating strategy into action*.

processes, adopt best practices, and develop process maturity, ensuring compliance with standard work and regulatory requirements.

Lean provides a framework for managing change and controlling operations—foundations of compliance. The financial officer of one client, a global, publicly traded company, referred to Lean as “the Holy Grail of Sarbanes-Oxley.” In his opinion, every hour and every dollar spent chasing compliance should be refocused on improving processes.

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## **BUSINESS PROCESS MANAGEMENT (BPM)**

As process improvement expands throughout the enterprise, an organization may reach a point where the scale and complexity of business processes and improvement activities require a formal *business process management* approach. Without a structured approach and supporting tools, the difficulty and overhead of managing the intricate interdependencies of enterprise value stream and information system improvements can be daunting. This is particularly true in larger organizations with multisite and multi-division operations.

A holistic enterprise process viewpoint is not easily achieved, due to the multidimensional nature of enterprise value streams and supporting processes, shared services, projects, resources, and stakeholders. However, if an organization is unable to identify its value streams, its supporting processes, and their interrelationships, it will be unable to make valid fact-based prioritization decisions on process improvements and IT investments.

Business process management is as much a philosophy of how to manage process improvement as it is a collection of technology-based tools. Nevertheless, as a Lean transformation matures beyond the early, low-hanging-fruit improvements, such a framework is often necessary to guide improvement efforts and align enterprise priorities.

Though an organization may not need an elaborate BPM software system, it will need a good infrastructure approach, with a sound schema to identify and categorize processes, manage ownership and team composition, track improvement activities and results, and control changes to process maps, documentation, and other artifacts. A disciplined approach is also helpful to organize metrics, dashboards,

and scorecards into a coherent enterprise-wide measurement system. Such process management and measurement information systems are often internally developed, and adapt over time to meet the evolving needs of management and the Lean Center of Excellence. Larger organizations will need a database to manage the many value streams and supporting processes, and their information system interdependencies, since tracking on a spreadsheet can be labor intensive and error-prone.

There are several categories of tools and systems that can help an organization manage its process information:

- Value stream and process mapping software—such as Visio and eVSM
- Process management repositories and systems
- Workflow technologies with rules engines—available as stand-alone applications and built into many ERP systems
- Process simulation tools—available as stand-alone applications and integrated with BPM systems
- BPM systems—integrated systems supporting mapping, data repositories, workflow, simulation tools, and interfaces to ERP applications

While we mention these applications to shed some light on how organizations may automate the complexity of process management, it's important to note that an organization should be careful not to invest heavily in technology and automation at first, but rather focus on the social and management systems issues. Hammer suggests:

The critical elements in success with process are executive leadership, creativity to come up with new ideas, the management of change, and the management of complex implementation. None of these have much to do with software tools. Yes, BPM software can help ... but it's not the difference between success and failure.<sup>11</sup>

Whatever systems an organization employs to manage its business process infrastructure, it should stress simplicity, transparency, and manageability.

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## PRIORITIZING PROCESS IMPROVEMENT WITH STRATEGY

Consistent and continuous focus on strategic drivers and critical differentiators helps the business develop a clear understanding of how each process adds value, so trade-off and investment decisions (including but not limited to IT investments) will optimize strategic outcomes.

One way to achieve this clarity is to separate processes into two categories: *supporting* and *innovating*.

### Supporting Processes

Supporting processes are those that are necessary for the business to operate, but do not create differentiation in the eyes of the customer. These include many repetitive or transactional accounting and administrative activities, as well as many inwardly facing IT operations.

Efficiency should be the primary goal for supporting processes; thus, they should be rigorously stabilized, simplified, standardized, automated—and ideally eliminated whenever possible. We are often astonished at how Lean companies think outside the box, eliminating many long-standing supporting functions that are so common they are assumed to be necessary. For example, we have seen cases where procurement and payment processes were eliminated, applying just-in-time and kanban approaches, so that receiving a shipment instantly triggers release of supplier payment. No invoice is ever printed, mailed, received, handled, matched, entered, or archived by the accounts payable department, eliminating countless transactions, errors, paper, time, and other wastes traditionally associated with the process.

Year-on-year reduction of supporting process operating costs, without sacrificing service levels, often requires investment in automation. This in turn can necessitate a move toward flexible service-oriented architectures and low-cost utility cloud computing (whether internally or externally hosted) and the potential for selective outsourcing. But here we strongly caution not to simplify, automate, or outsource supporting processes when they can be eliminated altogether. Nor should companies create overly complex, hyper-efficient, automated processes which result in near-term cost savings at the expense of long-term agility.

An example of significant reduction in supporting process costs can be found with Bechtel, one of the world's largest engineering firms. Bechtel made dramatic improvements through data center consolidation, server virtualization, and private (internally hosted) cloud computing. In 2005, more than 2,000 IT employees staffed approximately 20 datacenters, where server utilization averaged between 2 and 3 percent. In 2009, a department of 1,100 employees operates just three datacenters, where server utilization averages 60–70 percent.<sup>12</sup>

While projects like this can yield significant positive results for the enterprise, if not managed properly they can also spread fear throughout the IT organization. Even the perception of potential layoffs will throw a wet blanket on a Lean effort; few will enthusiastically support process improvement if they fear losing their job as a result. Herein lies a fundamental distinction between a focus on cost-cutting and an emphasis on adding value through waste elimination, which naturally results in cost reduction over time. A focus on cost reduction through rapid headcount reduction is like losing weight by giving blood—while it works quickly, it isn't very healthy. The key to Lean success in a cost-cutting world is to understand waste reduction as an opportunity to *free up human capacity and capability for value-added work*.

While waste elimination naturally reduces many costs in the short term, it also adds long-term value by unleashing potential for growth and innovation. Most companies do not have a shortage of good people with good ideas; these people are just buried under a mountain of wasteful activity disguised as daily work. Every time we free up people's time, emancipating them from unnecessary and often frustrating work, we enable them to apply their experience and creativity to perform new value-adding activities: these include improving, innovating, and spending quality time with the customer (see the Virginia Mason Medical Center case study). Underutilized human potential is the gold mine hidden within every company.

Successfully retraining and reassigning IT associates quickly, so they can become productive in a new function or area of the company, is accelerated by the tools and methods of Lean transformation. Once an individual develops proficiency with A3 thinking and problem solving, for example, he or she can *quickly get to the heart of any process* and confidently start contributing to its improvement.

As IT infrastructure and applications continue their inevitable migration toward a low-cost cloud computing model, the emphasis of the IT

organization must quickly shift toward process leadership and innovation, concentrating on the strategic drivers within each value stream. And it is this freed-up human capacity and potential that will fuel the transition.

## **Innovating Processes**

Innovating processes reinvent the business and establish differentiation in the eyes of the customer. Innovating processes may include the development of new products, services, markets, and partnerships; information systems often play a direct and vital role. For example, e-commerce and social-networking applications deliver self-service value (choice, convenience, speed, knowledge, community, etc.) directly into the hands of the customer.

Over their life cycle, innovations often evolve into standard products, services, and processes—and, at some point, their ability to create competitive advantage diminishes. According to Gary Hamel and C.K. Prahalad, in their *Harvard Business Review* article “Strategic Intent,” the essence of strategy lies in creating tomorrow’s competitive advantages faster than competitors mimic the ones you possess today.<sup>13</sup> In Nike’s case, for example, in the highly competitive athletic garment industry, some product life cycles are less than 90 days. In general, the toughest competitors often discontinue a product family before its life cycle goes into decline, causing their competitors to forever chase their next product release. Innovation can never rest.

As organizations learn to distinguish critical differentiators in their processes, they can invest their IT dollars more effectively. For example, many manufacturing companies are focusing their investments on *operating technologies* within core value streams, such as product life cycle management (PLM) and manufacturing process management (MPM), *directly* enhancing their ability to design, produce, and deliver their products and services.<sup>14</sup> This is accompanied by a corresponding de-emphasis on necessary but non-value-adding (NNVA) business processes and supporting IT assets, such as many of the supporting processes performed by back-office ERP systems. Other industries are following suit, directing less attention on NNVA and emphasizing direct, end-customer-facing operating processes (e.g., bank loan approvals, insurance claim processing, and medical laboratory order scheduling). In fact, in many information-intensive industries, such as banking, insurance, and often health care, the operating information

system *is* the production process, and information *is* the work product delivered to the customer.

This trend illustrates how IT innovation and differentiation are driven by awareness of customer value. If the IT organization is going to play an even greater role in the improvement and automation of mission-critical, customer-facing operational processes, then IT–business–customer collaboration is essential.

Innovating processes are often *practices*, different from standardized, repeatable processes as we discussed earlier in this chapter, requiring more human interaction, experience, insight, and judgment, supported by accessible structured and unstructured information. Innovating processes break new ground and often require multidisciplinary cooperation both within and across traditional boundaries of the enterprise. A new idea can come from anyone, anywhere, anytime. Thus innovating processes benefit from innovative information systems\* which facilitate open communication and knowledge sharing, enabling continuous and rapid learning.

Let's be clear—information and information systems do not drive innovation; they support and enable it. There is *only one thing* that ultimately drives value through innovation: the voice of the customer. So we must learn to listen carefully, engaging all our senses, which can be extended and amplified through our digital nervous system.

IT process leaders *and* business process owners must together understand the distinction between supporting and innovating processes, illustrated in Figure 4.6. With this understanding, accompanied by a constancy of purpose, IT leadership can guide the enterprise toward efficient supporting processes, while simultaneously enabling innovating processes to create new, differentiating, revenue-generating value for the customer.

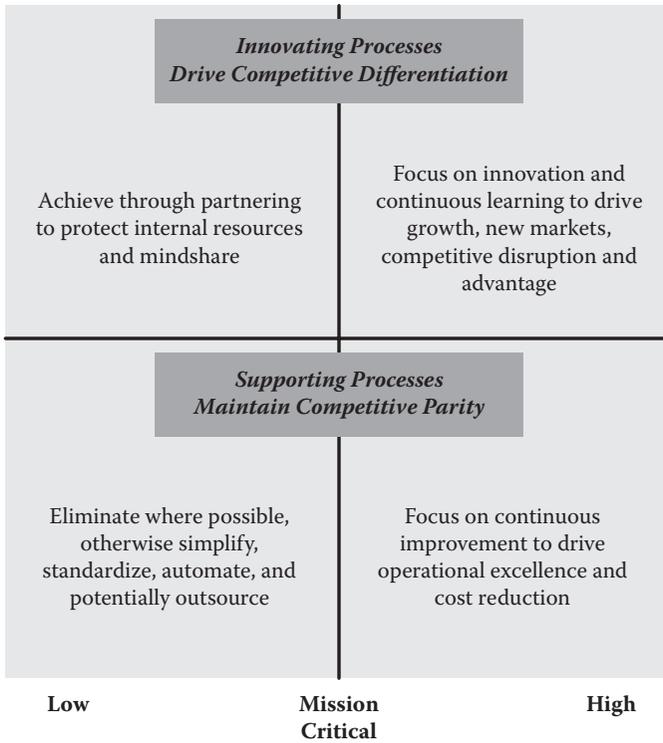
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## THE IT ORGANIZATION'S CONTRIBUTION

Throughout this book we explore the goal of alignment between IT and the core business in which IT and the business start thinking and acting as one, with a common purpose: to support the strategy of the organization.

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\* Some examples include collaboration tools, project management, product lifecycle management, business intelligence, market research and analytics, online surveys, social networking, design, modeling, and visualization tools.



**FIGURE 4.6**  
Innovating and supporting processes.<sup>15</sup>

But *alignment* is an ambiguous word and doesn't convey the full picture. IT and the business must work side by side as partners: learning, prioritizing, planning, executing, and measuring the results of process improvement and innovation initiatives. For such a tightly woven relationship we prefer the term *integration*. But no matter what you choose to call it, how you go about achieving it is the real challenge.

Quality information and effective information systems connect, support, and enable process improvement throughout the enterprise. Because information is the essential lifeblood that coordinates the flow of work and creation of value to the customer, the contribution of the IT organization is pivotal to the ultimate success of the organization and its value streams. In the end, organizational effectiveness is about each individual doing the small things well—seamlessly blending daily work and ongoing improvement.

In a Lean enterprise, cross-functional teams work in partnership with IT practitioners to improve business processes. In doing so, the IT organization becomes a partner and enabler of process improvement, shifting a large part of its focus from supporting activities to innovative solutions development in collaboration with the business.

## ENDNOTES

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3. Jeffrey K. Liker, *The Toyota way* (New York: McGraw-Hill, 2004), 160.
4. Baruch Lev, *Intangibles: Management, measurement, and reporting* (Washington, DC: Brookings Institution Press, 2001), The book of the month: "Intangibles: Management, Measurement, and Reporting" by Baruch Lev, [http://www.juergendaum.com/news/10\\_30\\_2001.htm](http://www.juergendaum.com/news/10_30_2001.htm).
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6. Michael Hugo, *Business Agility* (Hoboken, NJ: Wiley, 2009), 4.
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8. Michael English and William Baker, *Winning the knowledge transfer race* (New York: McGraw-Hill, 2006), 39.
9. Watts Humphrey, *Managing the software process* (Reading, MA: Addison-Wesley, 1989).
10. Michael Hammer, *The 7 deadly sins of performance measurement (and how to avoid them)* (Boston: MIT Sloan Management Review, Spring 2007), 19.
11. John McCormick, CIO, as chief process officer, interview with Michael Hammer, Oct. 3, 2007. [www.ciainsight.com](http://www.ciainsight.com)
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13. Gary Hamel and C. K. Prahalad, "Strategic intent," *Harvard Business Review*, May-June 1989, 63-76.
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# 5

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## *Lean IT Lessons Learned from Lean Manufacturing: Flow and Pull*

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### CHAPTER OBJECTIVES

Looking back on the last five decades of Lean's evolution, we find many important lessons learned that have a direct applicability to Lean IT, whatever the industry. We will:

- Examine flow, pull, and visual signals and contrast their simplicity and clarity with the complexity of material requirements planning (MRP), a popular manufacturing push-scheduling technique.
- Explore kanban, heijunka, and mixed model production and understand their impact on stability, efficiency, and flexibility (agility).
- Propose a step-by-step process for creating an effective IT demand management decision-making process.

Simplicity is the ultimate sophistication.

—Leonardo da Vinci

Factories are complex and chaotic places where events rarely go as planned. When not approached with caution, software intervention can *amplify* the existing complexity and chaos. Lean manufacturing practitioners have learned to simplify their production processes, aligning, balancing, and reallocating resources so work will flow along value streams, orchestrating

activity through pull signals and visual cues. Work is *pulled* by customer orders rather than *pushed* by a forecast-driven schedule. At the start of the transformation process, Lean practitioners focus on customer value and the value stream. Lean practitioners eliminate as waste the obsolete, the unnecessarily complex, and the ineffective, *including counterproductive information systems*. Technology is not reintroduced until the underlying processes have been simplified and stabilized.\*

Since Toyota's production, product development, and management systems laid the foundation for Lean practice, it seems natural to ask about their approach to IT to inform our own efforts. There is a commonly held misconception that Toyota is reluctant to use information technology. Toyota is in fact a significant IT investor and innovator; however, they do not *lead* with technology solutions. They first focus on business solutions, with emphasis on stabilizing and improving processes through relentless problem solving, supported by appropriate data. Electronic information systems are then carefully deployed to automate standard work, reduce the potential for errors, and support effective measurement.

Looking beyond Toyota to other large, global, manufacturing and supply chain enterprises, Nike's growth could not have occurred without extensive reliance on pioneering information technologies; their IT organization includes nearly 1,500 staff in 60 countries. Over the last decade, Nike has made significant investments in a sophisticated technology infrastructure for product development and supply chain management (not without some expensive learning experiences along the way),<sup>1</sup> which enables them to continuously innovate while improving operating efficiency.

Now that the essential technology framework is in place, Nike has turned its focus toward business process improvement as a driving force in IT strategy. In fact, the chief information officer (CIO) of Nike reports to the chief operating officer, ensuring an operational focus throughout all IT initiatives. As an indication of transformation in their culture, the globally renowned "Just Do It" company has rebranded their IT department as Lean Business Solutions (NikeLBS).

According to Lean Enterprise Director Steve Castellanos, "At Nike, we turned our Lean focus toward the enterprise some years ago and as we did

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\* For more on Lean IT in a manufacturing environment, see *Lean enterprise systems, using IT for continuous improvement*, Chapters 4 and 5, by Steve Bell

it became evident that our information technology delivery model was out of sync with the business processes that they were designed to support. This realization was the driver behind the organizational changes that brought the former IT and Process Excellence organizations together into what we now call Lean Business Solutions. With this structure our intent is to position LBS against enterprise-wide opportunities in an aligned and synchronized way.”<sup>2</sup>

Another global supply chain organization, Tesco, has been on their Lean journey for over a decade, with a particular emphasis on essential information systems. The fourth-largest global retailer drives growth through innovation with small, local stores selling fresh and innovative products. By simplifying and standardizing their business processes and information systems, Tesco is able to open new stores quickly, while adapting to local market conditions and consumer preferences.

Tesco’s supply chain systems operate by Lean replenishment rules that issue pull signals directly to suppliers on a daily basis. Unlike traditional retail models, this system does not rely solely on forecasts of consumer purchases. Daily consumption and replenishment signals help reduce inventory, handling, shrinkage, and stockouts, helping Tesco to ensure variety and freshness, while quickly spotting new trends and emerging problems. It’s interesting to note that Taiichi Ohno’s early inspiration for just-in-time inventory replenishment came on a visit to the United States, where he observed refrigerated products being replenished from behind as they were pulled off the shelves of supermarket coolers. So, in Tesco’s case, Lean has come full circle.

But even with Tesco’s strategic focus on market growth and advanced supply chain technology, it’s clear that it has internalized the primary focus of Lean: customer value. According to Mike Yorweth, Tesco’s group technology and architecture director, “We’re such a big business and it’s . . . complex. So you’ve got to make everything as simple as you possibly can, and standardizing makes things simple for people. If their jobs are easier to do, it means they can focus on customers. Ultimately that’s what we’re here for.”<sup>3</sup>

Toyota, Nike, Tesco, and countless other innovative manufacturing and supply chain organizations around the world have successfully leveraged IT capabilities with their Lean practices in a variety of ways. But it’s not just about big companies; the efficiency and lower costs of Lean operations and information systems create opportunities for small, agile companies to compete with larger ones.

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## PUSH VERSUS PULL: WHAT WENT WRONG WITH MRP?

One of the key IT lessons learned from decades of Lean manufacturing is to keep processes and supporting information systems simple. Nowhere is this more evident than in the history of material requirements planning (MRP), a method used to calculate what needs to be purchased and built based on routings, bills of materials, inventory levels, and other planning information.

In the 1960s computers started tackling many of the most complex challenges that business had to offer, including material planning and control. After all, if we could put a man into space, why couldn't we control what happens on a factory floor? Operations managers adopted a mechanistic view, creating the discipline of MRP. George Plossl, one of the founding fathers of MRP, describes these times as full of hope and promise, as well as unrealistic expectations:

Operations researchers were intrigued by the problem of determining “optimum” work sequence in complex manufacturing environments. MRP program designers, obsessed with the potential power of computers and software, attempted to build into MRP capabilities to cope with every eventuality in manufacturing, and to include every known technique, however little use these would be.<sup>4</sup>

In simple terms, MRP combines customer orders and forecasted customer demand for each finished goods item, then *explodes* it into time-phased component-level requirements to guide purchasing and production decisions. MRP calculations determine what needs to be manufactured at each workcenter and when, creating a never-ending stream of production schedules and dispatch lists—detailed marching orders for the shop floor. This is *push* scheduling, where every factory operation is planned in advance—much like a football coach calling all the plays before the game begins.

The problem is that the plan is *never* exactly right. First of all, it's mostly based on a forecast, and forecasts are just sophisticated guesses. Plus, conditions on the factory floor are always changing—machines break down without notice, sudden rush orders delay others, defects unexpectedly consume scarce materials, and so on. Although powerful computers and MRP software are able to rapidly recalculate each time something changes, frequent changes cause the schedule to become *jittery* or *nervous*.

Constant interruptions and shifting priorities, when communicated to the shop floor, cause workers to spend more time and energy chasing the schedule and performing costly machine changeovers (often making them jittery and nervous, too). So planners attempt to compensate by buffering with excess inventory, stocking more than is necessary in order to ride out variability while making fewer changes to the production schedule.

But as companies offer more options to their customers, as supply chains become more complex and geographically extended, and as customers continue demanding shorter lead times, the amount of excess inventory needed to buffer increasing uncertainty inevitably reaches a tipping point. Taiichi Ohno of Toyota identified excess inventory, and the overproduction (non-just-in-time) that created it, to be the primary causes of waste. Furthermore, excess inventory hides other forms of waste, hindering their identification and elimination.

Even the most powerful computers and sophisticated software can't solve this fundamental problem: the more we strive to control complexity through forecasting and push scheduling, the more the laws of uncertainty and chaos push back. So to many Lean manufacturing practitioners, MRP is perceived as *the enemy* of simplicity, agility, and flow.

But there are situations where MRP and other sophisticated planning and scheduling software tools are useful in Lean manufacturing and supply chain operations, as long as they are applied judiciously, with awareness of their limitations. The enemy is not the technology, but our assumption that we can somehow control complexity by throwing more complexity at it.

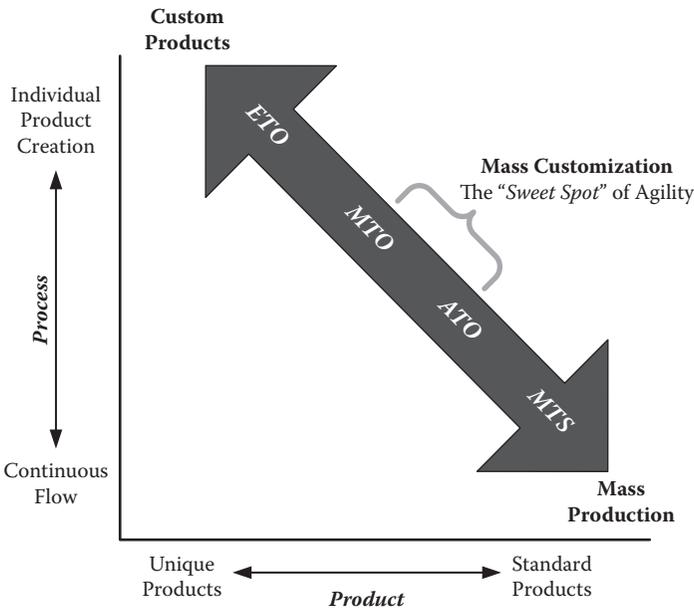
What is the key limiting factor in this scenario? Time! The further into the future an organization forecasts, the more uncertainty it must anticipate and buffer against, buying and building more inventory ahead of time. And when customer preferences suddenly change, or the economy takes a turn, the organization is burdened with this excess inventory. The solution is to shorten the planning horizon, to the point where production is driven not by a forecast but by actual customer orders. The more production is driven by customer pull signals, the less waste is created throughout the supply chain.

*Just-in-time production* is simple to describe, but difficult to achieve. Just as products, services, and processes differ from one company to another, so do their planning and scheduling requirements. By understanding these differences, Lean practitioners in any industry, and IT organizations in particular, can understand how to apply Lean flow techniques.

## FLOW, BALANCE, AND AGILITY

In 1979, two Harvard Business School professors described a pair of continua: a *product life cycle* based on maturation from individual-unit customization to standardization, and a *process life cycle* describing the various methods of production.<sup>5</sup> Combining these two continua results in a diagonal (Figure 5.1) which describes the progression of manufacturing types: *engineer to order*, *make to order*, *assemble to order*, and *make to stock*—commonly known by the acronyms ETO, MTO, ATO, and MTS.

At the ETO end of the continuum are unique products, individually designed and custom-made to exact customer specifications. On the other end of the continuum, MTS, highly standardized products are mass-produced in large quantities to forecast, and are stocked in a distribution channel for the customer to buy off the shelf. ETO emphasizes flexibility, while MTS emphasizes speed and cost. At this point the reader may recall the efficiency–flexibility continuum explored in Chapter 4 (see Figure 4.3).



**FIGURE 5.1**  
The product–process diagonal.

Over the years, manufacturers have developed a variety of tactics to provide customers with flexible, configurable products built upon standard, modular options that can be delivered quickly to customers' specific requirements. This approach, called *mass customization*, is covered by the central region of the diagonal. While some speed and flexibility are sacrificed, and marginal cost is added, the result is *agility*: the ability to quickly respond to changing market conditions and customer demand, based on a standard set of configurable products and processes, with minimal inventory in the pipeline.

The full expression of this approach is called *mixed model production*, where each unit flowing on a production line may carry different specifications. At an automobile manufacturer, for example, a red sedan with leather interior may be followed immediately by a blue passenger van with cloth interior, *flowing down the same line at a steady pace*. The right mix of materials is ready at the point of use, replenished by kanban (discussed shortly), and production activities are supported by visual communications. At any moment a worker discovering a defect may *stop the line* to quickly identify and correct its cause (quality at the source), improving process stability and product quality along every step of the process.

Many Lean manufacturers are moving toward this sweet spot of mass customization where an agile enterprise can respond to varying customer requirements with short lead time and relatively low cost. With a little creativity, Lean practitioners in nonmanufacturing applications (including IT) find they can apply the diagonal sweet-spot metaphor to their own products and services, since it represents an agile balance of efficiency and flexibility.

Let's try it now. Think of an office process in your company (e.g., processing a medical laboratory order, handling an insurance claim, or making a hotel reservation) where most of the time everything is normal and the process flows smoothly. But every now and then, a variable is introduced that slows the process down. Suddenly the associate doesn't know exactly what to do and has to stop what he or she is doing to search for materials or information. Flow is suddenly interrupted—not just for this one transaction, but also for all work queued up behind it.

While it is certainly not easy to make a process flow, there are several basic issues to consider. First, think about how you would identify all the common variations (options, configurations) in the product or service that the customer would value. How might you standardize and categorize them

so *anticipated* variation is handled smoothly? What sort of materials, information, training, and support should be provided so associates can handle these variations without interrupting flow? How would the physical and virtual workspace be organized to require minimal movement, transportation, and delay, while creating a visual line of sight across the entire process?

There are many benefits to flow, among them:

- Work flows smoothly, without interruption, congestion, or bottlenecks, enabling just-in-time response to customer requests.
- The pace of activity is based on demand signals, so no excess inventory is created, and no excess work is performed.
- Associates are able to spot and solve problems quickly, improving quality and process performance.
- Production time is stable, so customer service-level agreements (time and quality) can be consistently promised and met.

And, most importantly for the topic of Lean IT, flow simplifies the information requirements of a process. Since the pace of work is stable, sophisticated scheduling and control software is often not necessary. And because process problems quickly call attention to themselves, they are self-regulating, so invasive monitoring, data capture, and analyses also become unnecessary. That is not to say that it is not important to identify key metrics or key performance indicators (KPIs). And there is still value in collecting and analyzing *some* data, seeking to understand process variation and its relative impact on flow, in order to support continuous improvement.

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## **KANBAN IS AN *INFORMATION* SYSTEM FOR PULL**

Kanban is a signaling device that pulls the flow of work through a process at a manageable pace. Kanban has several purposes:

1. *Triggers work only when ordered by the customer:* When a kanban signal is received by a work center, it causes work to begin. Working only to demand signals (*just-in-time*) directs resource allocation and prevents overproduction and excess inventory.

2. *Indicates the specific work to be done:* Kanban signals contain a description of the work to be done next, which clarifies the sequence of work priorities for supervisors and associates.
3. *Controls the amount of work in process:* By regulating the quantity of kanbans within a process, inventory is limited.
4. *Buffers interruptions:* By keeping a *small, carefully calculated buffer* of safety stock between operational steps (also called a *supermarket*), the downstream operation is not starved by a temporary interruption from an upstream operation.
5. *Orchestrates the pace of work:* Since each operation is only working according to pull signals, the work flows at a natural cadence. A sudden interruption is easily spotted, and workers quickly converge and troubleshoot the problem in order to restart the process flow.

While kanban is simple to describe, the variations are limited only by the creativity of the team designing the system. In a manufacturing setting we have seen kanbans implemented using cards, bins, pallets, colored golf balls, flashing lights, and other clever devices.

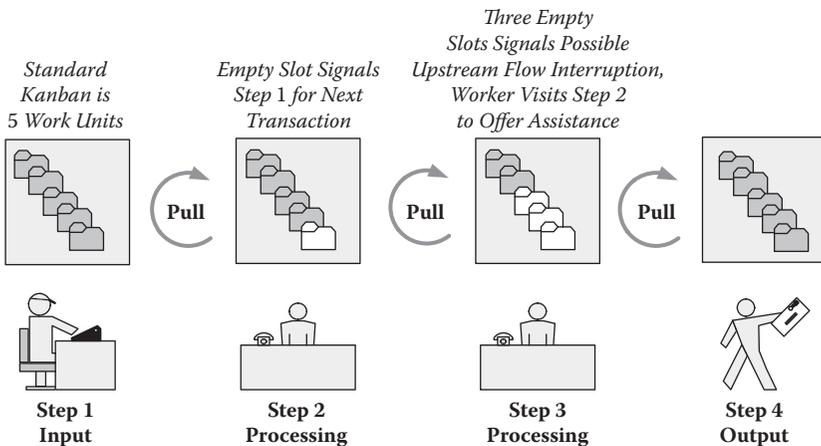
It's important to keep kanbans physical and visual whenever possible, but sometimes electronic kanban communications are appropriate. Electronic kanban signals include on-demand printed kanban cards with bar coding, overhead or kiosk electronic displays at each work center, roaming wireless devices, e-mail messages, and other computerized methods. The rapid communication of supplier replenishment over long distances can significantly reduce supply chain inventories and delays. Electronic data interchange (EDI) messages (demand signals) are often sent to suppliers (external vendors, as well as internal suppliers within an extended enterprise) to trigger replenishment, reducing labor costs, while preventing delays and data entry errors. Rather than an MRP system sending periodic release messages on a push-scheduled basis, however, electronic kanban pull signals should be triggered in real time by workflow events.

Electronic supplier kanban can be surprisingly simple. Years before webcams became popular and inexpensive, Boeing deployed a clever supplier replenishment visual kanban system. First, they organized the raw material storage location, using shelving and tape. It was very easy to view this area and quickly determine when replenishment was needed. After establishing min/max levels with their supplier, Boeing trained a web camera on this space. Boeing provided the supplier with a secure link so it could

remotely observe inventory levels several times each day. The supplier was authorized to initiate the replenishment order as needed.

Though kanban was first developed in a manufacturing setting, it translates easily into the office environment. Imagine an office setting where each step of a process is performed in someone’s cubicle. Outside each cubicle hangs a rack, and each slot on the rack can accept a limited number of folders containing work (loan applications, lab orders, patient charts, insurance claims for review, etc.). Each slot represents a standard unit of work, pacing production flow while limiting the buildup of excess work-in-process inventory. Each participant in the process now has line of sight to the entire process and visual signals to indicate how well the process is flowing. An empty slot sends signals upstream to produce more work. And if there are too many, or too few, empty slots at a particular position, it visibly signals that somewhere a flow interruption has occurred—a silent call for assistance. This arrangement is illustrated in Figure 5.2.

We have witnessed kanban effectively drive out waste in virtually every industry, and it can apply to any form of work, material, or information flow. For example, Naida Grunden, author of *The Pittsburgh Way to Efficient Healthcare*,<sup>6</sup> describes the use of kanban in the pathology lab of a Pittsburgh-area hospital, where color-coded cards hanging on key rings signal for a replenishment order. When an item is low, anyone can take a



**FIGURE 5.2**  
Office kanban.

laminated card and hang it on a plastic hook on the bulletin board right next to the phone, where the order entry person will see it. Once this system was implemented, staff labor dedicated to order placement plummeted from eight hours per week to 10 minutes per day. Inventory was reduced by about half, stockouts all but ceased, and the investment in an expensive new information system was avoided.

Just like a factory, when an office value stream extends across a distance (such as several buildings in a campus setting, or around the globe), there is limited physical visibility to kanban status without electronic communications. Thus electronic workflow and backlog/inbox management rules may be designed to follow simple kanban logic, with automated escalation alerts calling attention to exception and error conditions.

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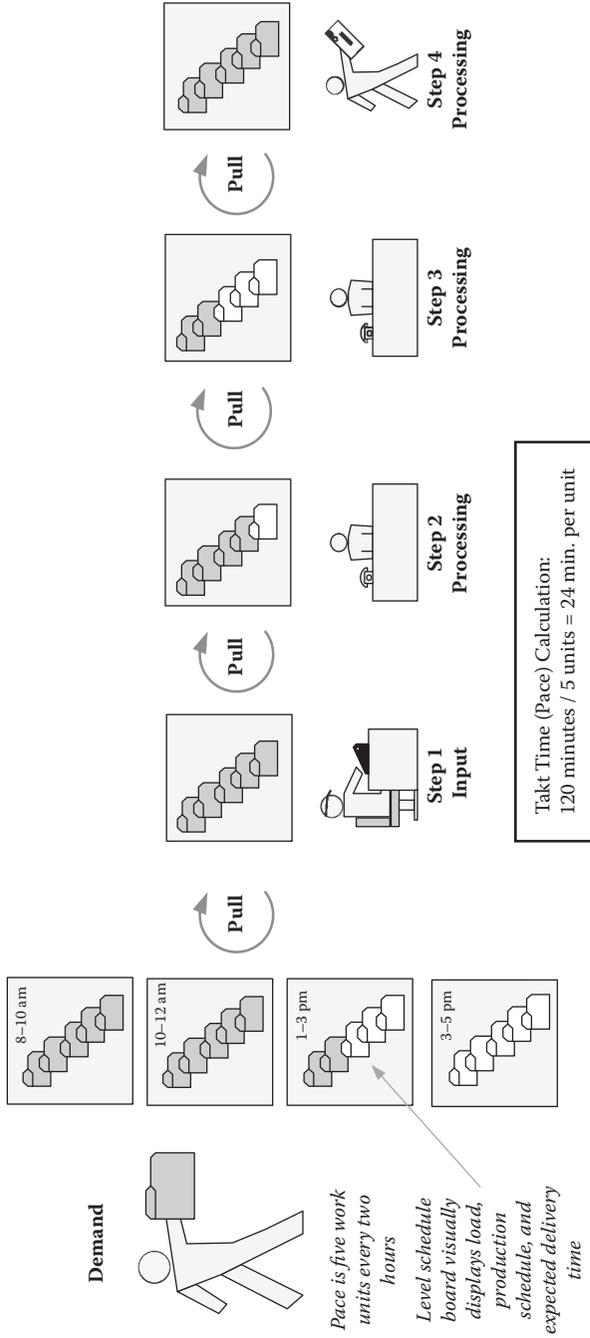
## CREATING A LEVEL SCHEDULE

Once a process is made to flow, it's important not to overload it. While kanbans regulate the internal load balancing of a process, a scheduling mechanism is still needed to prevent too much work from accumulating at the front, and to regulate a steady *release sequence* of work. An excessive or improperly sequenced backlog causes an unreliable schedule, which leads to frequent expediting and rule breaking, ultimately causing flow to fail—chaos.

*Heijunka* (Japanese for level scheduling), working with kanban, establishes a simple-to-understand visual schedule that releases work at a steady cadence, while responding quickly to change. Kanban signals can be physical cards in a physical *heijunka box* or electronic signals on an electronic heijunka box.

Figure 5.3 continues our office kanban example, showing the function of a level schedule. In this example, the pace is established at five work units every two hours. When people submit new work (demand), they can look at the daily backlog and instantly determine how loaded the process is, and when they should expect their work to be completed. This visibility prevents countless interruptions for schedule status information, which would otherwise interrupt flow and hinder productivity.

If the new work has a higher priority than what is already in the queue (a high-priority customer request), with proper authority (preestablished decision rules are important here) the work unit can be moved nearer to



**FIGURE 5.3**  
Office heijunka box.

the front of the queue. The remaining work shifts to a later slot, but since this work has not yet been released, its reprioritization does not disrupt the flow of work already in process. Once work is released it flows quickly (just-in-time) to completion and on to the customer, so expediting is unnecessary.

With a little creativity, level scheduling and kanban methods can be applied to any product or service process in any industry. In Chapter 8, we explore how these methods have been applied to Lean software development (also known as *agile*).

By simplifying process, product, and service design, and through the creative use of kanban and level-scheduling methods, the information-processing requirements of many processes can be simplified. This stabilizes the environment, helping to maintain service-level agreements with customers, while avoiding the investment and complication of sophisticated software and the cost and chaos it often creates.

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## **IT DEMAND MANAGEMENT: THE FOUNDATION FOR FLOW**

Plans are useless, but planning is indispensable.

—General Dwight D. Eisenhower

No matter how well a process flows, it is essential to manage the demand feeding it, creating a prioritized queue of work that is clearly aligned with customer demand and business objectives. Otherwise, it is possible that all you have accomplished (with pull and a level schedule) is to cause nonprioritized (and potentially non-value-adding) work to flow more efficiently to your customers. More likely, however, introducing non-value-added work into the backlog will result in sudden interruptions and unplanned changes once the customer sees the results.

IT demand management is essential to ensure the right work is introduced to development and then production at the right time. From the IT perspective many organizations live with a crushing backlog, often two years or greater in length. When a backlog grows this large, it becomes virtually impossible to effectively manage. As business decision makers

lose visibility to the workload, they are unable to make informed trade-off decisions regarding the best use of already constrained resources.

Also, when a clear decision-making process does not exist or is ineffective, customers tend to treat every new task as a rush job, so priorities are ephemeral, shifting by the moment. This leads to frequent juggling and thrashing of IT projects, and interrupting and task-switching of well-intended IT staff, causing widespread inefficiency, poor quality, frustration, and decreased morale.

When people become overloaded, they tend to shift into a reactive, fire-fighting mode: attacking symptoms and providing quick fixes rather than identifying root causes and implementing lasting solutions. This behavior only digs the IT organization into deeper turmoil, since every impulsive response adds to the growing technical debt of patches, workarounds, and legacy systems that must some day come due.

From the business perspective, IT is often branded as unreliable—consuming endless streams of capital, while delivering projects that are chronically late and over budget, and that ultimately underdeliver.\* In their struggle to establish priorities, many organizations devolve into a pattern of battlefield decision making, a process depending less on facts and business priorities and more on assumptions, influence, and persuasion. This in turn creates unhealthy zero-sum gaming behavior among managers and business units competing for limited IT resources. Often prioritization is unduly influenced by the requestor's rank or favors owed, rather than logical coordination of strategically aligned activities.

As such undisciplined behaviors become the norm, the IT organization is relegated to the role of order takers—a drive-through IT services window (although the typical fast-food drive-through yields higher customer satisfaction scores). In the end, the IT organization just does what they're told, and the business forgoes the process perspective, insight, and leadership that IT professionals have to offer.

In other cases, when priorities aren't clear, or are even contradictory, IT is forced by looming deadlines to make important prioritization and trade-off decisions by default, without clear business guidelines, and everyone suffers the consequences.

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\* In this section we focus on the demand management. Later in this book we'll explore related issues, including requirements definition, project portfolio management, strategic alignment, and governance. In Part 4, we'll bring all these pieces together into a holistic approach for a Lean management system.

The result of this dysfunctional behavior is the haphazard alignment of IT activities with business goals, and the squandering of IT resources and investments. This all but guarantees dissatisfied customers, in both IT and business, who see the chaos and learn to game the system to get what they think they require, and hope the situation will somehow remedy itself. This often leads customers to ask for more than they need, sooner than they need it, in an attempt to compensate for unreliable and inconsistent delivery performance. Backlog *sandbagging* creates even more overload and lost accountability, making matters even worse—and the cycle begins anew.

Such haggling and arm-twisting cause demoralization and loss of trust within the ranks of IT and across the organization, reminiscent of the old adage to *just keep whipping the horse harder to make him run faster*. Ultimately the best people leave for greener pastures (or, worse, for medical reasons), perpetuating chronic IT underperformance.

Perhaps we've exaggerated a bit, painting an overly grim picture? But then again, perhaps we haven't. According to the *CIO Magazine* article "A New Model for IT Demand Management,"

Demand management is clearly the missing link in most IT departments. Far from being the rational and structured process we would like it to be, [IT] demand management is usually a nebulous combination of decibel management [whoever yells the loudest gets the attention] and organizational politics, significantly amplified in international organizations when country politics and cultural differences are thrown into the mix.<sup>7</sup>

While some IT organizations have developed good demand management practices, in our experience they are the exception, not the rule.

### **Only Three Choices When Demand Exceeds Capacity**

Quite simply, the business faces three choices when its demand for IT services exceeds its capacity to deliver them:

1. *Do nothing*: The most common practice, no intentional action to address the situation, is a de facto choice to live with the frustration and ineffectiveness, which continues to worsen over time. The result is that projects are often prioritized by management edict or

IT default: while this may be expedient, ultimately command-and-control prioritization of IT activities does not yield optimal results.

2. *Add capacity*: This is costly, and not a viable long-term solution, often creating a deepening cycle of waste and confusion that temporarily masks the real problem.
3. *Manage demand and balance capacity with a disciplined decision-making process*: Clearly this is the only viable choice if an organization hopes to achieve IT operational excellence.

Most IT planning efforts focus on the supply side, emphasizing project management, scheduling, problem escalation, and equipment and human resources management. But without a deliberate focus on the demand side (balancing prioritized demand with capacity), IT risks doing many things efficiently, but not necessarily those things which deliver value to the customer. IT proactively positions itself to take responsibility for a backlog greater than its capacity, including projects that may not be strategically aligned.

## The IT Demand Management Cycle

Senior managers are responsible for establishing management systems that balance macro-level demand and supply, reducing systemic variability (*muri*)\* and overburden (*mura*). In the world of manufacturing, a methodology called *Sales and Operations Planning (S&OP)*† has evolved to address this requirement in production operations. A similar approach can be used to balance IT demand with available capacity. Illustrated in Figure 5.4, demand management is a periodic, closed-loop feedback system that over time learns, adjusts, and becomes self-regulating.

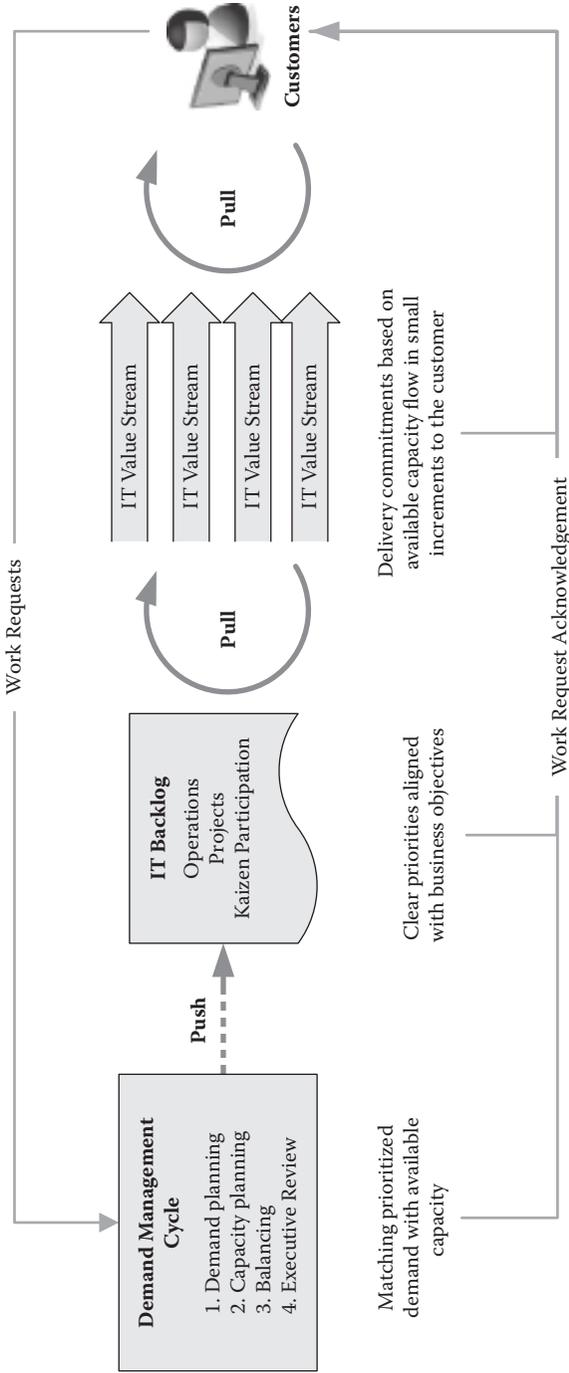
### *Demand Planning*

Using the traditional S&OP monthly cycle as a foundation, we will walk through a suggested IT demand management process. We recommend starting with a regular monthly cycle, standardizing and synchronizing the pace of organizational decision making.

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\* *Muri* and *mura* are described in Chapter 2.

† See *Sales & operations planning, The how to handbook*, by Tom Wallace.



**FIGURE 5.4**  
Demand management feedback loop.

During the first week of the month, the demand planning team gathers updated information on new demand, as well as changes to existing demand: backlog and work in process, including newly discovered in-process demand (e.g., scope additions, new challenges encountered, and unplanned work). New demand includes new projects and services, and changes to existing service-level agreements. It also includes unplanned ongoing operational commitments for new systems (maintenance, support, upgrades, etc.) that were not accounted for in the original implementation project budgets—an unfortunate but common occurrence. Unexpected changes to existing demand are investigated to spot trends and emerging problems, identifying root causes of those problems, which are used to improve the accuracy of the ongoing estimating and planning process (PDCA).

Unlike supply chain organizations that have abundant transactional data (customer orders, sales history, seasonality, and other trends) to support their demand planning, IT relies largely on anticipated demand requested by the business.\* These requests are often informal and unstructured, and thus unreliable. Demand planning is a collaborative process where service provider value stream and process owners meet with the internal and external customer stakeholders that identify and prioritize demand for IT activities. During this time, the business case is developed, demand identified, and the demand-planning process continuously improved.

### ***Flow Simplifies Demand Planning***

Lean flow naturally simplifies demand planning. When delivery cycles become faster (approaching just-in-time), the planning horizon becomes shorter. At a certain point, operations are based on what the customer needs (pull signals) rather than what we (and they) think they might need sometime in the future. This in turn extends an invitation for frequent communication with the customer.

This interaction also creates an opportunity to modify the customers' "buying habits" to create a more level, stable demand. For example, customers of Lean manufacturers are often motivated to submit

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\* With larger organizations, and those with complex demand and capacity scenarios, process and software tools beyond spreadsheets (such as Project Portfolio Management software) may be necessary to facilitate the demand management process. However, this section will focus on the process, not the tools.

more frequent orders for smaller quantities, creating a level pace of demand to the supplier, while reducing supply chain inventory. The same approach applies to IT demand planning, whether in the iterative, synchronized steps of a software development project, or the rapid execution of small, operational steps. When customers develop confidence that they can request something important and receive it soon afterward, they begin requesting changes in smaller increments over a shorter time horizon, which makes their requirements more precise. This creates a smooth flow of smaller work requests, which can be managed by a level schedule.

### ***Capacity Planning***

During the second week of the month, IT department and project managers, and IT value stream owners, review the various IT project and value stream loads to determine available capacity. When determining available resource capacity, the question often arises about how to plan for ordinary time commitments such as meetings, e-mail management, breaks, and ongoing kaizen participation. The simplest approach is to allocate a percentage of total work time for such activities. Critical capacity constraints should also be clearly identified and addressed.\*

The distinction between value streams and IT projects is important:

1. *Value streams* are relatively permanent groups of resources, often physically or virtually co-located, that perform similar ongoing activities. For example, a value stream may support the processes of a particular line of business, a domain of IT operations such as security or communications, a specific software application, or an enterprise application integration infrastructure. With dedicated value stream resources, the scheduling challenges of shared resources are avoided. Teams are cross-trained and internally load balance, enabling a stable pace of workflow. While the assignment of resources to individual value streams usually results in an incremental increase in total enterprise resources, long ago Lean manufacturers discovered that this trade-off was worthwhile, since flow reduced total operating costs, improved stability, quality, and productivity;

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\* See the Theory of Constraints.

and enabled agility. Since value streams are designed for flow, the determination of capacity is relatively simple: the capacity of a value stream is the processes' maximum rate of flow, and (like demand) can be measured in estimated hours, work units, or points (for discussion of points, see Chapter 8).\*

2. *IT projects* are teams temporarily assembled for a specific event or deliverable. Multiple simultaneous projects may share resources, causing contention and scheduling challenges among them; shared resources are a primary cause of flow interruption. The demand and capacity balancing of IT projects can be chaotic, because of their temporary nature, frequent scope changes, and resource sharing. Capacity is calculated as the number of available work hours by skill set, and tracking availability is challenging because scarce resources often move unpredictably among multiple projects.

### **Balancing**

During the third week of the month, all stakeholders representing IT demand *and* capacity gather in a series of collaborative sessions to clarify priorities, manage constraints, and identify trade-offs.

Because of the challenges of shared resources, large groups of IT project stakeholders must meet together, because changes in one project often cause a ripple effect of compromises and trade-offs in others. This assumes visibility across all projects—a key element of portfolio management (see Chapter 9). On the other hand, the demand and capacity balancing sessions for dedicated IT *value streams* are more focused, and usually simpler and faster. In fact, IT value stream teams often adopt daily standup meetings to maintain stable flow conditions, so current demand and capacity are *always* known and more visible.

During balancing sessions, priorities are established, and the backlog is updated. Note that there is a subtle but important difference between prioritization and sequencing. Prioritization indicates the urgency of the deliverable needed by the requestor. Sequencing of individual tasks or elements is usually a production consideration, where a lower priority task might be completed first, because there is a dependency from a

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\* For an example of IT value stream organization, see the Con-way case study; and for an example of IT demand and capacity planning, see the Group Health case study.

higher priority element. Demand management is concerned primarily with prioritization of loading the backlog. Furthermore, backlogs must be kept to a reasonable duration. Many organizations impose a finite length, such as six months or one year. Requests that do not make the backlog should not be kept on an informal back burner list to be slipped into the backlog by sleight of hand. Resubmitted requests should pass the same rigorous qualification process as new requests.

Summary materials are then prepared for the executive review session. The strategic and financial impact of each issue is considered at this time. When decisions requiring management authorization are needed (such as significant investment for new resources, new equipment, or a new partner relationship), alternative scenarios and recommendations are prepared for the executive session. If consensus on a particular trade-off decision cannot be reached, then justifications and supporting information should be prepared to inform an executive decision.

### ***Executive Review***

This brief (target two-hour) meeting should occur late in the third week of each month, allowing the organization time to prepare for the following month's activity. The meeting agenda should be standardized, concise, and tightly facilitated. The root cause of any significant deviation from the meeting agenda (often due to lack of preparation, unclear recommendations, or excessive detail) should be investigated and prevented from recurring in future cycles (this is PDCA applied to effective meetings).

The executive review is much more than just a rubber-stamp session; it may be the only time when non-IT executives get to look deep inside the engine room to understand IT concerns and their impact on the enterprise. This monthly session aligns tactical operational IT activities with strategic objectives. Information should be presented at a high level, but assumptions and recommendations must be clearly documented, and stakeholders should be prepared to instantly drill down to the underlying details when requested. Meeting notes should be recorded, capturing firm decisions and open issues (parking lot) to be investigated.

The monthly demand management cycle is a good example of a *management system* (explored in the next chapter), where management is accountable for standard, repeatable performance, creating an environment of stability throughout the enterprise. In the dynamic world of IT demand

and capacity, fluid balance is maintained and communicated, continuously adjusting to new facts and circumstances.

As manufacturers learned years ago, once the monthly planning cycle is functioning smoothly, the organization will evolve the discipline and preparedness to call an ad hoc planning session if a serious situation suddenly arises. And because the demand management process is being rigorously practiced and continuously improved with each passing month, the required effort decreases while the quality of the information improves, supporting informed decision making and reinforcing the *alignment* and *agility* of IT performance.

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## LEAN IT LESSONS LEARNED FROM THE SHOP FLOOR

Many simple but profound lessons have been learned from Lean manufacturing and applied effectively to other industries. The same guiding principles, tools, and systems have also proven effective to the IT organization.

Perhaps the highest accomplishment in Lean is to achieve value stream flow. So here are our simple (but not necessarily easy) guidelines for creating Lean IT flow:

- Position and evolve each value stream toward your competitive sweet spot; maintain a fluid balance between flexibility and efficiency in every process and practice. Stay light on your feet; keep your focus moving in the direction of competitive advantage as the market and your competitors evolve.
- Strive for simplicity and stability in every process before investing in electronic information systems: apply people, process, and technology—in that order.
- Listen to your customers often, and proactively manage demand to support just-in-time operations
- Flow every process where you can. Keep a simple line of sight (physical or virtual) along the entire length of every value stream and supporting process, so they become self-regulating, leveraging the creativity and problem-solving capability of every participant.

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# 6

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## *Lean Management Systems*

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### CHAPTER OBJECTIVES

In this chapter we will explore the following elements of a Lean management system that are typically supported by IT shared services and discuss how a Lean IT approach can make them more effective:

- Communication
- Knowledge management and collaboration
- Performance measurement and business intelligence
- Strategy deployment
- Lean accounting

So much of what we call management consists of making it difficult for people to work.

—Peter Drucker

Most Lean transformation efforts are unable to sustain themselves over time as organizations lose momentum and regress to familiar, wasteful behaviors. This failure is often attributed to abstract notions such as “lack of leadership support” or the “inability to create a Lean culture.” While these explanations may sound plausible, what exactly do they mean, and more importantly, how can we avoid falling into these common traps?

While localized, short-term gains are often achieved with the initial, enthusiastic application of Lean tools, lasting change requires the transformation of collective behavior—which happens neither quickly nor by accident. This points to the need for effective and deliberate management systems to spread, guide, and sustain change throughout all levels of the organization—aligning daily work with strategy.

In *Creating a Lean Culture*, organizational psychologist David Mann suggests that as an organization changes the way work is done, it must also fundamentally change the way it *manages* that work. He describes the behaviors necessary to create an effective *Lean management system*:<sup>1</sup>

- *Leader standard work*: Explicit, interlocking managerial tasks ensure continual focus on the process, as well as the outcomes
- *Visual controls*: The performance of processes is visually apparent at all times, immediately calling attention to abnormalities
- *Daily accountability*: Brief, structured meetings focus on performance, with follow-ups to close gaps between actual results and expected performance
- *Discipline*: Consistent behavior reinforces good work habits and process stability, establishing a culture of quality and accountability

The success of a Lean management system relies on collaboration and the smooth flow of quality information. The ideal information system is a manual one, where the information is *experiential*: visible, accurate, and meaningful—clearly tied to immediate actions and consequences. In such an environment, participants intuitively understand the situation and are able to solve their own problems.

But in most modern organizations, value streams cross many boundaries—departments, workgroups, project teams, functional silos, buildings, time zones, and countries. The span of managerial responsibility is also great, so face-to-face interaction and hands-on information are usually not sufficient for an enterprise-wide Lean management system.

Microsoft's Bill Gates chose the phrase *digital nervous system* to describe the role of a distributed business information system. Similar to the function of a biological nervous system, a digital nervous system provides a constant flow of feedback essential to the organization's survival:

You always are alert to the most important things, and you block out the information that's not important. And companies really need to have that same kind of thing: the information that's valuable getting to the people who need to know about it.<sup>2</sup>

Clearly, a well-designed framework of *shared information system services* is necessary to enable an effective Lean management system. It is difficult to imagine getting a day's work done without e-mail, shared drives, collaborative workspaces, and reporting and analysis tools. But each of these alluring "productivity-enhancing" tools can also potentially distract our focus, causing us to *mistake activity for productivity*.

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## COMMUNICATION

Few will argue that e-mail and meetings are out of control in many organizations. Office workers often report a large part of each day is spent wading through e-mail or trapped in ineffective meetings, diverted from their value-adding work.

When does e-mail add value? The answer to this question in part depends on the nature of the work each individual performs. The further people are removed from the hands-on operational activity of the business, the less structured work and communications they perform. So we should expect a larger part of managers' and executives' daily activity to include communications by e-mail, phone, and meetings.

Furthermore, organizations on the Lean journey usually experience more cross-functional interaction as they practice systems thinking, breaking down organizational silos and concentrating on value streams. This naturally causes additional email traffic and increased meeting frequency.

While such less-structured communications are important, excessive or inappropriate e-mail traffic, endless conference calls, and back-to-back meetings leaving no time for reflection or follow-up can cause significant waste. These wastes include *waiting* (high-value-added work is delayed because the person is distracted by low-value activities), *unused human potential* (frequent e-mail and instant messaging interruptions sap creativity and energy), and *overprocessing* (reading the same e-mail thread multiple times before acting on the situation, or attending redundant, unproductive meetings).

Worse yet, when individuals become habituated to these distractions and interruptions, they may lose a sense of cadence and flow with their standard work. They may also fail to recognize subtle process exceptions and problems, missing valuable opportunities for process improvement. So e-mail, instant messaging, social networking, and other forms of unstructured communications should be scrutinized with the same criteria of waste, value, and standardization as any other business activity.

Much has been written about how to conduct effective meetings, yet poorly run meetings remain a chronic time-waster in many organizations. When standard work is effectively practiced, and meetings are properly facilitated, group interactions become more purposeful and structured; many unnecessary meetings are eliminated, while those that remain become more productive. Particularly effective are standup meetings, where a team gathers (physically or virtually) around visual status boards for a brief daily meeting or to focus on a sudden problem.

Concerned with reducing the time, cost, and environmental impact of unnecessary travel, many organizations are investing in remote-meeting capabilities. At the same time, organizations must also learn how to manage these meetings properly. How many of us have mentally checked out, distracted by e-mail or other interruptions, during a poorly facilitated or uninteresting electronic meeting or webcast? Remote meetings require discipline and engaged participation, supported by standard work or else they too can become monumental time wasters.

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## KNOWLEDGE MANAGEMENT AND COLLABORATION

In a learning organization, the whole of knowledge gained through dialogue and problem solving is greater than the sum of the contributions from individual team members. Learning is therefore both a technical and a social process. In *The Fifth Discipline*, Peter Senge describes knowledge as a natural result of human interactions:

Knowledge is social. Collaboration is the flip side of knowledge management. So, to manage knowledge you need to address collaboration and tools that help people collaborate.<sup>3</sup>

Knowledge management and collaboration systems offer many opportunities for individuals and teams to virtually gather and share knowledge across an enterprise and beyond. But their flexibility also threatens to spread information chaos and waste. Unless an organization deliberately establishes a discipline of workplace organization and standard work, *electronic document waste* can threaten the value and security of an organization's intellectual assets.

## Knowledge Management

A great deal of *structured* information exists in databases, used by applications to automate business processes; however, this represents only a small fraction of the overall knowledge of the organization. A much greater amount is stored as *unstructured* repositories of documents (spreadsheets, text, diagrams, photos, videos, etc.) scattered throughout an organization's hard drives. But the *majority of knowledge* (80 percent, according to a 2002 study)\* is stored deep inside people's heads.

Baby boomers will soon retire, threatening to take much of their knowledge with them. This knowledge (undocumented procedures and insights) must be captured and standardized, or else the intellectual capital and competitive advantage of many organizations will be at risk. This loss of knowledge is especially serious when the work involves more practice than process (see Chapter 4).

Harnessing collective knowledge is an extension of the empowerment that personal computers first brought to knowledge workers, and there is a historical parallel here worth considering. In the late 1980s, personal computers became increasingly powerful and software more capable—perhaps some readers remember the impact of Lotus 1-2-3, WordPerfect, and Novell networks? During the 1990s departmental networks and client/server systems proliferated, displacing (and often duplicating) the functions of centralized mainframe and minicomputer systems. This unplanned and ungoverned information expansion and accessibility created endless challenges for IT managers.

In much the same way, abundant departmental shared drives, web-based repositories, and social networking systems are a double-edged sword.

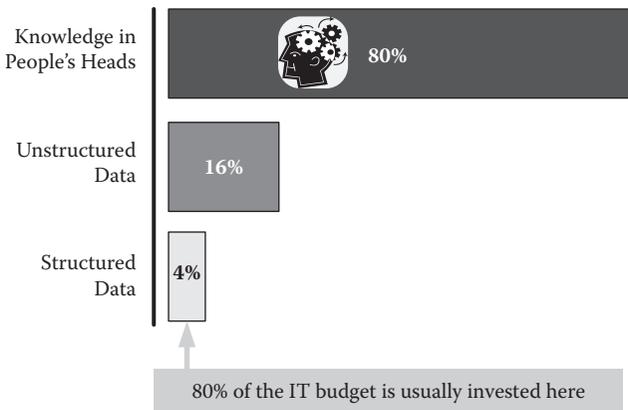
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\* This study was prepared by the Giga Information Group, which was later acquired by Forrester Research.

On the one hand, they enable individuals and teams to take ownership of information, gathering and sharing knowledge quickly and easily. But on the other hand, they often violate standards for security, data quality, version control, change management, and compliance. To IT managers who experienced the dawning of the personal computer age, this tension between flexibility and control may seem familiar.

In the years since the study illustrated in Figure 6.1, many organizations have implemented document and content management systems, attempting to store and access shared information quickly and securely. Yet these efforts are not always successful, often because of the lack of standard work and discipline; many document repositories have become sophisticated junk drawers . . . with unlimited capacity.

Experts estimated that in 2008 an additional 487 exabytes of data were created in the “digital universe”—an exabyte is a million billion megabytes. They also predict that, with the growing popularity of various forms of digital content, in 2012 five times as much digital information will be created.<sup>4</sup> The content management challenge has suddenly become much more complex. With the rapid evolution of social networking capabilities—blogs, wikis, online videos, and whatever is coming next—more of what was once inside our heads is quickly becoming universally accessible information. We see IT organizations investing heavily in these areas—but their resources are often exhausted simply by chasing these rapidly evolving technologies, rather than proactively managing them.



**FIGURE 6.1**  
Composition of organizational knowledge.

On the one hand, organizations should leverage the creative power that these new technologies offer. But on the other hand, security, risk, and other basic governance concerns must be addressed. There is no simple answer to this challenge, but Lean offers an approach to restore order from the mounting chaos.

In our experience, the 5S method of workplace organization can be effectively applied to knowledge management. Given time, coaching, and specific guidelines (policies that must be adhered to), teams will develop creative approaches to managing knowledge—and then they will make them stick, because they own the solution. Most importantly, by focusing on the fourth and fifth S, standardize and sustain, teams themselves (not just by management edict but also through peer pressure, motivated by a sincere desire to improve) will enforce standard work to ensure everyone follows the mutually agreed upon rules.\* And the teams will innovate and adapt to the continuously changing technology landscape.

## Collaborative Workspaces

Collaborative workspaces offer a group of virtually co-located individuals the ability to share knowledge and maintain visual awareness of project status. Like the traditional project “war room” (also known in Lean as the *obeya* room, see Chapter 9), a virtual collaborative workspace helps distributed teams work in unison, tightly coupling learning with action.

Simple implementations of collaborative workspaces provide capabilities such as document management, communications, reports, task lists, and portals linking to external sites and content. Sophisticated implementations may include group calendars and scheduling, project and resource management, automated status alerts, dashboards, and scorecards. When the team includes members outside the organization, special consideration should be given to security and intellectual property protection.

We often see a special form of collaborative workspace dedicated to Lean transformation. Lean is truly a team sport, and at the core of the team are the internal facilitators who support the Lean Center of Excellence (CoE)—those employees who coach and facilitate kaizen

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\* For more on 5S, see Chapter 2, and also the Con-way Virtual 5S case study.

## THE EVOLUTION OF A LEAN INTRANET SITE

One client describes their journey:

“Lean learning is a lifetime journey, and nearly everyone takes a unique path, making for a rich web of knowledge exchange, materials and information. Our organization employs over 30,000 people in over 30 countries, including 400 lean coaches who actively facilitate the transformation. Because of our global size and reach, we recognized the need early on to create a commonly shared intranet site to eliminate waste from the learning and knowledge management process.

“Our first release was based on a simple intranet site targeting support just for our lean ‘pioneers’, the early adopters who were experimenting and learning at a fast pace. Our transformation was moving so quickly that six months later we began the development of the next generation, a more complete site targeting a broader audience. The front page promotes the lean program with examples of kaizen activity and the benefits realized, while the rest of the site provides an events calendar, kaizen report-out summaries, and a document repository for sharing best practices.

“We are now planning the third generation site, a portal design that will allow us to incorporate higher levels of engagement, knowledge sharing and connectivity through social networking tools, blogging, and video streaming. Of course, the more features we implement the more improvements we discover are needed to support our customers.

“We began measuring site performance with a target around number of visitors each week. We are currently reaching an average of nearly 700 visitors per week, with 70 new visitors a week on average. On weeks when we run lean promotions we approach 1,500 visitors per week and we have an end of year target of 2,000. This measure has helped us to drive focus into our improvement efforts, identifying problems quickly to better understand what works and what does not. We are now exploring a metric connected to purpose, proficiency and how people use the site to create value for the company.

“So far we’ve seen many benefits from this site, as our lean program has expanded worldwide:

- Our measures indicate a growing number of people in all areas looking for ways to engage and learn.
- Best practices are being shared across our businesses and regions at a faster pace.
- Learning materials are centralized and standardized, enabling our knowledge base to grow quickly and efficiently.
- Everyone shares their accomplishments, spreading knowledge and enthusiasm, creating a sense of pride and ownership.
- Shared learning is helping to redefine our cultural DNA: who we are as an organization and how we work.”

activity throughout the organization. In our experience, the most effective facilitators come from the trenches, since they have a deep understanding of the organization and its customers, business processes, problems, and culture.

Developing a CoE and a team of internal facilitators requires a significant investment in training, coaching, and experiential learning over time. What better opportunity could there be to create an online community for sharing knowledge? In fact, many organizations invest in a collaborative site for this purpose, with information, contact lists, schedules, lessons learned, training, articles, links, online videos, book reviews, templates, and more.

## **IT Service Desk (Help Desk)**

Service desk is an often underappreciated job, the Rodney Dangerfield of the IT world—they don't get much respect. However, an effective IT customer service function\* can provide a leading indicator of emerging trouble throughout the company—the canary in the IT coal mine. In fact, the service desk can become a fertile source of improvement ideas. With effective teamwork and mentoring, the service desk can also be an effective onramp for new IT employees, where they can learn the inner workings of the organization, and its people, teams, and processes.

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\* See Chapter 7 for more on IT service desk operations, ITIL, and continuous improvement, and Appendix D for an example of an A3 for improving service desk performance.

The service desk is a knowledge hub—continuously processing new technical information from vendors as products are released and updated, disseminating information to help individuals troubleshoot (and hopefully prevent) problems, while gathering new information during each call. Effective management of a support knowledge base, and the ability to provide self-service access to this knowledge, can improve service desk performance and end user satisfaction.

In one service desk 5S kaizen event we facilitated, over 30 percent of the documents in the support knowledge base were found to be obsolete, and many more lacked standard search keywords. In some cases, because documents were hard to find, duplicate documents had been created, often with conflicting information. Since knowledge wasn't shared evenly, pockets of specialized resources evolved, leading to silos of technical support and dependencies on particular individuals.

As a result of the kaizen, within just a few weeks the number of documents in the knowledge base was reduced by 20 percent. Standard work ensured that documents were properly stored, easily located, and regularly updated. During this short time, successful search results increased by nearly 50 percent, dramatically improving first-call problem resolution. Mentoring and cross-training were also instituted, helping to spread knowledge and avoid overspecialization. Best of all, the improvements to the existing processes and system proved that a new and expensive service desk application was not needed.

## **Education and Training**

eLearning utilizes the rich capabilities of the Internet to provide a standardized education and training experience to a large number of individuals. eLearning can be as simple as individual online sessions delivered on demand, or as sophisticated as live facilitated online classes, with links to research and reading material, collaborative exercises, and interactive discussion forums. eLearning can also provide online testing and assessment, with the ability to track individual learning activity and performance—identifying individual strengths to be leveraged and weaknesses to be addressed.

Digital video cameras now appear regularly during gemba walks and kaizen report outs, recording events to be used for educational purposes. The ease and low cost of publishing online video provides a new vehicle to record and share standard work instructions, simply by asking an

experienced worker to demonstrate and describe a procedure. In this way, short, interactive, task-specific training sessions are available to individuals online when performing a task that requires demonstration.

In general, eLearning can significantly reduce travel and other training costs, while capturing and sharing a significant amount of useful information that can be reused and easily updated when necessary. However, we have also seen many online learning sessions where attendees become distracted by e-mail and other interruptions, so discipline and standard work are important. Even though content can be delivered electronically, there is often still value in bringing people together in a physical classroom setting for hands-on training and exercises. Interaction and shared storytelling can make the learning far more experiential and relevant, while developing a sense of teamwork.

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## PERFORMANCE MEASUREMENT

A sound performance measurement strategy is a critical foundation for successful and sustaining continuous improvement. Standardized work creates a stable process baseline for improvement, then measurements provide constant feedback on how well those standards are performing, helping teams determine where best to focus the next round of improvement activity.

A well-designed measurement system is also essential for an effective Lean management system. According to David Mann, “Unlike managing in a results-focused system, process focus implies frequent measurement against expected *intermediate* outcomes. As necessary, interventions can be started before the end results are affected.”<sup>5</sup>

In order to respond quickly when corrective intervention is needed, feedback should be immediate and visual. Consider the difference between push and pull performance measurement. Push performance measurement involves periodic reports that may identify problems some time after they have occurred. Pull is immediate, event-driven, exception-based feedback, allowing individuals to focus their attention on the problem at hand.\* The faster

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\* One example is the automated publish-subscribe method of asynchronous messaging, which prevents broadcasting unwanted information. Users subscribe to a particular topic, and the system publishes information on that specific subject whenever an important event occurs, in various formats such as e-mail alerts and exception reports. This is pull, where the user asks the information system to “send me what I need to know the moment it happens.”

an abnormality is detected, the sooner preventative action can be taken—or, if damage has already occurred, it can be quickly contained and mitigated. And the sooner a team investigates after a problem occurs, the better their chances of detecting the root cause and so preventing its recurrence.

According to Steven Spear in *Chasing the Rabbit*, organizations learn to solve problems and build knowledge by *signaling*, *swarming*, *solving*, and *sharing* what they have learned. First, a problem should signal for attention, then teams quickly swarm and solve it, sharing what they have learned with others. According to Spear,

Swarming a problem is not only beneficial in terms of what is prevented—an infectious spread of the problem’s impact. It is beneficial in terms of what is allowed—the gathering of essential, contextual information that would otherwise be lost to fading memory and changing circumstances. High velocity organizations insist that the “scientific method” be used in a disciplined fashion. High velocity organizations multiply the power of their new knowledge by making it available, not only to those who discovered it, but also throughout the organization.<sup>6</sup>

There are many ways to share information in an organization, and they do not necessarily require technology. For example, in a well-designed work environment, problems should call attention to themselves visually. According to Gwendolyn Galsworth, author of *Visual Workplace, Visual Thinking*,<sup>7</sup> the walls, floors, fixtures, and other physical surroundings in an office or factory are often underutilized—“mute.” But they offer great potential to enable flow and pull, preventing errors, while visually signaling for assistance when an exception, error, or defect occurs.\* Process line of sight allows all participants to immediately sense (see, hear, or feel) an interruption of flow.

When processes are transactional, spread over long distances and time frames, and events are electronic, computers can sift through large volumes of data, looking for abnormalities or trends indicating a potential arising abnormality. This can be achieved with common business intelligence tools such as database alerts and after-the-fact exception reporting, and through more sophisticated techniques such as real-time performance monitoring, data mining, and predictive analytics.

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\* Exceptions are process abnormalities that do not necessarily cause errors but their root cause should be investigated for their impact on standard work; errors are mistakes that do not necessarily cause defects; and defects are flaws in the work product that must be corrected before they are passed downstream to the customer.

In this way, computers can generate highly effective, proactive leading indicators of emerging issues, signaling workers and managers where attention is needed so they can swarm the problem for preventative and corrective action. This creates a *virtual line of sight*, where participants have constant visibility to the entire process. For measurements to add value they must lead to effective action: teams must understand what they're measuring, how they're measuring it, and how frequently, how status will be communicated (visual is preferred), and how they will respond to deviations.

## Lean Business Intelligence

The IT world offers many sophisticated and fascinating business intelligence tools: dashboards, scorecards,\* statistical analyses, data mining, predictive analytics, visualization, and more. And enterprise databases are overflowing with potentially useful information. From a Lean perspective, a simple business intelligence approach used effectively is far better than a sophisticated tool used improperly.

For example, accuracy and timeliness are more important than precision. In fact, data can be extremely precise (e.g., to six decimal places), supported by sophisticated analyses and visuals. Yet it can be inaccurate, untimely, and irrelevant, giving a false sense of significance to the viewer.

In *Performance Dashboards: Measuring, Monitoring and Managing Your Business*,<sup>9</sup> Wayne Eckerson describes three levels of performance measurement dashboards (shown in Figure 6.2) that work together to support a healthy environment for continuous improvement.

*Operational dashboards:* Monitor operational activity, often in real time. This is virtual gemba, providing process line of sight.†

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\* Dashboards and scorecards are both visual measurement and feedback systems. The two terms are often used interchangeably, although dashboards provide immediate performance feedback in near real time, whereas scorecards display trends and progress toward goals over time. Dashboard and scorecard views can be mixed in the same user interface, further blurring their distinction.

† It's important to remember that virtual gemba should ultimately lead to actual gemba, since no software can replace human interaction. For example, we recently heard a doctor say, "I hope somebody does a study of the quality of interaction when electronic medical records are introduced. The nurses and doctors tend to have more eye contact and interaction with the computer screen than with the patient."

	Operational	Tactical	Strategic
Purpose	Monitor operations	Measure progress	Execute strategy
Users	Supervisors, specialists	Managers, analysts	Executives, managers, staff
Scope	Operational	Departmental	Enterprise
Information	Detailed	Detailed/summary	Detailed/summary
Updates	Intra-day	Daily/weekly	Monthly/quarterly
Emphasis	Monitoring	Analysis	Management

**FIGURE 6.2**

Three levels of performance dashboards and scorecards.<sup>8\*</sup>

\* In this table, tactical scope indicates a departmental focus. From a lean perspective, this should be expanded to include a cross-functional value stream and supporting process perspective.

Automated alerts notify individuals to conditions that may indicate an emerging problem or condition requiring immediate attention. Operational dashboards often use visual displays (dials, thermometers, flashing lights, etc.) to display status, and are typically in plain view using electronic signboards, kiosks, wireless devices, and even electronic *andons* (e.g., lights or sounds) to attract attention. High-level indicators are often able to drill down, displaying additional detailed data as needed to assist in problem solving.

*Tactical dashboards and scorecards:* Provide managerial views of operational processes, projects, and kaizen activity. They typically identify exceptions and provide analysis capabilities—both simple self-service analytics, as well as sophisticated tools for specialized analyses (e.g., forecasting, modeling, and predictive statistics). For example, overall equipment effectiveness (OEE) measures are a good application for tactical dashboards, since they summarize volumes of operational data helpful for total productive maintenance (TPM) activities.\* Visual project and process status indicators can significantly reduce interruptions by supervisors and managers. And, as many managers are always on the move, these systems are often capable of sending alerts and visuals to smartphones and other handheld devices.

\* OEE is a set of metrics used to measure availability, performance, and quality of a tool or process; TPM is a preventative maintenance program where the operator or team is responsible to monitor and care for their equipment.

*Strategic scorecards:* Provide consolidated views of underlying measures to track progress against strategic objectives, and key performance indicators (KPIs) to monitor important enterprise-level processes. Executive scorecards often employ balanced scorecard and strategy deployment methodologies (more on Strategy Deployment later in this chapter).

The three integrated levels of performance measurement (operational, tactical, and strategic) create a tiered, interlocking structure necessary for linkage and alignment of a Lean management system. A well-crafted performance measurement system provides custom alerts and self-service access, so an executive, manager, supervisor, or associate can monitor areas of interest and drilldown to more detail as needed. But these sophisticated systems should not replace going to gemba—where the work is performed, managing by walking around—“go look, go see, ask why.”

IT organizational involvement in deploying a performance measurement system becomes especially important in multisite situations, and particularly when each site uses different operational information systems. In such a case, IT participants must be intimately involved in understanding the processes and data structures of each site and the systems they use, so a centralized, integrated, coherent set of consolidated information can be presented.

Companies that invest in sophisticated business intelligence (BI) systems at first often deploy more metrics than necessary, over time reducing the number until they arrive at a limited set of KPIs that can be used to effectively guide decisions and identify exceptions. This excess is wasteful and distracting, and can limit the acceptance and eventual utility of the BI system investment. Organizations beginning the journey to integrated business intelligence should move slowly and carefully, identifying information requirements as they go and designing new reports based on their immediate usefulness for process monitoring and improvement, rather than on a desire to utilize the tools in order to justify the technology investment.

## **Rapid Acquisition and Integration**

Our discussion on performance management naturally leads to the brief mention of a related topic, the merging of several companies into a single

Lean enterprise. Naturally, the acquiring and acquired companies seek to quickly and efficiently assimilate and share their collective knowledge and best practices. Ideally, when this synthesis is achieved, the value of the combined entity is greater than its individual parts while the individual distinction and competitive advantage of each entity are preserved.

The lessons of Lean are useful here. Standardized work may be applied to the technical integration process itself, with templates, checklists, and the use of data integration and business intelligence tools that can unite diverse enterprise software systems into consolidated financial and operational views. Standardized work may also be applied to the normalization of business processes, management systems, and information systems (processes, data structures, reporting and analysis, and knowledge management) across consolidated entities.

A good example of this approach is Danaher Corporation, whose legendary success with rapid acquisition and integration is in part due to a disciplined focus on IT standardized work. Using business intelligence and data integration tools, and providing templates, checklists, and a pre-defined framework for rollup and reporting of operational and financial data with their global enterprise resource planning (ERP) system, within 30 days of a new acquisition Danaher often achieves a consolidated view of customers, operations, and financials. Their standard approach also encourages the rapid assimilation of the Danaher Business System best practices within the acquired company, while allowing a degree of continued local autonomy.

It has been said that the greatest synergy of a business combination is either realized or lost within the first six months. If this is so, then a rapid and standardized (Lean) approach to IT and business process integration drives significant value and competitive advantage for the entire enterprise.

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## STRATEGY DEPLOYMENT

A Lean enterprise continuously strives to *align* itself, engaging in systems thinking, reaching beyond localized improvements to achieve a holistic and sustaining transformation. Peter Senge stresses that “empowering the individual when there is a relatively low level of alignment worsens the chaos and makes managing the team even more difficult.”<sup>10</sup> Once aligned,

the energy of chaos is converted into synergy, and the organization is able to direct its activities toward shared goals.

There are two dimensions of alignment: vertical and horizontal.

*Vertical alignment:* Ensures all stakeholders from the board room to operations, through the layers of management interaction, goal setting, and review, can trace their activities and objectives back to the strategic goals of the company.

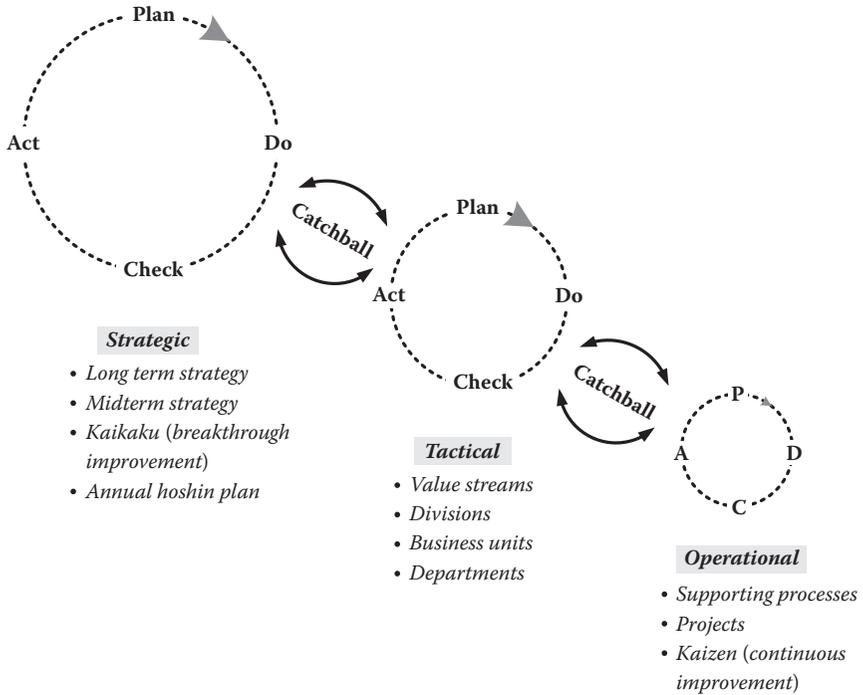
*Horizontal alignment:* Ensures that cross-functional stakeholders of each value stream, supporting process, project, and kaizen, share common objectives, making appropriate prioritization and resource allocation decisions that add value to the customer.

In a Lean enterprise, alignment is shaped and guided through the practice of *strategy deployment* (also known as *hoshin kanri*). Strategy deployment emerged in Japan in the 1950s and has continued evolving to this day. In *Value Stream Management: Strategy and Excellence in the Supply Chain*, coauthor Dan Jones (who also coauthored *The Machine That Changed the World* and *Lean Thinking*)<sup>11</sup> and other researchers at Cardiff's Lean Enterprise Research Centre identified strategy deployment as the first of four pillars behind high-performance supply chain organizations. The second pillar, the formalization of cross-functional management, is the organizational structure through which strategy deployment is executed.

Strategy deployment is often overlooked as organizations plan their Lean transformation. This is in part, explain Jones et al., because “of all the Japanese management techniques, the [strategy] deployment system is the most ‘invisible’ within the factory and less easy to distinguish or emulate than those ‘visible’ elements of the Japanese production systems such as kanban.”<sup>12</sup>

Those techniques that are easier to identify and emulate are usually tactical, not strategic, in nature. Strategy deployment begins with a set of specific objectives to support the strategic direction of the organization. Strategy deployment drives *kaikaku*, or breakthrough improvement (described in Chapter 2), throughout the enterprise and guides the many incremental *kaizen* priority decisions made each day.

An iterative communications process known as *catchball* (Figure 6.3) cascades through successive levels of the organization, guiding improvement efforts and resource assignments to achieve vertically and horizontally aligned targets which support the overall strategic objectives. These



**FIGURE 6.3**  
The strategy deployment management system.

catchball discussions center on the A3, which helps focus thinking and clarify communications.

Regular meetings at each level establish a steady *cadence* of interaction and feedback, essential to leader standard work and daily accountability. Teams then assess cause-and-effect relationships and develop appropriate countermeasures and action plans to achieve established targets. In addition to the regular pace of standard meetings, ad hoc dialogue occurs spontaneously whenever a problem is identified that requires managerial input.

At the operational level of the strategy deployment hierarchy, a team or individual is able to clearly relate how their actions and initiatives support the strategic goals of the organization. Strategy deployment thus provides an internal governance mechanism, guiding priorities so resources are consistently targeted across every level and dimension of the organization.

Strategy deployment decentralizes decision making, shifting problem solving from traditional functional heads to teams that are closer to the

work and to the customer. Strategy deployment in particular, and a Lean management system in general, empowers all departments, teams, and individuals to make fact-based decisions in support of strategic goals, and to understand their purpose and contribution to overall success.

By now, you may have noticed the similarity between the levels of the strategy deployment management system and the levels of performance measurement scorecards and dashboards: *operational*, *tactical*, and *strategic*. To be effective, each level of strategy deployment *management* must be supported by effective *measurement*. The strategy deployment management system and the tiered performance measurement system should evolve in parallel so they are intuitive and mutually reinforcing.

## The Role of Information Systems in Strategy Deployment

Strategy deployment relies on a set of cascading A3 documents, along with supporting documents (text, photos, and other artifacts) data, and measurements. In time, computer assistance (while carefully avoiding unnecessary complexity or overautomation) may be necessary to provide a strategy deployment infrastructure. Specific reasons for this investment may include:

- *Geography*: If the planning process spans large distances, a web-based system can facilitate access.
- *Change control*: The system can prevent changes to targets, history, baselines, and other control data while recording changes made to dynamic information over time.
- *Security*: Sensitive information can be controlled.
- *Data types*: Electronic A3 documents are often implemented with spreadsheet-style user interfaces, providing the user with familiar functions, including text, tables, calculations, and graphics.
- *Standardization*: User-friendly templates and instructional tools facilitate iterative and cascading communications, data-gathering, problem-solving, reporting, and decision-making processes.
- *Scalability*: Organizations often begin with spreadsheet-enabled A3s in a document repository offering version control and security, moving to website and database-enabled applications later as the sophistication and scale of the strategy deployment process evolve.

We are not suggesting that a strategy deployment system must be deployed using sophisticated software. In fact, strategy deployment should first be implemented manually, in a pilot mode, to ensure the process and framework suit the requirements and culture of the organization.

However, the potential benefits of technology should not be overlooked, as an organization strives to establish the foundation of a Lean management system that will help to align and sustain enterprise-wide continuous improvement. To that end, we direct you to the Toyota case study later in this book, where you will learn why this Lean pioneer chose to automate their hoshin kanri management system, the lessons they learned along the way, and the benefits they have realized.

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## MEASURING VALUE: LEAN ACCOUNTING

It was not enough to chase out the cost accountants from the plants. The problem was to chase cost accounting from my people's minds.

—Taiichi Ohno

Now that we've explored the role that information, information systems, and the IT organization play in a Lean management system, we conclude this chapter with a brief exploration of why financial decisions are often misinformed—and what we can do to change this.

To frame this discussion, let's briefly explore an important, yet often misunderstood, discipline: *Lean accounting*.<sup>\*</sup> Why is this subject so important? If you've eliminated waste, reduced inventory, cut cycle times, and increased throughput by applying Lean, but have not changed your accounting views or thought processes, you may be running your business with potentially misleading information and burdening operations with wasteful data collection.

Standard cost thinking does not compel Lean behavior; Lean accounting reflects operational and cash flow reality. If the fundamentals of Lean accounting are not clearly understood, the CEO, CFO, and shareholders can quickly kill a Lean transformation, just as it is beginning to take hold.

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<sup>\*</sup> Our focus here is on accounting for Lean results, not applying Lean techniques to improve the efficiency of accounting operations (accounting for Lean, not Lean for accounting).

In a manufacturing environment this is because Lean accounting causes a sudden shift of previously absorbed overhead expenses (contained within inventory stockpiles) from the balance sheet to the income statement.

Similarly, using standard cost-accounting assumptions in an IT environment, decision makers can also make misinformed decisions on many important issues, including IT investments and the provisioning of IT services. This is because traditional indirect cost allocation and chargeback practices often obscure the true cost, value, and capacity of IT shared services.

Standard cost-accounting practices are not only misleading but potentially *counterproductive*. According to Brian Maskell and Bruce Baggaley, authors of *Practical Lean Accounting*:

Traditional accounting, control and measurement systems ... motivate people to use non-Lean procedures. Traditional systems are wasteful. Standard costs can harm Lean companies because they are based on premises grounded in mass production methods. The methods are complex and confusing to generate, they provide a misleading understanding of cost, and they lead to wrong management decisions on important issues, such as make/buy, profitability of sales orders, rationalization of products or customers, and so forth.<sup>13</sup>

Traditional standard cost accounting captures many transactions in order to allocate costs to specific products and services—these unnecessary transactions themselves are information waste (Figure 6.4). Furthermore, the allocation of indirect costs distorts financial information. In *Real Numbers*, authors Cunningham, Fiume, and Adams explain the fallacy of traditional cost accounting: “Many companies have armies of cost accountants poring over variance reports after month end, trying to determine their reason for variances. The problem is ... it is virtually impossible to trace an unfavorable variance to its root cause. The role of cost control in a Lean environment is to reduce cost by eliminating waste.”<sup>14</sup>

Many individuals, teams, and departments invest their valuable time and energy chasing abstract concepts such as labor efficiency, cost allocations, and variances, distracting attention from the focus of Lean: proactive waste reduction and value creation. Carefully monitoring and regularly measuring activities (inputs and their direct outcomes) helps everyone do things a little better each day.

	Lean	Traditional
Focus	Value stream performance against strategic objectives	Organizational performance, department reports to compare budget to actual
Costing	“Real numbers” — direct costs summarized by value streams	Allocated indirect costs, standard costs that absorb overhead, variance analyses attempt to drive corrective action and process change
Profit drivers	Profit comes from optimizing flow and value to the customer, excess capacity provides flexibility	Profit comes from full utilization of resources, excess capacity is bad
Transactions	Unnecessary transactions are wasteful	Detailed transactions are often captured simply to drive cost allocations
Control	Processes are simple and visual so they are self-regulating	External financial, operational, and audit controls are essential for governance
Performance reporting	Box score: single page value stream summary showing relevant cash-basis financial and operational metrics, capacity utilization, and non-value activity to aid decision-making	Commonly financially oriented, based on cost accounting assumptions; these are difficult for non-accountants to understand, and of limited use in daily problem solving and prevention

**FIGURE 6.4**  
Comparing Lean and traditional accounting.

At the heart of Lean accounting is *value stream costing*, where there is no allocation of overhead (indirect costs) to activities. Shared costs (such as indirect labor, rent, utilities, and *IT shared services*) are treated as direct costs of multiple value streams *only* when they can be easily identified and tracked (e.g., the direct, variable costs of an application used only for certain product or service lines). This results in simple financial information that can be clearly understood to support sound business decisions consistent with Lean.

Lean accounting reinforces a culture of accountability, emphasizing the overall performance of the value stream and not the optimization of any particular asset or activity within it. Simple measures and reports provide information that is easy to understand, relevant, and actionable, helping

individuals and teams at every level of the organization to make sound daily decisions that drive Lean results.

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## **FOCUS ON CREATING VALUE, NOT COST REDUCTION**

Not everything that counts can be counted, and not everything that can be counted counts.

—Albert Einstein

Controlling cost has always been high on the CIO's agenda, but after the high-tech bubble burst in 2001, the resulting crisis of confidence in IT caused many organizations to begin holding IT accountable to more rigorous cost-cutting measures. To many chief financial officers, running a "Lean" IT budget implies weight loss—reducing costs and resources as a primary objective.

Lean practitioners clearly understand that a primary focus on cost reduction, rather than value creation, is hazardous. Leading with a cost focus can cause an organization to continue doing the wrong things more efficiently. Worse yet, across-the-board mandated cuts may inflict irreparable injury to the long-term performance and health of the organization, losing valuable knowledge.

Shigeo Shingo said, "The four goals of improvement must be to make things easier, better, faster, and cheaper."<sup>15</sup> Note the sequence of this list; Lean focuses on adding value and eliminating waste through simplification, quality improvement, and lead time reduction; cost reduction is a natural outcome. According to Gartner, "One of the biggest mistakes companies make with Lean is focusing too heavily on driving cost out of the business. If you approach Lean with that attitude, you're bound to fail. Building a huge data center may give you great economies of scale, for example, but it may also reduce agility and flexibility."<sup>16</sup>

Nevertheless, there is often a relentless emphasis on IT cost reduction, especially during economic downturns. While many organizations (and their shareholders) focus primarily on financial measures, this can lead to short-term thinking at the expense of long-term value. For example, when an employee wastes 10 hours each week performing non-value-

added work, and this activity is suddenly eliminated, that employee can then focus his or her skill, experience, and creativity on adding value elsewhere. But since this does not lead to a reduction in salary expense, or any direct impact to the financial statements, this improvement often goes unrecognized, or is characterized as a *soft* savings. The same argument can be made for a kaizen that reduces floor space or the need for existing equipment, creating the potential that these assets can be redeployed to add more value elsewhere.

Few people will argue that these improvements don't create value, but when it comes to prioritizing improvements, there is nevertheless a strong bias toward hard cost reduction—those improvements that go right to the bottom line. This creates a predisposition toward short-term improvements that have quantifiable cost reduction or avoidance, but many strategically significant improvements are long term and not easily measured (consider improvements to flow, quality, and customer satisfaction). To mitigate this bias, organizations may use hard- and soft-value categories when assessing the impact of kaizen activities, so whether or not there is a direct financial impact, they are acknowledging overall value contributed.

To ensure sound decisions are made for the health of the overall enterprise, IT professionals must help the business clearly discern and measure the true value of each IT service, and its contribution to customer value.

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## THE IMPORTANCE OF THE LEAN MANAGEMENT SYSTEM

In the end, a successful Lean transformation requires the aligned, cooperative behavior of executives, management, and individuals. This is enabled by strategy deployment, and supported by communications, knowledge management, collaboration, and performance measurement systems that focus on value creation. Good decisions and effective, aligned action require simple, understandable, and actionable information.

A Lean management system communicates quality information throughout the organization, accompanied by the steady cadence of leader standard work. By decentralizing problem solving and decision making, and encouraging everyone to take responsibility for Lean performance, an organization cultivates a sustaining Lean culture.

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## **Section III**

### **Performance**

#### *IT Operational Excellence*



# 7

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## *Lean IT Operations: ITIL and Cloud Computing*

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### CHAPTER OBJECTIVES

This chapter provides an introduction to Lean concepts applied to IT operations, and the delivery of IT services to your organization and customers. We will:

- Discuss how Lean IT creates a foundation for sustained IT operational excellence.
- Explore how the Information Technology Infrastructure Library (ITIL), a best practices framework for IT service management, complements Lean IT.
- Speculate on the future of cloud computing and its implications for the IT organization, from a Lean IT perspective.

The IT organization is like a black box to many business executives and managers. Computers are everywhere, and our employees and customers depend on them virtually every minute of the day. When IT services are functioning properly, IT operations are transparent—we don't notice them. However, there is often an underlying fear of the unknown, of catastrophic failure, so organizations invest large sums of money and effort in business continuity plans and disaster recovery preparedness—though often not effectively addressing the root causes of potential failure.

More insidious, what we often don't realize or measure is the impact of countless small failures on every desktop each day. Temperamental computers and software steal incalculable hours each week from otherwise productive employees. An incomprehensible error message suddenly appears on a screen, a printer stops working, a software application hangs up, a document is lost ... calls to the help desk eventually fix the immediate problem, but only after delays and frustration. So we continue on with our day, holding our collective breaths until the next time.

At best, minor interruptions sap the vitality of the organization. At worst, chronic instability may cause anxiety, workarounds, and underutilized IT investments. We once overheard a CEO refer to his IT organization as "a necessary evil." Another CEO lamented that his company was "held hostage" by intractable information systems. In fact, many executives harbor a deep concern about the dependability of their essential systems, feeling powerless to take effective action. Meanwhile, in many IT organizations, technical specialists dash about maintaining order and stability, keepers of secret knowledge and skills that are hard to understand, and even more difficult to standardize, measure, and manage.

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## QUALITY IS FREE

Chronic information system instability, when it exists, is unacceptable. And often, even when systems are stable, there is the perception of instability and excessive cost, born from lack of comfort and understanding about how the IT operations function. In any case, IT operational excellence, and confidence in their performance, is necessary if we are to trust information and information systems to support our businesses.

In 1979 Philip Crosby published *Quality Is Free*, arguing that every dollar invested in quality is returned in profitability.<sup>1</sup> Although Crosby was addressing manufacturing at the time, the very same methods may be used to ensure quality, consistency, reliability, and peace of mind when delivering IT services. After all, IT operations are a business, and they should be run and measured like one. In the opening paragraph of *Measuring ITIL*, author Randy Steinberg poses a challenge:

Much has been written lately about how IT needs to be “run like a business.” A stronger statement is that IT needs to “act like a business.” While technology is certainly important, IT needs to inject much better business management practices by operating services instead of technology silos, measuring the quality and effectiveness of those services and taking timely actions to make sure those services are delivered in line with business needs.<sup>2</sup>

For most organizations, the cost of basic IT operations represents the majority of the total IT budget—just to keep the lights on, the servers running, and the applications working. In 2009 PricewaterhouseCoopers reported that “operational expense is typically more than 80 percent of the IT budget. And everyone has a story about IT not fulfilling requests quickly enough. Business agility is definitely constrained by a lack of IT agility.”<sup>3</sup>

Clearly, IT operations and the delivery of shared services represent a significant investment for the business, one that in many companies often fails to deliver expected results. To ensure value, the business drivers behind IT costs should be clearly understood by business *and* IT stakeholders, supporting well-informed decisions on IT investment priorities. And once these investments are made, the IT organization must deliver services that balance complexity and manageability, so the business stakeholders can use systems properly and with confidence. At the same time, IT must deliver these services while adapting to constantly emerging and maturing technologies. Furthermore, this technological complexity and flux are expected to be hidden from the end users, who simply want the services to meet their current needs, while anticipating future growth and innovation.

To achieve these lofty objectives, the IT organization must manage itself in a way that reduces uncertainty and variability, providing uninterrupted quality services to its customers. At the same time, they must maintain an inward focus on morale and on attracting, retaining, and cultivating the best talent. After all, notwithstanding the sophisticated technology, IT is essentially an intellectual capital endeavor.

At the bottom line, the business wants to see year-on-year cost reductions and improvement of IT service effectiveness, achieved in a manner that supports continuous improvement of business processes, and in a way that encourages innovation and positively differentiates the business from its competition. Is all that too much to ask?

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## FUNCTIONAL SILO OR VALUE-ADDING SERVICE CENTER?

Traditional IT organizations structure themselves around technical domains and skill sets. This approach aims to reduce cost through economies of scale, where specialized resources are concentrated, and the cost of centralized systems and services are shared across many customers. According to the assumptions of mass production, which have been ingrained since childhood, this approach is commonly accepted as efficient and cost-effective.

Lean manufacturing pioneers discovered that the functional grouping of machines causes many challenges as intersecting value streams compete for shared resources and specific skills, resulting in large or rapidly shifting backlogs, excessive work in process inventory, unclear and shifting priorities, frequent interruptions, quality problems, cost overruns, and delays.

In the case of IT operations, the overspecialization and concentration of shared resources can cause:

- *Flow interruptions* as distinct subgroups focus on internal schedule optimization and resource utilization, causing uneven batch-and-queue workflow.
- *Risk of excessive dependence* on overburdened individuals with special skills, who have neither the time nor the motivation to share their knowledge with others.
- *Communication breakdowns* as essential information is not shared across value streams.
- *Tendency for specialists to overemphasize technical issues* rather than business processes, leading to unnecessarily complex and wasteful solutions that are often resistant to change.

And finally, a functional organization presents a disjointed view of IT services to the customer, particularly when a service is interrupted and multiple groups have to be contacted separately. This is where the finger-pointing cycle often begins: each group troubleshoots separately, focusing on its own localized issues rather than the overall problem from the customer's perspective. Not only can this situation be frustrating, but

also this fractured approach obscures the true cost and perceived value of the services. As a result, the IT organization is often shrouded in an aura of unpredictability and mistrust, creating a perception of an out-of-control cost center rather than a value-adding service center.

Some IT leaders have therefore begun organizing their resources around a portfolio of the services required by their customers. These services are often grouped in categories, such as:

Application services:

- Application Delivery
- Communication and Collaboration (E-mail, Voice, Video, etc.)
- Document and Image Management
- Service Desk (help desk)/Application Support

Component technology services:

- Application and Data Hosting
- Network and Telecommunications
- End User Devices (Desktops, Laptops, Handhelds, etc.)

Professional services:

- Business Technology Strategy Consulting
- Application Selection and Implementation
- Application Development
- System and Application Integration
- Portfolio/Program/Project Management
- Training

Each category usually includes several distinct services and service-level agreements (SLAs) with a fabric of underlying processes to deliver them. Furthermore, each underlying process may support multiple service categories (such as application hosting processes which also impact systems integration services) creating a cross-functional, process-oriented web of interdependency, responsibility, and accountability.\*

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\* More specifically, within a formal IT Service Management Framework, Service Level Agreements (SLA) are generally established with business customers who use the IT services (primarily software application services) to support business processes; these are outward facing agreements. Operational Level Agreements (OLA) are inward facing agreements established among the various technical and professional services (hosting, storage, security, telecom, consulting, etc.) to enable and support the outward facing services. This web of interdependent service elements (OLAs and SLAs) are published in the service catalog, which documents combinations of service elements as predefined service offerings based on predictive customer demand patterns. From a Lean IT perspective this represents a comprehensive framework of *IT service value streams* for designing, delivering, measuring, and continuously improving IT Services

Rather than emphasizing specialized skills development, resource utilization, and task efficiency, the collective focus of process-oriented teams shifts from economies of scale to *economies of flow*. This perspective unites business and IT stakeholders toward increasing the value of IT services, emphasizing their contribution to the organization's goals, rather than exclusively reducing the cost of delivery. For example, cross-functional teams will be more inclined to eliminate non-value-adding IT activities altogether, rather than simply make them more efficient. This emphasis on value over cost is underscored in the Shingo Prize for Operational Excellence guidelines:

A process focus naturally leads to flow thinking. Flow—producing one item or performing one service component a step at a time and in a series of continuous steps flowing toward the customer (rather than batching products or service steps)—is the best driver to make processes easier, better, faster, and cheaper. A cost focus is particularly dangerous, when it creates perverse incentives and budget manipulations incidental to actual improvement.<sup>4</sup>

Gartner describes the same phenomenon from an IT perspective in *Six Steps to Process-Based IT Organizational Design*:

Traditional IT service delivery and organization models achieved efficiency at the expense of effectiveness. When resources are orchestrated in silos, many such silos become involved in delivering an IT service. None, however, possesses the insight, visibility or accountability for anything other than its own small part of a delivery chain. To the extent that business operations are dependent on repeatable, reliable IT service delivery, a process organization and culture are required. Although technical skills will always be required, the optimized process-based organization is horizontally focused on outcomes, not vertically oriented around skills.<sup>5</sup>

Many natural impediments resist this process-based reorientation, and perhaps none is greater than basic human nature. Humans are territorial creatures, especially when they have cultivated specialized skills that become part of their personal identity and sense of pride. If we are going to ask our IT associates to share their skills with others, to focus their attention on specific services (rather than the constant adrenaline rush of smoke jumping from one crisis to the next), and to even move their desks

(gasp!) to a cellular organization more conducive to service-based collaboration and flow, we'd better have a compelling reason.

That reason is found in the hazards of *shared resources*—people or equipment with unique capabilities that are spread across multiple value streams. Shared resources are difficult to schedule and are subjected to frequent interruptions, creating a migratory bottleneck that can suddenly disrupt the flow of any process.

Lean offers many approaches to mitigate a shared resource.\* First of all, a constrained resource (bottleneck) should avoid doing work that an unconstrained resource can perform instead. Second, the organization should reduce its dependency by encouraging knowledge capture and cross-training. Ultimately the IT organization should focus on simplifying processes, tools, and components, reducing the need for specialized resources. For many years software designers have emphasized standardization, reusability, and component-based, service-oriented architectures—these same principles should be extended to the design of IT services themselves, and to the organization of resources which support them.

Cellular organization is a useful Lean method, where the people and equipment supporting all or part of a value stream are grouped together to encourage workflow. Multiskilled workers can move about to lend a hand where and when it's needed. Constant daily interaction, coaching, cross-training, visual measurements, and knowledge sharing within the cell build capability and flexibility, while encouraging standardization and small improvements every day. IT workcells may be physically or virtually co-located, so demand, status of workflow, and issues requiring attention are quickly and visually communicated among team members. For more on how remotely co-located teams can be supported by Lean approaches and virtual collaboration tools, see also Chapter 6.

Fundamentally, once resources are aligned so that value streams can flow, it is far simpler to balance demand and capacity for each IT service (see Chapter 5 on IT demand management). Service-oriented teams are also intuitively better able to see and reduce waste across the entire value stream (systems thinking), delivering more value to the customer. Cost reduction is a natural by-product of this reorientation.

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\* For more on mitigating bottlenecks, see the *Theory of Constraints*; while it may not be practical for an IT organization to eliminate all technical specialization, and the one-off systems and technologies that give rise to them, identifying and mitigating these constraints is an important first step.

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## ITIL: A LEAN APPROACH TO IT SERVICES MANAGEMENT

The Information Technology Infrastructure Library (ITIL) is a widely used IT *service management framework* that is consistent with many Lean IT principles and tools. The creation of ITIL is commonly attributed to the United Kingdom Office of Government and Commerce in the mid-1980s (which has trademarked the name), and it has since been adopted in many businesses and governments worldwide.

The fundamental value proposition of ITIL is simple yet profound: without effective change management, the *break-fix response* to IT problems is random, time consuming, and costly. Over 80 percent of system downtime is self-inflicted, caused by people and process failures rather than technology failure. Furthermore, over 80 percent of the time and effort required to restore service is spent tracking down the changes that were made and determining how they caused the system failure so effective corrective action can be taken.<sup>6</sup> From a Lean perspective, such reactive, unplanned activity is waste.

At the core of ITIL is continuous improvement, using the scientific method (PDCA) for identifying, correcting, and preventing problems. By establishing standardized work methods that regulate system changes, capture and correct failures when they occur, and rapidly diagnose their root causes to prevent future failures, performance can be clearly measured and the system reliability improved. As a result, the percentage of unplanned work (firefighting and reactive workarounds) performed by the IT staff is significantly reduced, and replaced with planned work which adds value to the business. Time, quality, and cost of IT operations measurably improve; systems stabilize; and morale improves. Everyone wins.

Auditors are also pleased with ITIL since quality is built into each process, resulting in documented procedures and a more stable environment with less business risk. This *quality at the source* approach reduces the cost of compliance, an important consideration with the increasing burdens of the Sarbanes-Oxley Act and other governance and regulatory compliance obligations.

One of the most significant long-term benefits of ITIL is the creation of a *common language for IT services*. This enables the business and IT communities to agree upon services provided by the IT organization, setting

clear expectations for their performance and establishing meaningful measurements against those expectations. One of the essential components of this common language is a *service catalog*, describing the value-added services the IT organization provides to its customers. A service catalog should describe standard service offerings and how they are ordered, delivered, and charged for, with explicitly measurable service-level agreements that define performance and customer satisfaction—the *voice of the customer*.

An effective communication, measurement, and feedback framework encourages adaptation and innovation, where customers can describe, in meaningful terms, new services they desire and are willing to pay for. This framework should also allow for the request of nonstandard services as required, such as research and development activities. Service catalog offerings form the basis for IT resource planning, staffing, skills development, and management, aligning service capacity with customer demand.

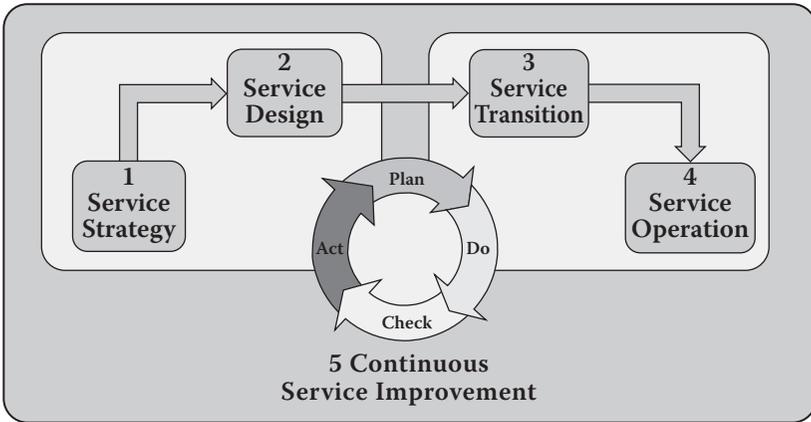
The ITIL framework is also useful in collaboration with suppliers and external customers, describing and defining service catalog offerings to provide dependable supply chain infrastructure and integration services, while creating a baseline for evaluating future supply chain technology investments.

Over time, as IT and the business learn the common language and deploy a standard framework of IT services, chronic system instability disappears, replaced with teamwork, dependability, and trust.

## **ITIL Is a Set of Integrated Processes**

Over the past two decades, ITIL has evolved to support greater business alignment—the ITIL Version 3 library (introduced in 2007) has a greater emphasis on service delivery, service life cycle management, and continuous improvement. According to Manoj Garg of Virtual Information Executives, the evolution of ITIL demonstrates the transition from a technical focus toward the continuous improvement of processes:

ITIL version one was focused on managing systems and technical silos. Version two added a process dimension, but it did not offer guidelines for how to implement those processes. Version three not only helps the IT



**FIGURE 7.1**  
ITIL Integrated Service Lifecycle Model

organization and the customer work together to define a meaningful bundle of services and performance measures, but also uses PDCA to monitor and continuously improve the fit and quality of those services. This approach is especially important because the customer understands and defines the services they are agreeing to purchase, and is actively involved in their definition, delivery and measurement.<sup>7</sup>

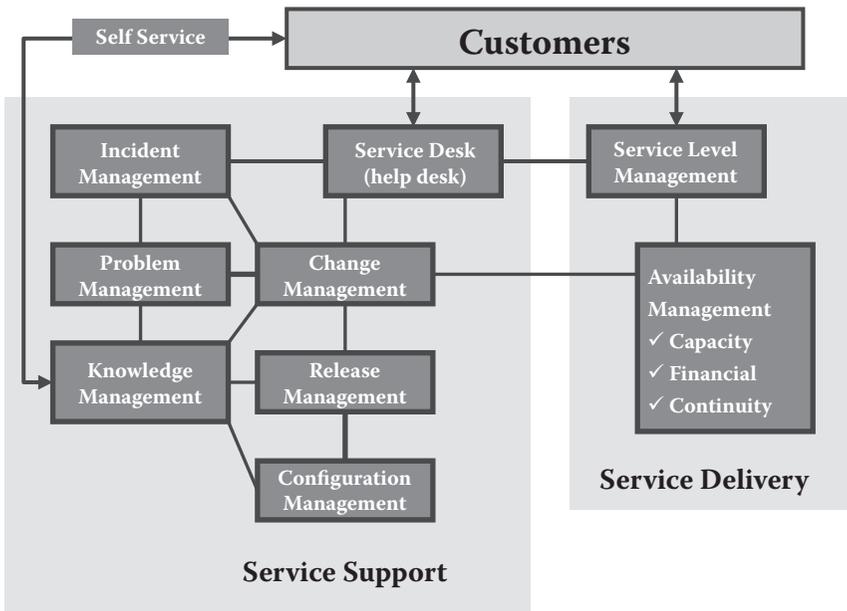
The ITIL Version 3 service life cycle model consists of five stages, shown in Figure 7.1:

1. *Service strategy*: Developing a clear vision and plan for service portfolio design, demand management, and IT financial management
2. *Service design*: Developing appropriate and innovative IT services, including their architecture, processes, policy, and documents with the goal of satisfying current and future business requirements
3. *Service transition*: Deploying new services, managing service changes, and the knowledge related to those services
4. *Service operation*: Delivering services to clients at the agreed level of service, while managing the applications and underlying technology to support their delivery
5. *Continuous service improvement*: Sustaining and improving value to the customer, collaborating on design improvements and service modifications

## HOW ITIL EMPHASIZES QUALITY AT THE SOURCE

The diagram below depicts the ITIL Service Support and Service Delivery functions (version 2) and is useful to illustrate the inter-relationships of several key functions:

- The customer has a problem and seeks assistance through access to a self-service knowledge base or by logging the issue with Incident Management (e.g., service desk or help desk)
- Service Level Management tracks service desk performance against customer expectations as established in Service Level Agreements (SLAs)
- Incident Management coordinates with Problem Management to establish if the issue is a known problem, and with Knowledge Management to determine if there is a known resolution
- Problem Management interacts with Change Management and Release Management, since most problems are typically caused by past changes and releases, and future changes are planned as releases to address known problems
- Configuration management tracks the current known state of all systems (configuration, software, settings, etc)



Since roughly 80% of problems are typically caused by changes, proactive Change Management (interacting with Release and Configuration Management) is the key to improving quality and stability. By understanding the root cause and effect interrelationships among configurations, changes, and releases, new incidents are quickly addressed, and underlying problems can ideally be prevented—this is the Lean principle of *Quality at the Source* in action.

All ITIL functions and processes across the five life cycle stages are interdependent; thus, feedback from one stage drives improvement in another (see sidebar). This is *system kaizen*, where improvements in one area of a process are felt throughout the entire value stream, creating value for the customer.

## **How ITIL Supports Lean IT**

Though ITIL appears to have evolved independently from Lean practice, by understanding the similarities ITIL can be integrated with the enterprise-wide Lean IT transformation.

### ***A3 Problem Solving***

Problem solving is at the heart of ITIL. Beyond the philosophy of scientific problem solving and Plan-Do-Check-Act (PDCA), ITIL teams find A3 problem solving can provide an essential step-by-step guide to help them focus on solving a problem without wasted time or effort.

### ***Voice of the Customer***

Voice-of-customer (VOC) techniques help determine what the customer needs, and what elements of the service catalog are required to satisfy those needs, guiding the development of SLAs to define how they are delivered, measured, and valued. VOC is the why, service catalog is the

## LEAN THINKING APPLIED TO SECURITY AND LICENSE MANAGEMENT

Two areas where Lean thinking has proven effective are software license management and security management. These two domains share common characteristics: they are complex, are constantly changing, expose the enterprise to great cost and risk, and touch virtually every desktop in the organization.

*License management:* Organizations usually pay too much, or not enough (often at the same time for various license agreements), in part because they have difficulty identifying currently installed and/or used software applications. Not only does this complicate IT operations, since there is no reliable record of installed configurations, but it also exposes the organization to potentially significant legal liability. Tracking licenses has become more difficult in recent years, due to the variety of platforms supported (servers, laptops, hosting, software as a service, etc.) and the variety and endless details of licensing agreements offered by vendors. In our experience, the only way to get a handle on this growing challenge is through a cross-functional effort involving IT operations, service desk (end user support), finance (asset tracking and compliance), and legal (contract negotiation and review), as well as representatives of all stakeholders that use software within the organization. This is fundamentally a workplace organization challenge, so the 5S methodology is useful—sorting, organizing, and validating assets in place, then establishing standards to sustain recordkeeping. Sustaining measures ensure that assets are properly licensed and configuration changes are tracked in a timely manner, reducing audit costs and eliminating unnecessary license fees and compliance risks.

*Security management:* Many service desks report their largest call volume is the response to lost password and reset requests. Security threats are tenacious and widespread, affecting virtually every aspect of IT and business operations, causing tremendous waste, disruption, cost, and risk. And the more critical a business process is, the more extensive the gauntlet of security defenses usually surrounding it; thus, the most critical processes often suffer the most *security waste*. (For an interesting perspective, see *Security Kaizen*.)<sup>8</sup> Because of its

pervasive nature, specific kaizen activities should focus on security issues across organizational boundaries, processes, and applications. And all IT-related kaizen activities should deliberately consider the security implications of every change, clearly identifying when security measures add value, and when they do not. Rigorous A3 thinking thus provides an effective foundation to address the constantly changing landscape of security risk and waste.

what, and SLA is the how. Conversations with customers should focus on the *what*—too often businesspeople want to define the *how*, and it can either be contentious or lead IT efforts down the wrong path. The Lean IT organization should encourage regular engagement and feedback with all customers to define and improve services and service-level agreements.

### ***Quality at the Source***

ITIL problem management establishes a discipline of root cause analysis followed by corrective and preventative action. ITIL change management prevents abnormal conditions from occurring. Lean tools that may assist include error proofing of processes and user interfaces, and visual measurement of process performance with leading indicators of defects or problems, all aimed toward helping to *design quality into* IT services.

### ***Standard Work***

IT associates are often rugged individualists, very smart people who like to do things their own way—and that is often the fastest and newest way. IT professionals and business end users alike are often guilty of wanting the latest software and equipment—but this causes an endless churn of new systems and configurations that must be supported, resulting in unnecessary variability (*muri*), leading to pockets of technical specialization and chronic instability.

Many of the greatest challenges of IT operations are caused by lack of standardized work, particularly the lack of standard hardware, peripherals, software, and system configurations. When standard hardware models and configurations are encouraged throughout the enterprise, this not only reduces purchase and support costs but also reduces spare

parts inventory and service response time, improving the stability of the environment.

Resistance from IT staff is common; the thrill and adrenaline rush of crisis response are self-perpetuating and strangely rewarding to many. So while IT staff may initially view the emphasis on standard procedures as mundane and unsatisfying, in the long run a more stable environment supports true innovation and value creation. Culture changes only when basic behaviors change; this is a team effort, and everyone must learn to play well together.

### **Measurement**

ITIL measurements have been well defined in recent years, with each measure focused on producing actionable results,\* providing feedback to drive continuous improvement:

- *Ratio of planned to unplanned IT work*: Provides a good general measure of the stability of the environment. Although this requires an investment to track unplanned work time, the data are then useful as inputs for problem categorization and root cause analysis.
- *Mean time between failure (MTBF)*: The average time between service interruptions. This is commonly used to measure hardware failure, but it can be equally effective with service failure.
- *Mean time to repair (MTTR)*: The average time to restore service after an interruption.
- *Availability*: The availability of a resource, which includes planned and unplanned downtime.
- *Percentage of successful changes*: This refers to changes that do not result in downtime or unplanned work, requiring the correlation of incident report data and change management data.
- *Server to system administrator ratio*: Measures staffing levels required to manage systems, indicating the degree of standard work, availability, and manageability of systems.

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\* Many of these measures are familiar to practitioners of Total Quality Management (TQM), Total Preventative Maintenance (TPM), and Overall Equipment Effectiveness (OEE).

- *Percentage of effort deployed early in the change-release cycle:* A good leading indicator that the scientific method is being followed: more *Plan* means less *Do-Check-Act*.

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## LEAN IT IN THE CLOUD

*Cloud computing* is suddenly threatening to disrupt many traditional IT organizations and practices. Let's explore, from a Lean IT perspective, what this relatively new practice could mean for the future of the IT organization and its value proposition for the business.

Many companies, including Google, Microsoft, and Amazon, are investing in enormous global data centers to provide Infrastructure as a Service (IaaS), moving many functions of IT operations into a utility model. These are true computing factories, providing IT services at massive economies of scale: low cost (an order of magnitude lower than most companies can provide for themselves), with virtualization, engineered redundancy and fault tolerance, and automation for high availability and hands-off management.

Going further, many companies (Google, Microsoft, Amazon, Salesforce, SAP, Oracle, and many others) are providing software as a service (SaaS) business application components and platforms using a service-oriented architecture (SOA) to provide standardized and interchangeable parts needed to assemble (and reassemble as needed) enterprise-class applications over the Internet with lower change and management costs. This shift resembles the gradual transition of manufacturing from custom engineering to mass customization (see the diagonal shift explored in Figure 5.1).

It may take years for most companies to significantly transition their applications strategy in this direction. And cloud computing won't be appropriate for every situation; indeed, it could make some issues, such as security and compliance, more challenging than ever. Nevertheless, cost will inevitably drive many IT services into a utility model, whether internally or externally sourced. The coming of the cloud will not eliminate the IT organization, but we expect that it will dramatically change its role and approach toward value delivery to the business.

In the short term, we expect that IT organizations will invest in the standardization and continuous improvement of infrastructure and related services, improving stability and reducing operation cost; this is where ITIL

can play an important role. Over time, as some organizations move significant elements of their infrastructure and application ecosystem to the cloud, this transition will create competitive pressures for other organizations to move into the cloud as well.

The adoption of cloud computing will undoubtedly cause a shift in IT operations staffing, but it clearly won't eliminate the need for highly skilled internal resources—although many services will be provided from the outside, the relationships and interfaces to the business must still be skillfully managed. But we expect there will be an even more significant and positive shift in emphasis toward business process improvement for the IT organization. According to the *CIO Magazine* article “The Tech Jobs That the Cloud Will Eliminate,” there will be “[a] gradual movement of the IT profession away from the nuts and bolts of technology toward the business end of the organization. The cloud is accelerating that movement of technology into the business with business-process-level expertise becoming more important than ever.”<sup>9</sup>

In his provocative book *Does IT Matter? Information Technology and the Corrosion of Competitive Advantage*, Nicholas Carr argues that with increasing standardization and commoditization of computing resources, like the shift from localized to centralized electricity generation in the late 1800s, computing will no longer be a source of competitive advantage since it is available to everyone at a low cost. While Carr makes many good and subtle arguments, we disagree with the fundamental assertion for a simple reason: the low cost and accessibility of a resource do not ensure that everyone will utilize it equally well. In fact, it may be that with the lower cost of IT services, more companies will be at risk of making unwise decisions leading to poorer use of IT capabilities, creating more unnecessary complexity than ever before. While the cloud may change the cost structure of IT services, competitive advantage will still go to those who are able to use IT effectively to support the business. And the key to this? IT process leadership, supporting the continuous improvement and innovation of business processes—*Lean IT*.

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## LEAN TIPS FOR SUCCESSFUL IT SERVICES ADOPTION

Now that we have explored ITIL within the context of Lean IT, we must remember that while a singular focus on tools may yield significant short-

term benefits in isolated areas, sustained enterprise-wide behavioral and cultural transformation will only occur when actively supported by management and founded upon deeply held principles. Perhaps the greatest cultural challenge with ITIL and Lean IT, and with developing an IT service management mind-set in general, is leaving behind what might be called a *cowboy* or *hero* culture, transitioning to an environment that encourages cross-functional teamwork, disciplined problem solving, management by fact, and responsible change management. Some individuals may feel that change management implies non-value-added bureaucracy, and often this occurs temporarily as the IT organization overcompensates to stabilize an out-of-control environment. But over time the processes, and the stakeholders responsible for those processes, should become self-regulating. As Stephen Katz, former chief information security officer of Citibank, once said, “Controls don’t slow the business down. Like brakes on a car, controls actually allow you to go faster.”<sup>10</sup>

From a senior leadership perspective, the service orientation and common language of ITIL provide an opportunity for developing clear and measurable goals for the IT organization. This is useful in aligning IT service activities to the business operations and strategy, and for establishing effective IT operating and governance policies and procedures. Executives and business managers must be involved in charting the course, establishing clear process ownership, service-level expectations, and accountability for each IT service.

As we mentioned in Chapter 3, ITIL is a framework upon which to build your own best practices. While ITIL offers a set of useful characteristics or attributes, it is not a prescription, checklist, or methodology for implementation. The ITIL volumes describe a comprehensive but generic future state which must be adapted to the idiosyncrasies and culture of a particular IT organization and the business that it serves. ITIL is not a *project* or *implementation*; like Lean IT, it is an ongoing journey of discovery and experimentation. Like any Lean initiative, IT leadership must ensure that all stakeholders understand and buy in to the discipline and long-term commitment that are required. Successful IT service management transformation is thus more social and cultural than it is technical, and should develop from within rather than be imposed from the top-down or the outside-in.

As you have learned in this chapter, ITIL naturally encourages reorganization away from a functional, silo-based structure, to one aligned according to IT service-based processes that support the customer—from the

Lean perspective, this is value stream orientation. This suggests a change in roles and responsibilities; each process should have an owner who is responsible for its performance, directed by service-level agreements established with the customers.

A service management framework thus naturally aligns core processes with the needs of the customer, rather than traditional inward-facing performance measures. At every step of the transition, it is therefore important to establish understanding and consensus among team members and customers, supported by a transparent decision-making process coupled with effective feedback mechanisms. Respect for every individual's concerns and ideas is essential—their hearts, and not just their minds, are needed for a lasting transformation.

Then there is the issue of operations outsourcing; selection of a partner should consider their willingness and ability to genuinely participate in continuous improvement activities. This begs the question of how they are compensated—on the basis of activity or value delivered? For example, an outsourced call center paid on the number of calls is not incented to address the root causes that drive higher call volume, thus creating a disincentive for continuous improvement. Consider operating-level agreements that recognize the value of effective problem solving and continuous improvement, which requires an explicit commitment of the partner's time and resources.

This consensus and transparency must also extend to customers, since they should understand the relationship between what they request and how much it costs. Cost chargebacks act as pricing signals to the business, naturally driving behaviors—whether effective or ineffective. The common language of ITIL, with clearly defined service-level agreements and IT resources aligned by service rather than function, makes it much easier to develop direct and clearly understood costing methods that drive desired behavior and IT investments (see the *Lean accounting* discussion in Chapter 6).

All stakeholders involved in the request and delivery of IT services should come together to define *value* and determine how it is created. We recently asked ITIL authority Steve Bittinger, Gartner's director for government research, "Does a team-based, continuous improvement approach to problem-solving accelerate and sustain the adoption of ITIL, when compared to a top-down, command and control ITIL effort driven by management and external consultants?"

His response is good advice to any IT organization attempting, whether through specific ITIL best practices or general Lean techniques, to improve IT operations performance:

Failure to take a continuous improvement approach is one of the core problems that many organizations experience during an ITIL implementation. The challenge is to identify a series of improvements that are practical (feasible/achievable), will create tangible benefits, that matter to the business, and can be done in a relatively short time. ITIL implementation then becomes a series of these improvement projects, each paying its own way through the benefits delivered, and collectively contributing to fleshing out the over-arching ITIL process architecture. It is a very dynamic process that requires thinking strategically, and acting tactically.<sup>11</sup>

Though the terminology and best practices framework of ITIL are specific to the IT operations domain, it should be clear to the reader that the fundamental principles of ITIL and Lean share many of the same themes: alignment of value-added services based on customer-defined value, standardized work, PDCA problem solving, and continuous improvement that, over time, creates sustainable business results.

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# 8

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## *Lean Software Development*

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### CHAPTER OBJECTIVES

In this chapter we will explore Lean software development, also known as *Agile*. We will:

- Continue our examination of waste versus value, this time specifically in terms of software development.
- Explore the importance of rigorous voice-of-customer techniques when defining software requirements.
- Demonstrate how many of the standard principles and tools of Lean can trim waste and build flexibility into the software development life cycle.
- Examine how Lean manufacturing approaches such as kanban and heijunka (level) scheduling, along with demand management and a focus on problem solving, revolutionize software development practices.

In 2001 a group of 17 visionaries signed the Agile Manifesto, establishing a simple set of principles:

We are uncovering better ways of developing software by doing it and helping others to do it. Through this work we have come to value:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan<sup>1</sup>

Over the past two decades Lean software development has gone by many names, most commonly *agile* (an umbrella term often used to describe the collection of techniques), *scrum*, and *extreme programming*. Behind these names are many Lean tools and methods that have been adapted to software development, revolutionizing practices in the software industry. It is difficult to determine which Lean software development tools and systems were developed independently and which were derived from both the Lean manufacturing *and* Lean product development disciplines.\* In any case, the lessons learned from Lean are useful to guide the continuing evolution of Lean software development.

The adoption of the term *Lean software development* is more than a name change. While *agile* is a set of development and life cycle management tools and methods focused on the just-in-time development of quality software, Lean software development addresses a larger context: the environment within which the software operates, the value streams of the enterprise. For example, in a business application, properly functioning software is viewed as a *supporting* element of the business process. In an embedded software application (such as the operating system of a smartphone or the control systems of a jet aircraft), the software is part of the overall product design and value proposition to the customer.

Lean emphasizes *seeing the whole* through the eyes of the customer, not its component parts through the eyes of the designer or developer. “Lean software development views all Agile methods as valid, proven applications of Lean thinking to software,” says Jeff Sutherland, a signer of the Agile Manifesto. “It goes beyond Agile, providing a broader perspective that enables Agile methods to thrive.”<sup>2</sup> In the words of Mary and Tom Poppendieck, “A Lean organization optimizes the whole value stream, from the time it receives an order to address a customer need until software is deployed and the need is addressed. If an organization focuses on optimizing something less than the entire value stream, we can just about guarantee that the overall value stream will suffer.”<sup>3</sup>

We have witnessed many skilled agile practitioners fall into the common Lean trap: focusing on tools and techniques rather than solving problems and eliminating waste. Lean software development expands agile’s focus from optimizing the software development process toward improving

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\* See *The Toyota Product Development System: Integrating People, Process And Technology* by Jeffrey Liker and James Morgan.

entire value streams. Thus, Lean software development must integrate and synchronize with all business processes, management systems, and kaizen\* activity, supporting the Lean transformation of the overall enterprise.

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## THE CHALLENGES OF TRADITIONAL SOFTWARE DEVELOPMENT

In the early 1980s, the U.S. government (the world's largest software customer) conducted a study to improve software quality, resulting in the Capability Maturity Model (CMM), which became a requirement for government contractors. CMM defines requirements for software development and creates a framework for process improvement, ensuring a degree of standardization and measurability, and thus it has been widely adopted. Despite CMM's benefits (it imposed a degree of standardization on a characteristically haphazard industry), it further entrenched a mass production mentality, introducing significant administrative overhead, while in many cases making it difficult for organizations to adopt innovative methodologies such as agile.

In 1999, the President's Information Technology Advisory Committee reported that the unreliable and costly nature of software development, combined with the government's enormous reliance on software for defense and administration, had become so severe that it was potentially harmful to the United States' national interests. The committee recommended additional funding for research programs in software development methodology.

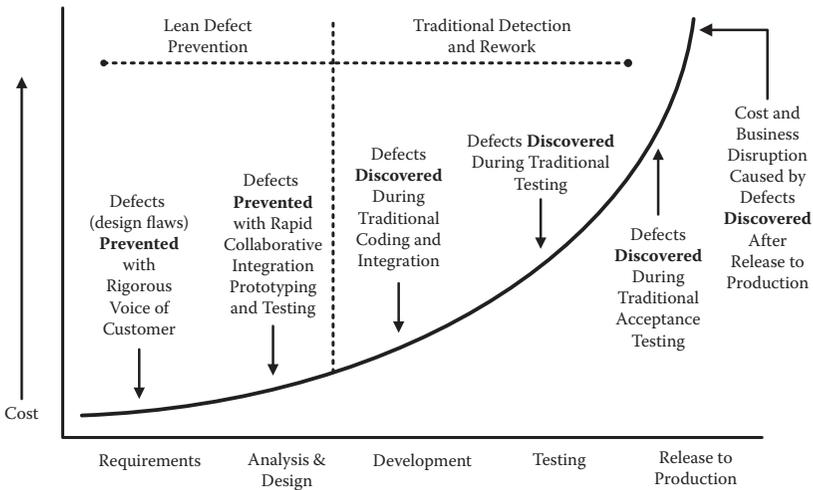
Waste abounds in software design—only about 20 percent of the features and functions in typical custom software are used regularly and around two-thirds are rarely used.<sup>4</sup> In our experience, IT professionals generally agree that at least 50 percent of software capabilities in general, whether or not they are used, are not adding value to the business process they support; this unnecessary complexity hinders the usefulness of the applications, and requires additional training and support. Furthermore, these excess features must be designed, built, and maintained, wasting development team effort which could otherwise be directed toward value-adding activity. In Lean terms, this is the waste of overprocessing—doing more than the customer values—shortly, we'll discuss why this occurs.

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\* Kaizen is the continuous improvement of business processes described in Chapter 2.

Then there's the concern over software quality, the waste of errors and the defects they cause. On average, professional developers make 100 to 150 errors in every 1,000 lines of code they write, according to a multiyear study of 13,000 programs by Carnegie Mellon. As a result, software projects often devote 80 percent of their budgets to repairing flaws they themselves produced.<sup>5</sup>In addition to this astonishing level of rework are the time, frustration, and disruption inflicted upon the business and its customers, and the effort required to provide support while problems are corrected.

The Cost of Change Curve (Figure 8.1) illustrates the impact of this dilemma. Originating with the Total Quality Management movement, the cost of change shows that the cost of fixing errors increases exponentially the later they are detected in the development life cycle. This suggests that not only must we detect and eliminate errors as early as possible, but also, more importantly, we must prevent errors and unnecessary features from being introduced into the life cycle in the first place. This is the *quality at the source* Lean principle applied to the software development life cycle.\*

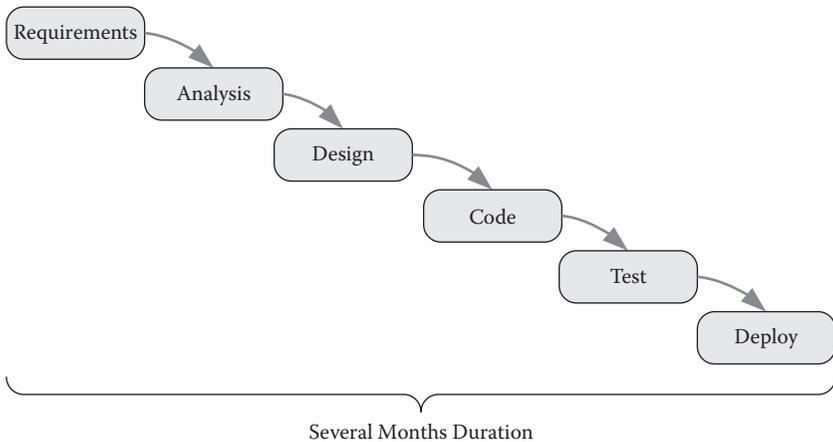


**FIGURE 8.1**  
Cost of Change Curve compares Lean and traditional outcomes.

\* Design for Six Sigma (DFSS) deserves mention here, a discipline that has evolved through the application of Six Sigma techniques to the development of new products and processes. DFSS practitioners describe the cost of change as a lever—the earlier in the life cycle that potential errors and defects are prevented, the greater the cost/benefit impact on the end result, and thus more leverage.

Why do these extraordinary wastes of unnecessary complexity, errors, delays, and cost overruns consistently result from traditional software development? Waste is often embedded in a mass production mentality, shown in Figure 8.2 as the *waterfall* approach<sup>6\*</sup> where the time between initial customer request and delivery of the software is so great (months or even years) because large batches of changes are grouped into carefully planned and controlled releases. This is analogous to the wasteful *batch and queue* approach to mass production that is addressed by Lean manufacturing.

As large amounts of incomplete and untested code accumulate (work-in-process inventory), undetected errors proliferate throughout the system. Since the project duration is so long, developers (especially those with scarce skills in great demand) may be shared across several projects and production support incidents, causing frequent interruptions, switching costs, bottlenecks, and more errors. On top of it all, this approach involves significant project management overhead: detailed project schedules,



**FIGURE 8.2**  
The traditional waterfall approach.

\* See the original 1970 IEEE paper by Dr. Winston W. Royce, *Managing the Development of Large Software Systems*, calling attention to the risks of the waterfall, suggesting an iterative approach. It is important to note that the diagram shown here is an extreme oversimplification; in Royce's visionary paper he called for a sophisticated iterative approach that was a forerunner to agile thinking. However, many software development organizations have designed their life cycle processes according to an overly simplified approach represented by this diagram, with the undesirable outcomes we describe in this section.

status reports, and resource management challenges are discussed at endless meetings by teams attempting to manage complexity, competing priorities, and scarce resources while trying to keep multiple projects on track. These are similar to the challenges that drove the transformation from *push to pull* in Lean manufacturing over 50 years ago.

Testing is the final step prior to release, where customers finally get to see what they asked for. Commonly, though, what customers initially asked for may not be what they really needed. And because of the long delay, their requirements are likely to have changed (*requirements churn*) causing significant rework, additional cost, delays, and customer dissatisfaction.

This unreliability of customer requirements is due, in part, to customers protecting themselves from long development lead times. When a development request is submitted, customers may include everything they can think of in the requirements list, since they're afraid their next opportunity won't come around for months or years—if ever. Then, since the scope is so large, there is a tendency for planners to buffer the estimate for uncertainties. As the gamesmanship and sandbagging pass through several levels of estimating and planning, customer requirements are distorted and the cost and time proposed become far greater than necessary.<sup>7\*</sup>

These extended project life cycles sacrifice agility: the ability to respond quickly to changing circumstances and requirements. Because software is developed in such a linear and monolithic fashion, it becomes overly complex and inflexible, increasingly resistant to change. In Lean software development terms, such a system has accumulated *technical debt*, a liability of complexity and obsolescence that must be repaid at a later time. In the broader context of Lean enterprise transformation, dysfunctional software development practices inhibit business process improvement efforts that often depend on those small, frequent software changes.

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## LEAN SOFTWARE DEVELOPMENT BASICS

Lean software development begins with a simple premise: *identify the 20 percent of the code that provides 80 percent of the value, and deliver*

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\* This is similar to what is known by Lean manufacturing and supply chain planners as demand amplification, where estimated demand becomes distorted as it passes through multiple layers of a supply chain; see the infamous MIT Sloan School of Management, “Beer Game,” <http://web.mit.edu/jsterman/www/SDG/beergame.htm>.

*it just-in-time.* Lean software development emphasizes pull rather than push scheduling, engaging the customer with requirements definition and testing at every iteration. This approach is reinforced by the popular phrases “Write less code” and “Test early, learn rapidly, and fail fast.”

According to Tom Poppendieck,

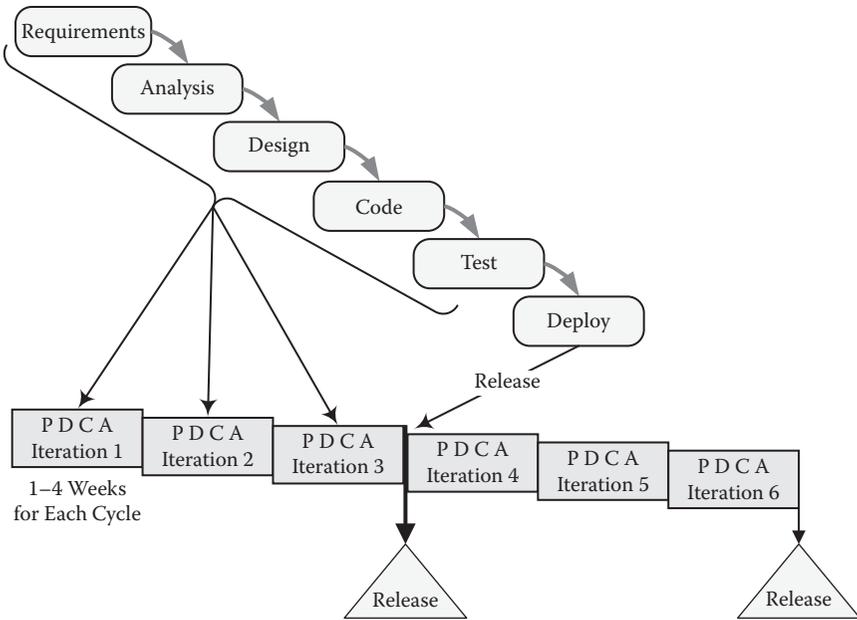
[T]he real problem with the cost of change curve [Figure 8.1] is that it fails to separate workflow (the sequence of activities) from scheduling (what do we do when). The curve is fairly flat when we do one feature at a time, it gets exponential when we do all of one activity before beginning the next. The underlying mental model behind these mistakes is thinking of software development as a kind of production (input-process-output) rather than as a problem-solving/learning activity.<sup>8</sup>

An effective software development methodology must therefore nurture an environment where discoveries and ideas unfold quickly and naturally, deferring design commitment to the last practical moment. Lean software development does not follow a rigid prescriptive model (a checklist-driven, command-and-control push schedule) but an iterative and adaptive approach where team members quickly learn and solve problems. Consistent with the Agile Manifesto, collaboration, experimentation, and feedback are more important than designing the *right* solution\* the first time.

Paradoxically, adopting a strict zero-defects mentality too early in the life cycle discourages creativity, continuous learning, and experimentation. According to Dr. Christoph Steindl of IBM Global Services, “[W]hen a (traditional) organization has software development challenges, there is a tendency to impose a more disciplined process on the organization, with more rigorous sequential processing; this generally makes a bad situation worse.”<sup>9</sup> So rather than a lengthy waterfall with rigorous project management, Lean software development relies on rapid iterations (*sprints*) where each cycle is an opportunity for the team (including the customer) to make new decisions based upon the results from the

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\* With set based development, teams may simultaneously develop several approaches to the same problem and cherry-pick the best elements from each prototype. While this might appear to be a waste of resources, it can be a very effective way to quickly deliver high-quality, innovative products that customers want.



**FIGURE 8.3**  
The rapid iteration approach.

previous cycle. Each iteration<sup>\*</sup> is a complete Plan-Do-Check-Act (PDCA) cycle of problem solving.<sup>†</sup> The transformation of the traditional waterfall to iterative development is illustrated in Figure 8.3.

Fine tuning the development process to support just-in-time releases usually drives improvements (speed, quality, cost, and flexibility) throughout the value stream; this is analogous to the transformation which naturally results over time as a manufacturer shifts from large to small batch sizes, moving toward one-piece flow. For example, delays and changeover costs from one iteration to the next can be *dramatically* reduced. Techniques such as *setup time reduction*<sup>‡</sup> and *continuous integration*<sup>§</sup> can fundamen-

\* Each iteration tests a small set of features in an offline system, which are integrated into periodic releases and deployed to the customer.

† For more on PDCA, A3 thinking, and the scientific method, see Chapter 2.

‡ Introduced by Shigeo Shingo at Toyota, this technique seeks to reduce the setup time of each batch, making it more economical to produce smaller batches.

§ Continuous integration is a rapid PDCA cycle where each member of the development team integrates his or her code frequently, leading to multiple integrations each day. This approach detects problems early, reducing rework, delivery time, cost, and risk.

tally change the installation and upgrade process, making it possible to rapidly apply small changes efficiently and with no business disruption.

Perhaps the most widely experienced example of one-piece flow in Lean software development is demonstrated by Google, whose customers around the world have learned to appreciate (dare we say *expect*?) frequent, smooth, and surprising innovations, often released on a daily basis. Google associates are encouraged to invest up to 20 percent of their time pursuing new ideas and product inventions, similar to engineers in the highly innovative manufacturing company 3M. This investment of time has proven to be a strategic driver of rapid product innovation and market share growth.

Google designers observe daily usage behavior, guiding future development based on evidence of popular features and functions (voice of the customer). These small, customer-driven innovations are often released in a matter of days or weeks with little fanfare, and with few service interruptions.

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## LEAN SOFTWARE DEVELOPMENT LIFE CYCLE

### Organization and Approach

The role of *product manager*\* is responsible for the overall vision, design, delivery, return on investment (ROI), and strategic alignment of the software that is being developed. This individual rarely has direct authority over the entire team, in this matrix management role. The product manager guides the life cycle, owns the backlog, and balances customer requirements and production capabilities, often managing several teams—each developing individual software components toward a consolidated product. He or she participates in daily standup team meetings and weekly synchronization meetings across multiple teams.

Collectively, product managers are the primary linkage with the enterprise, synchronizing the pace of software development with changing business requirements and continuous improvement activities. Each product manager (and their delegates) should participate in enterprise-wide kaizen efforts, coordinating IT involvement for his or her particular software product with each business process owner.

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\* Other titles include product owner, on-site customer, and active stakeholder.

Each development team should be assisted by a facilitator\* skilled in Lean software development techniques, and with an objective perspective of the project. Teams should be kept as small as possible,<sup>10,†</sup> while representing a balanced voice of all customers and stakeholders. These multidisciplinary teams should be composed of individuals with complementary skills, where every person on the team has something to share and something to learn from the others.

In the spirit of concurrent development, the entire team (representing all stakeholders, including the customer) should operate in close proximity,<sup>‡</sup> in a space designed to encourage team collaboration and workflow. This is the application of Lean work cell design, where teams are aligned with value streams and supported by pull signals and visual indicators. The organization should avoid shared resources across teams whenever practical, for reasons we explored in Chapter 5. In the case of distributed teams where physical co-location is not practical, virtual collaborative workspaces may be used, but occasional face-to-face meetings are helpful to maintain cohesion and overcome communication blocks. In all cases, team members should make regular trips to where the customer work is performed (gemba) to reinforce their understanding of customer requirements.

Communications and measurements should be kept as immediate and visual as possible.<sup>§</sup> Visual displays of demand, customer stories, schedules, project status, priorities, issues, and problems limit interruptions, keeping the team focused on the essentials with minimal communications overhead. Electronic dashboards may be necessary with distributed teams, but in our experience nothing beats the energy of a standup meeting in front of a wall filled with storyboards, butcher paper, and overflowing with colorful sticky notes, index cards, and discount pizza coupons.

## Requirements Definition

The *voice of the customer* is an essential element in Lean software development, as the customers' definition of value guides all activity. In this

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\* Other titles include scrum master, coach, and project manager.

† For an insightful look at optimum team size, and why adding more people does not necessarily add value or reduce time and cost, see *The Mythical Man-Month*, 2nd ed., by Fred Brooks.

‡ The venue for co-location is known by many names: project room, war room, bullpen, and Obeya room.

§ This approach is also known as the visual workplace, big visible charts, informative workspace, and information radiators.

case, *customer requirements* guide the actions of the software development team. The term *customer requirements* might be interpreted to suggest that the customer controls software design decisions, and that there is a separation between the problem, the design of the software, and its implementation. Consider instead the term *design choices*, which suggests that the customer and software designers collaborate to understand the problem and develop countermeasures, which may or may not involve software changes—this is problem solving versus solutions thinking.

First of all, who is the customer? This may be an *internal customer*, someone within the enterprise who is processing transactions as part of an internal workflow. In other cases, the application is used by *external customers*, either to support their business relationship with the enterprise (e.g., order processing or status inquiry) or as a commercially licensed software product. In all cases the software development organization must partner with internal customers, and/or representatives of external customers, ensuring all requirements are clearly understood and collaboratively addressed.

The old adage “The customer is always right” doesn’t necessarily apply to Lean software development, at least not early in the life cycle. This is the essential reason for the discipline of A3 thinking, since the immediately apparent “solution” often addresses symptoms, but not the root causes. The team should therefore respectfully assume that customers may *not* initially know what they need, for several reasons:

- Customers may have strong opinions based on an incomplete understanding of the situation. They often don’t see or understand the entire process, which includes the complexity hidden behind the user interface and buried deep in the database, and the interdependencies with other processes and systems. Comprehensive requirements are thus uncovered by cross-functional teams using tools such as value stream mapping, where the process is understood by everyone. Start by asking not what the customer *wants*, but what the problem to be solved is; this is A3 thinking.
- Despite their dislike for the old system that is being replaced, the customers’ mental model of how the job is done, and how the overall business process works, is based on their familiarity with the current design. To many business users, the system *is* the process, and they may have a difficult time separating the two in their minds. They may

also have a comfort level with the old system, however distasteful and dysfunctional it may be, and the fear of change may subconsciously distort how they visualize and articulate a new approach. The team must help customers transcend their current mental model; otherwise, the new application may end up behaving much like the old one.

- Different customers think differently; for example, a manager and an operator may request something entirely different from the same application. Similarly, expert users may require different capabilities from mainstream and novice users; it is often the expert users and managers who are the most outspoken about the system requirements, and mainstream users are left to struggle with unnecessary complexity in their daily work. The team facilitator should ensure balanced input while gathering requirements.
- The most important knowledge is often tacit: customers don't realize what they know. The team must go to gemba, carefully detecting the customers' intent and needs, but not necessarily their initial words. It is often only through conversation, observation, and experimentation that customers realize what problems must be solved; this is how breakthrough improvement and innovation often emerge.

The team may use a variety of information-gathering techniques to discover the voice of the customer, in both qualitative and quantitative terms. These techniques range from simple brainstorming sessions and interviews to questionnaires, focus groups, and elaborate studies such as the *Kano method* and *quality function deployment (QFD)*.<sup>11,\*</sup> Value stream maps and other outputs from kaizen activity also provide essential guidance to software development requirements and priorities.

In order to translate customer requirements into software specifications, the team gathers customer-generated *use cases*, *stories*, and *scenarios*,<sup>†</sup> which describe desired user behavior rather than technical requirements. In fact, the test case design process often helps customers clearly understand what they really need, helping them to visualize the new application in the context of their daily work rather than theory. Thorough testing is also essential to mistake proofing, since it challenges the customer to ask,

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\* For an in-depth look at these VOC tools and techniques, see *Lean Software Strategies* by Middleton and Sutton, part 2.

† For more on customer scenario modeling, see [www.agilemodeling.com](http://www.agilemodeling.com).

“What can go wrong here?” Test scenarios are also important artifacts that support documentation, training, and the iterative improvement of the code long after initial release.

## Demand Management

The product manager is responsible for managing the backlog, which is a catalog of stories that identify discrete components queued for development, and the amount of time and effort they are expected to require. Early in the process, *T-shirt size* rough estimates are often used (S, M, L, and XL) to indicate the relative work content of each story. To balance customer demand with development capacity, each component is assigned a capacity requirement estimate through a standardized points system. Each point roughly indicates a standard unit of development duration.

There are many unknowns and variables to consider when estimating points: degree of difficulty and complexity, interdependencies, skills of the team members, and so on. At first, the product manager and the team may struggle with estimating points, but after several cycles of feedback and problem solving, their accuracy usually improves.

Each iteration period has a limit to the number of capacity points it may be assigned, according to the team cadence (other names include *velocity*, *pace*, and *drumbeat*). These are similar to a concept in Lean manufacturing known as *takt time*, where the pace of production varies according to the rate of demand. However, with software development there is usually more backlog than capacity. So instead of speeding up and slowing down according to a changing rate of demand, the team should develop a cadence that is comfortable and sustainable over time. This results in a level pace and a stable allocation of capacity points for each period.

When determining cadence, the team should agree upon available work time, deducting downtime for regular meetings, training, preventative maintenance, vacations, and other planned activities. Unplanned activities should not be factored into available work time; each interruption should be investigated to identify the root cause to prevent reoccurrence. A slack factor should also be deducted from available work time; this factor should be in the range of 15–20 percent of available work time.<sup>12</sup> Sustained resource utilization above 80 percent is harmful to agility and productivity in general. Queuing theory and Lean manufacturing practice have

proven that there must be slack or else thrashing and quality problems inevitably result.<sup>13</sup> *The slack factor is not excess capacity or wasted time*—it is intentionally unallocated time, a reserve to be used wisely, giving busy teams and individuals a little breathing room to do the right things, and do them right the first time.

The number of points that may be achieved for each sprint cycle is determined by the team based on this demonstrated cadence, not assigned by managers. This is pull based on capacity, not push based on demand, enabling the team to naturally maintain a level schedule where the workload is stable without disruptive peaks and valleys (*mura*)\* over time. With a level schedule, the team develops a steady work rhythm, avoiding periods of overload (*muri*) that cause poor quality, low morale, burnout, and turnover.

To maintain level demand, the development team and the customer work together to prioritize the components to be included in the next iteration. Negotiation is often necessary, and the product manager should facilitate trade-off decisions among competing priorities, also balancing technical considerations with customer requirements (see also Chapter 5 on demand management). The team must also decide how much time to allocate for defect correction—bug fixes and rework looping. The severity of the issue and the service-level agreement status should be considered when prioritizing corrections. During the backlog negotiation process, unnecessary features are also culled out; otherwise, they may remain on the backlog for endless cycles yet never make it to production. The customer must decide when stories should be removed from the backlog, but the product manager should encourage discipline—features left in the queue that will never get built are waste.†

A requirement may be identified and prioritized, but there may be a low degree of certainty in its work content, or how many capacity points it will consume. Work should not be released to production until the significant unknowns are clarified; otherwise, they will likely cause errors and delays, which are catastrophic to just-in-time performance. According to Jeff Sutherland, “[T]here are only two stable states: *ready* and *done*. The team

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\* *Mura* and *muri* are described in Chapter 2.

† The product manager may keep a backburner list of potential changes that are reviewed periodically, but should strive to keep the active backlog uncluttered, representing a limited number of iterations.

shouldn't let anything that's not ready into the flow, and let nothing escape that's not done."<sup>14</sup> Additional analysis should be performed prior to inclusion in the backlog if points cannot be reasonably estimated. Fortunately, if a component is deferred for more analysis, it doesn't have to wait long for the next iteration to come around. This is a key benefit of just-in-time: the production cycles are very short, so work is inserted as needed into the next iteration. If at the last minute work is resequenced, the cadence of production is not affected, which explains how high-quality software may be created with astonishing speed, and according to a customer's immediate and changing requirements, while causing no disruption to the smooth pace of development.

The disciplined ongoing process of planning, prioritizing, and sequencing the backlog is essential to maintaining a level schedule. The team, facilitated by the product manager, should dedicate a significant amount of effort to making sure the right decisions are made; *backlog grooming* and subsequent *sprint planning* may require as much as 10–15 percent of the total available work time for the product manager and some team members. Placing the emphasis on more P (Plan) at the front end of each cycle ensures less *DCA* (Do, Check, Act) is needed later—less development time spent chasing half-baked solutions.\*

## Execution and Test Iterations

Once work is pulled into production (development and testing), it should flow swiftly to completion without delays, interruptions, or defects. Lean manufacturing practitioners have evolved flow into a fine art, even with highly complex and variable products and processes—just like software development. Here we will focus on two specific tools: kanban and heijunka, which we introduced in Chapter 5.

Kanban is a signal causing work to begin or to move to the next step of production. Kanban pulls workflow by demand, rather than being pushed by a predetermined schedule. In a factory where work is tangible, kanban signals are often physical: cards, containers, flashing lights, or other signals. In Lean software development, kanban is usually implemented with a

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\* For a broader perspective on IT services demand management see Chapter 5; for an example of the alignment of software releases with company strategy using Strategy Deployment (Hoshin Kanri) see the Group Health case study.

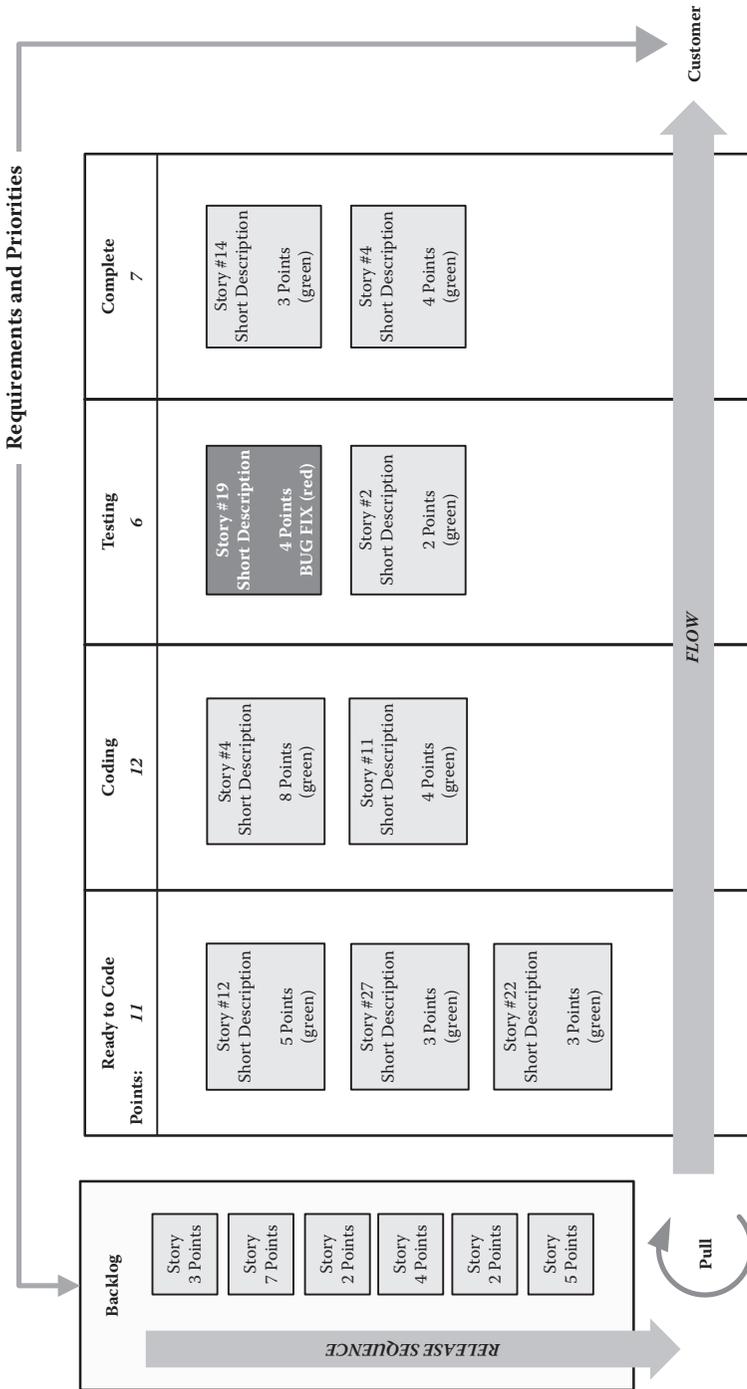
wall-mounted board and note cards or sticky notes, with each card representing a component or story. A kanban board indicates the demand and activity on a single team or project, so a development organization usually has several kanban boards, each located near its team. Daily team standup meetings center around the team boards (including the kanban and other visuals), which also serve as a spontaneous gathering spot whenever a question or issue arises. Daily discipline is required to keep the visuals current, or else they quickly become useless and even counterproductive.

There are two types of kanban boards most commonly used in Lean software development (Figure 8.4):

1. *Backlog*: Visually displays queued work, quantifying their relative degree of difficulty, effort, and priority. This display provides the customer, team, stakeholders, and business at large with the ability to visualize priorities and sequence and understand backlog duration.
2. *In process*: Visually displays all components in development (build and test) for the current iteration. While this may appear to be a form of waterfall, these steps are tightly integrated and flow very quickly, with the entire cycle typically lasting no more than a few weeks. This visual display clarifies priorities, and prevents status inquiry interruptions and other unnecessary communications.

Heijunka (meaning *level schedule*) is a visual-scheduling tool that enforces a steady sequence of work according to kanban pull signals. In a factory or office, the *heijunka box* is a series of sequentially timed slots, like a set of post office boxes (see example in Chapter 5, Figure 5.3). Each slot represents a scheduled release, and kanban cards representing jobs are inserted into the slots. When ready for the next job, the gateway (first) workcenter pulls the next card from the slot. This approach is helpful when the content of the work being done (whether insurance claims, lab orders, or software components) changes from one item to the next, since each kanban card may carry individual specifications and instructions.

In software development, the heijunka schedule is visualized with the “In-Process Kanban Board,” shown in Figure 8.4. Stories in the backlog waiting for development may be scheduled and sequenced according to the cadence, thus providing a basis for the team to estimate when the next story will be released to development. The total work



**FIGURE 8.4** Backlog and in-process kanban board example.

in process is illustrated by the total points on the board, and the flow of work through the process may be viewed by the points at each stage in the process—excess accumulation of points at a particular stage in the process suggests a temporary flow impediment. When work stops flowing, the heijunka release schedule falls behind, and kanban provides a visual sign of where the bottleneck has occurred. These signals guide problem-solving efforts to identify and address the cause of disrupted flow: perhaps the scope of work is too large (points/hours underestimated), the balance of load and skills needs adjustment, someone is interrupted or stalled, or myriad other things that can change or go awry on a daily basis.

An alternative heijunka technique may be applied to Lean software development, moving from a time-boxed iteration schedule (controlling the amount of work released to production in each iteration) toward the ideal of one-piece flow. With this approach, the team simply pulls the next kanban card from the backlog as they're ready for it. This works best for routine tasks with few interdependencies. By continuously reprioritizing the backlog as circumstances change (e.g., a critical bug is suddenly discovered), a steady stream of new work may be pulled into production at any time, triggered by available team capacity. In a factory this evolution may take years, and in some cases a true one-piece flow is never achieved (and sometimes is not practical); nevertheless, one-piece flow is a *perfection target* toward which the Lean software development team may strive.

## Customer Service and Support

In our experience, customer service and support is a critical element of the development life cycle that is sometimes disregarded by both traditional and agile software development practitioners. Voice-of-customer information is ideally gathered from the field as all customers (not just those represented on the team) use a deployed application. There is perhaps no better place to gather this vital input than through the service desk (help desk)\*, providing an avenue for customers to identify potential problems, and submit enhancement requests to be considered in the development backlog.

For example, during the Lean enterprise transformation of one client, we discovered an agile implementation where documentation and service

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\* For more on incident and problem management, see Chapter 7.

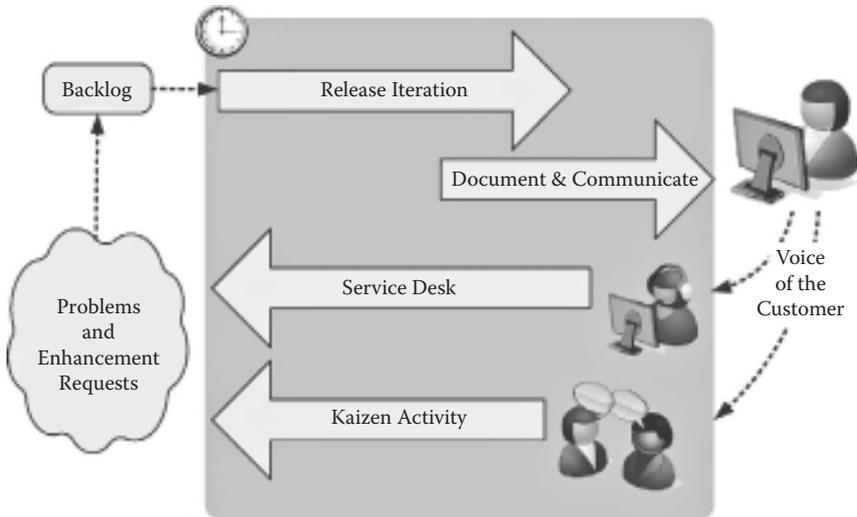
desk activities were still anticipating long, slow change cycles. What should have been a closed loop was in fact two disconnected loops that were out of phase: service desk staff were never certain of the current deployed state of the software, since their documentation and training were often weeks behind the agile release schedule. And since they had only limited visibility to the backlog, they didn't know which problems and enhancement requests had been reviewed by the team, and which had been approved and placed in the backlog for development. In addition to causing internal chaos, the customers were frustrated, with their problems unresolved, not knowing when (or if) they were going to be addressed in the future. This is a case where agile focused on the software development life cycle, but disregarded the overall value stream.

Figure 8.5 illustrates a complete closed-loop customer feedback cycle integrating development, communication and training, support, and ongoing kaizen activity. We know of one large company that requires members of the development team to stand duty on the service desk whenever new code is released, so they can hear the voice of the customer firsthand.

## **Measurements**

Traditional software development controls and measures focus on cost and schedule, reviewed periodically on a very large and complex scale. Until development is performed on a scale that supports rapid, iterative changes, both of these measures are virtually guaranteed to be inaccurate, providing counterproductive guidance during the project. And the act of performing these measures, using traditional detailed push-scheduling tools, can be arduous and wasteful, leading to many long project status meetings, lengthy and complex reports, and heated arguments over the validity of the information. And since these traditional measures are lagging, not leading, indicators, they are of limited use—signaling for corrective action to a problem that might have been avoided in the first place.

Compared to traditional software development project management, Lean software development measures are simple, visual, and immediate. Just as in the Lean factory or office, because of small scope and rapid iterations, there should be little overhead spent on monitoring and reporting. Problems should call attention to themselves before they are out of

**FIGURE 8.5**

Closed-loop voice of the customer.

control and be addressed during the daily standup meetings (see also Chapter 9 on Lean project management).

Ideally, the team should maintain just a few leading indicators (process measures) that indicate the functioning state of the process, guiding proactive behavior, for example: backlog status, kanban boards, burndown charts, and defect trend charts. When a deviation occurs in a leading indicator, the team should apply A3 thinking to solve the problem at the root cause level.

The burndown chart is a common tool to keep the team on track, showing all tasks underway and their status, points or hours consumed, and work remaining for each component. Ideally, the remaining points or hours should represent a realistic estimate for the remaining work to be done, rather than the initial estimate of total hours less time invested so far, which may misrepresent the amount of remaining work. Significant deviations between originally planned and final estimates should trigger a root cause analysis in order to continuously improve estimate accuracy. The burndown chart is often shown as two trend lines, one displaying the planned schedule for the iteration, and the other showing actual progress. The gap between the two lines is an effective early warning signal during each day's standup team meeting, helping the team respond quickly with corrective and preventative action.

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## IMPLEMENTATION AND INTEGRATION LESSONS LEARNED

We close this chapter with a few general observations about implementing Lean software development.

There is active debate about the ability of Lean software development to scale for large or geographically distributed teams, for complex products requiring extended development timelines, or where multiple systems must be integrated, especially with products developed by outside parties who are not practicing Lean. However the larger and more complex a system is, the more capacity for change should be designed into it; otherwise, the cost of change and its negative impact on business agility will be significant. Each case, of course, is different, with its own challenges to be addressed. Lean software development is not a one-size-fits-all prescriptive approach, but an iterative cycle of experimentation and learning.

Similar objections have been leveled at Lean manufacturing over the years, but the principles, though not necessarily specific tools, have prevailed in every type of situation. For example, the application of Lean tools in a repetitive (high-volume, low-mix) production environment is quite different from a highly engineered (low-volume, high-mix) factory. Nevertheless, using A3 thinking, teams problem-solve their way to create flow, often discovering new applications for existing Lean tools and techniques. Similarly, as Lean software development continues to evolve and push the envelope of scale and complexity, generations of practitioners will apply Lean thinking in new ways, sharing their discoveries with others.

This leads to the most important factor in the evolution of Lean software development, as it supports the continuous improvement of the overall Lean enterprise. In our experience with common agile practices in the field, software development teams often do not receive formal problem solving or Lean training, just an introduction to specific agile development tools and techniques. Nor are they regularly invited into kaizen activities such as value stream mapping and gemba walks, and thus they do not see the whole value stream, or the immediate problem to be solved, from a business context. Software development teams should regularly engage in business process improvement and problem solving alongside the business, since most problems are caused by faulty processes, not software. This points to a fundamental shift in the traditional way that the IT

organization interacts with the business, which we explore throughout this book.

Implementing Lean software development (and Lean IT in general) comes down to each individual thinking differently about the way he or she works, and the business context within which he or she adds value. Leadership should anticipate initial resistance to such fundamental change in thinking and culture. For example, teams often initially oppose co-location within a bullpen setting, which is often perceived as a violation of their personal space. And there will always be some who challenge the Lean approach every step of the way, for a variety of reasons.

In the *CIO Magazine* article “How to Instill Agile Development Practices among Your IT Team,” CIO Jackie Barretta of Con-way sums up the spirit of honesty and respect,

I made a rule that every person had to initially follow the practices precisely. I told them that as they became knowledgeable in the practices they could tweak them, and when they really understood them they could decide which ones to adopt. So far most people who have experienced the practices have decided to adopt them for the long term.<sup>15</sup>

To effectively implement Lean software development, leadership must establish conditions in which trust can develop. For so long, software developers have taken the brunt of many jokes, and they are often the scapegoats for project failure, complexity, and problems that originate from faulty requirements and flawed business processes. Not that software development is blameless, of course, but teams must come to the table with a spirit of openness, solving problems and improving processes while not blaming people. After all, Lean software development naturally focuses critical attention upon uncomfortable issues within the business processes that many would rather avoid. Honesty and trust between the business and the IT organization are essential, or this simply will not work.

While product managers naturally take the lead role working directly with the business, each member of the software development team should have an opportunity to participate in kaizen events, going to gemba, sharpening their Lean skills while developing a better understanding of how the business works. The IT staffing plan must therefore include time allocation for participation in ongoing Lean training and kaizen activities.

While this will not be easy, just like maintaining slack in production capacity, the investment will ultimately pay off in many ways.

When all stakeholders, including IT, actively participate in kaizen activity, quality software releases will naturally align and synchronize with the continuous improvement of the business processes that need them.

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# 9

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## *Applying Lean to Project Management*

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### CHAPTER OBJECTIVES

An organization's project management capability directly impacts the pace and success of its Lean transformation. In this chapter we will consider how the principles and tools of Lean can be applied to achieve better project results while reinforcing Lean thinking throughout the enterprise, as we explore:

- The framework and benefits of conventional project management, including portfolio management and the Project Management Office.
- How Lean principles complement the strengths of traditional project management.
- How Lean project management specifically applies to IT projects.
- The importance of Lean project management competence as it applies to Lean enterprise transformation.

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### THE VALUE OF EFFECTIVE PROJECT MANAGEMENT

Anyone who has tried to lead a project, particularly an IT project,\* knows they are inherently complex, problematic, and risky. If not skillfully

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\* For the purpose of this discussion, an IT project is any temporary effort to deliver a technology-based solution (e.g., software development, application implementation, enhancement, or process improvement).

managed, the typical IT project goes on longer than expected, costs more than budgeted, encounters unexpected setbacks, and fails to satisfy stakeholders' requirements and expectations. Underperforming projects draw resources and focus away from daily operations. In most cases, project management is the means by which change is implemented—either enabling the business or dragging it down.

Effective project management is about successful execution—getting the *right* work done and delivering value on time and within budget. Effective project management is an essential driver of continuous improvement, operational excellence, and lasting change. Let's be clear: this discussion is not an indictment against professional project management. In most cases, it is not a failing of project management processes, but the failure to apply project management processes *properly*, that leads to failed projects.

Let's set the stage by describing a hypothetical situation at GreatServices, Inc. where a cross-functional team has been formed to reduce IT service request delays. The team includes a sponsor, a project manager, and eight team members representing various functional groups throughout the company. The project goal seems straightforward: the company's associates need timely IT support to do their job—break-fix, technical support, reports, new applications, equipment, and so on—and current service request practices do not consistently meet expectations.

The project sponsor requests an initial investigation. Using questionnaires and interviews, the team learns that to submit a request, some departments rely on e-mail, fax, and phone calls, while others use manual or electronic forms. After submitting a request, not everyone gets a confirmation that the request has been received. The IT staff explains they don't always know when a request has been submitted. As a result, service requests often get lost and deadlines are missed.

Associates describe the process as “a frustrating waste of time.” Some say they are occasionally surprised to have their requests met quickly and can't explain why the system works well only some of the time. One associate characterized the process as “hit or miss.” It's clear to the team that no standard service request process has been established.

On the supply side, IT service providers say they have no visibility of their overall workload or available capacity and, thus, are unable to provide reliable service delivery dates. One manager exclaimed, “Our hands

are tied!” The level of frustration is so high that some departments have resorted to contracting expensive outside providers because they have lost confidence in their in-house resources.

Based on their findings, the team concludes that service delays occur primarily because the company doesn’t have a standard automated service request system. Many of the people interviewed suggest that the right software system should provide the structure, functionality, and controls that are currently lacking. The project manager develops a business justification for the purchase and installation of a software application to process all IT service requests. The proposal is reviewed and approved by a capital expenditures committee. Next, the project manager creates a project charter and project plan with a six-month duration.

Upon project approval, the clock starts ticking (it actually started ticking when the business customers initially became frustrated) and work gets underway. The project manager submits weekly status reports to the project sponsor that track the budget and task completion, highlighting any setbacks encountered or potential problems detected. A steering team (composed of the project sponsor, several directors, and the project manager) meets every month to review project status and change requests.

The project is eventually completed with mixed results, taking four months longer to complete than anticipated, while exceeding the original budget by almost 50 percent. Although training sessions were held and an online tutorial is available, users of the system say it’s user-unfriendly, overly complex, and packed with features *they don’t need*. In the end, many choose not to use the new system, developing workarounds and reverting to old methods. A *postmortem* is held to discuss what went well and what didn’t. At the meeting, the CEO declares, “I see this as a qualified win. It could have been much worse; at least the system is up and some people are using it!” A final report is completed and filed away.

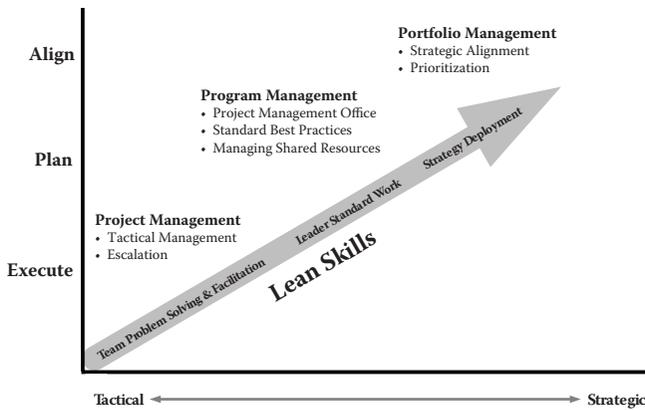
Does this sound familiar? It’s a scenario that plays out every day in countless variations. So what went wrong in this case, and what goes wrong with projects in general? Simply this: people tend to jump at solutions, bypassing the rigor of grasping the situation, identifying the real business problems that need to be addressed, and understanding root causes. In addition, the unexpected is almost always guaranteed to take place. From the first thought that a project may be required to the

time the project is completed, myriad events and discoveries occur that alter the assumptions and circumstances upon which the project charter and plan were created. Unanticipated events occur throughout the life cycle of all projects: new stakeholders, additional requirements and expanded scope, delayed decision making, internal politics, constrained resources, project delays, and changes in funding. These unforeseen changes, occurring suddenly and with little warning, are a major reason why projects are often late, are over budget, and produce results that fail to meet the customers' changing requirements (see the *CHAOS Report* in Figure 3.1).

In our experience, the root cause of project failure is the improper application of project management methods. In addition, many project teams do not examine the value stream context of the problem or opportunity being addressed. Thus, they are unable to properly diagnose the current state and their "solutions" are predestined to fail. The telltale symptoms of doomed projects include:

- Poor understanding of stakeholder requirements
- Right solution to the wrong problem
- Wrong solution to the right problem
- No strategic alignment
- Conflicting priorities
- No consideration of risks or formal risk management
- Lack of user buy-in, trust, and resistance to change
- Deficient user involvement
- Inadequate resources and/or funding
- Unrealistic timeline
- Poor change/transition management and communication
- Ineffective control of scope
- Weak or missing user testing and acceptance
- Insufficient monitoring and upkeep after go-live

For anyone who has been involved in a large-scale IT project, this list is all too familiar. Before we consider how Lean complements and strengthens effective project management, let's briefly explore portfolio, program, and project management.



**FIGURE 9.1**  
Portfolio, program, and project management.

## The Project Management Body of Knowledge

The Project Management Institute (PMI)\* has established a foundation of practice upon which we can apply Lean thinking to augment project management practices. The Project Management Body of Knowledge (PMBOK)† provides a framework that supports central Lean tenets including alignment, standard work, structured problem solving, and effective teams. Lean principles and tools apply to all three levels of project management: portfolio, program, and project, as shown in Figure 9.1. Organizations require competence across *all three levels* to effectively align, plan, and execute projects, allocating limited resources to best achieve strategic objectives.

## Portfolio Management

Beginning in the upper-right-hand corner of Figure 9.1, *portfolio management* focuses on “ensuring that projects and programs are reviewed to prioritize resource allocation, and that the management of the portfolio is consistent with and aligned to organizational strategies.”<sup>1</sup> Its focus is

\* The Project Management Institute establishes global standards and certifications for portfolio, program, and project management. See [www.pmi.org](http://www.pmi.org).

† In 1987, PMI first published *A Guide to the Project Management Body of Knowledge (PMBOK)*, presenting the foundational concepts and standards that are applied to project management worldwide. The most recent fourth edition was published in 2008.

strategic, aligning and coordinating all projects and programs to fulfill the overarching goals of the organization. In harmony with Lean's strategy deployment (see Chapter 6), portfolio management takes a holistic view of the company's projects and programs (which represent investments in people, time, and money), attempting to balance priorities and available resources with strategic objectives.

Organizations with ineffective or missing portfolio management capabilities are like an orchestra without a conductor—each section of the symphony is playing their part but with no coordination, cadence, or synchronization. The collective impact on the business can be disastrous, leaving a trail of costly disappointments, conflicting priorities and effort, overburdened resources, and poor morale.

## **Program Management**

PMI defines a *program* as “a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.”<sup>2</sup> Program management is both tactical and strategic: tactical in that it focuses on coordinating the interdependencies and resource requirements of related projects, and strategic in the sense that it supports and directs associated projects toward shared objectives. Program management allocates resources based on priorities established at the portfolio management level. Organizations without effective program management are less equipped to purposefully assign resources to those projects aligned with organizational objectives.

Unmanaged complexity and risk from project interdependencies increase the likelihood of program failure. Program management addresses interdependencies *between* projects while ensuring coordination of resources aligned with established priorities. Through the Project Management Office, standards and best practices are established, giving project managers the tools and support they need to effectively manage programs and projects.

## ***The Project Management Office***

The *Project Management Office* (PMO) acts as a *Center of Excellence* for project management expertise and discipline throughout the organization. A Center of Excellence provides standard practices, tools, templates, training, support, knowledge management, measurements, and infrastructure

### IS LEAN A PROGRAM?

We often encounter organizations that refer to Lean and/or Six Sigma as a *program* when describing their efforts to become a learning organization pursuing ongoing improvement. In our experience, labeling continuous improvement a *program* is a mistake as it sends the wrong message to the organization. A program is similar to a project: it typically has a beginning, a middle, and an end point. But continuous improvement is a never-ending journey of experimentation and learning. Labeling Lean a program is at best misleading as some associates may choose to “sit this one out,” anticipating the changes to be short-lived. We prefer to call them *initiatives, efforts, methods, or ways* (as in “the Lean way”).

for a particular domain of knowledge and practice such as Lean or project management.

Depending on the culture and project management capabilities already in place, a PMO sometimes works in a consultative role providing project management training, tools, and coaching. Alternatively, PMOs may also actively coordinate and manage project resources, ensuring project management standard practices are followed, monitoring project status, and intervening if a project appears to be heading for trouble. Often PMOs assist senior management with portfolio management and steering team activities as well.

Project managers either are members of the PMO and assigned to functional areas of the business as needed, or they are permanent members of the business who look to the PMO for standards, support, and additional resources. Figure 9.2 compares each approach. A pool of project managers reporting to a central PMO strengthens consistency of project management standards and practices. On the other hand, project managers directly assigned to functional areas develop a deeper level of understanding of business operations and stronger relationships with customers. Operations which *own* permanently assigned project managers directly control assignments and sometimes develop unique project management tools and methods to meet localized needs—a good thing when these best-practice innovations are then shared with the rest of the organization.

When project managers are centrally located, there is often a challenge for the PMO to balance demand and supply of project managers (demand management), necessitating enterprise-wide trade-offs. Some would argue

Project Managers Assigned to Central PMO	Project Managers Assigned to Business Units
Consistency of PM practices	Deeper knowledge of the business
Sharing of enterprise best practices	Sharing of business unit best practices
Access to coaching and support	PM practices customized to that business area
Enterprise Demand Management	Localized Demand Management
Central Control of PM resources	Direct Control of PM resources

**FIGURE 9.2**

Central Project Management Office (PMO) versus decentralized project managers.

this is preferable as long as trade-off decisions are aligned with enterprise objectives, creating a dynamic, collaborative environment where choices are acknowledged.

When project managers are located in functional areas, department managers may independently make trade-off decisions when demand exceeds supply, at times choosing between organizational goals, localized objectives, or individual compensation objectives. In this case, without an effective governance mechanism in place, there is a greater likelihood that localized decisions may not be aligned with organizational priorities. (We'll address governance in Chapters 10 and 11).

Applying the principles and tools of Lean, the PMO can standardize project management best practices across the enterprise, eliminating wasteful non-value-adding activities while reinforcing the consistent use of A3 thinking, customer-defined value, value stream awareness, and Plan-Do-Check-Act (PDCA) problem solving. More on this later.

## Project Management

PMI defines a *project* as “a temporary endeavor undertaken to create a unique product, service, or result.”<sup>3</sup> A project is goal oriented and consists of a series of interrelated non-routine tasks. When projects are completed, there is usually a handoff to operations.

*Project management* is defined as “the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.”<sup>4</sup> PMI's Project Management Body of Knowledge identifies 42 core project management processes spread over five distinct phases (process groups) shown in Figure 9.3.

## **THE DISCONNECT BETWEEN STRATEGY AND EXECUTION: THE ROLE OF THE PMO**

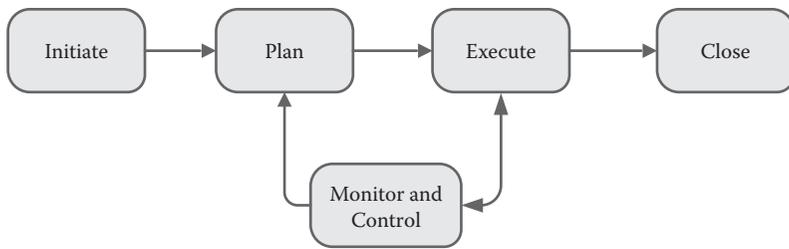
IT organizations face the constant challenge of maintaining existing information systems while keeping up with evolving customer requirements for information and a changing technology landscape, given limited resources and unremitting pressure to control costs. But they often lack a standardized approach for prioritizing projects, ensuring adequate capacity, effectively monitoring project performance, and making timely corrective actions. These shortcomings are by no means exclusive to IT and are often present throughout the enterprise.

Why do so many companies struggle with the strategic alignment of programs and projects, and their successful execution? We often discover a disconnect between portfolio management and project execution, between strategy and tactics, intention and action. One Fortune 100 company formed a global project oversight group using state-of-the-art portfolio management tools. Senior management was pleased with their plan for strategic alignment of programs and projects.

However, there were no central oversight measures in place, nor had standard project management practices been developed. Each functional area (e.g., operations, IT, and procurement) and each geographic region was left to devise its own project management systems and practices. Not only was alignment detached from execution, but also every project was run differently. The company had not defined standard project management practices, nor created support systems to reinforce standardized work.

The consequence to the organization was inconsistent project results, with no clear linkage between the defined strategy and targeted results. Some projects were thoroughly planned and well executed, delivering anticipated outcomes. Others applied informal, improvised approaches rendering isolated successes mixed with many disappointments and a few colossal failures.

What the company was missing were management systems and standard processes to provide oversight and ensure that strategic intent was distilled into aligned, prioritized projects that were consistently executed. Applied properly, effective portfolio, program, and project management address these issues by providing the framework and standard tools to proactively plan for and adjust to competing priorities and relentless change.

**FIGURE 9.3**

The five phases of project management.

The primary focus of project management is *tactical*—centered on task execution through attention to scope, quality, schedule, budget, resources, and risk. Experienced project managers may be familiar with another popular definition for project management: *having the responsibility to create a miracle but not the authority to do so*.

Most projects have some disruptive impact on the organization as they divert resources and attention away from daily operations. When project management is ineffective, the extent of the disruption is even greater and expected benefits are often postponed or abandoned. The longer a project languishes, the greater the cost in time, resources, and credibility, and the more difficult it is to control scope, budget, and resources while maintaining focus on delivering customer-defined value.

In the past, project management concentrated most of its effort on maintaining project schedules and budgets, emphasizing the administrative mechanics of defining tasks, monitoring progress, and reporting status. In today's complex and multifaceted IT projects, while traditional project management skills are absolutely necessary, they are not by themselves sufficient. And, from a Lean perspective, as much as half of project management tasks add little or no value and can be eliminated. Examples include detailed status reports, excessive meetings, overly-documented conversations, unshared analysis, and other information-gathering tasks that do not improve project performance.

Lean principles and tools position the project manager and team for success. As organizations seek to become more agile (see Chapter 4) and find ways to remove time and cost from projects without compromising on quality results, Lean principles and tools represent essential core capabilities. Project managers must see their role as evolving from an exclusive focus on efficiency, completing projects on time and within budget, to a

focus on flexibility, quickly delivering incremental value to internal and external stakeholders.

Beyond tactical project management skills, project managers must develop proficiency in Lean thinking, facilitation, effective team building, problem solving, and escalation. Escalation is the ability to sense when an insurmountable barrier is approaching and to resolve it skillfully by gaining the appropriate level of authority without alienating any stakeholders. Lean project management, driven by A3 thinking and management by facts, supports the art of escalation while minimizing internal politics. Lean thinking focuses on problem *processes*, not problem *people*, to address root causes, often removing resistance and strengthening trust. Critical assessments become constructive when people are no longer targeted as part of the evaluation (i.e., shot for being the messenger).

### **Improving Project Management Results with Lean Thinking**

As we've discussed throughout this book, organizational effectiveness is created and sustained by continuous process improvement. Companies that perceive problems (and projects) as opportunities to improve underlying processes are able to stay ahead of the competition. Frequently, however, project teams focus exclusively on the *deliverables* of the project: a system upgrade, new infrastructure, or other tangible investment. While these may be valid objectives, when teams fail to see the business process improvement opportunity, they miss the path to superior results. By implementing a *solution* before thoroughly understanding problems and improving underlying processes, they unknowingly increase the risk of project failure. To avoid this common error, rigorous project management should be augmented with Lean thinking, a focus on the less tangible (but equally important) deliverables of process improvement—*creativity before capital*.

One pragmatic client of ours, a seasoned project manager, observed, “On the surface, some projects appear to offer very little process improvement content; you just need to crank out the work.” In our opinion, all projects are opportunities to work on process improvement *while* getting the work done. Organizations that eliminate the distinction between performing the work they do and improving how work is done develop the habit and culture of kaizen. We like the motto: do your work, improve your work, and improve yourself.

Information system project managers tend to come from technical backgrounds and are likely to perceive a project as an *implementation* (e.g., the delivery of an enhancement or new application), not a process improvement project (e.g., streamlining the release management process). Often IT projects are assigned a project manager but not a Lean facilitator, so their focus is primarily on the execution of predefined deliverables. Project management has developed formalized processes to manage complex issues and avoid common pitfalls. However, some of the methods used by today's project managers inadvertently introduce inflexibility.

For example, extensive planning, documentation, and stakeholder signoffs at the front end of a traditionally managed project can create resistance to change later in the project, suppressing much needed midcourse corrections. Formal change control may require extensive documentation and authorization. It's understandable that project managers push back on change: it's additional work to change the plan and obtain another round of signoffs. However, such resistance to change can inhibit the iterative PDCA process of Lean and prevent a company from becoming a learning organization focused on rapid cycles of improvement.

Project teams can become so focused on a fixed end state that they may not pause to consider the root causes of problems. "That's out of scope," they often counter. Such "get'er done" projects must return later to address root causes (rework), or, even worse, the organization learns to live with suboptimal results—both are wasteful outcomes. In fact, by not addressing root causes, the project may introduce *new* inefficiencies and additional layers of wasteful non-value-added work. This is a training and process problem, not a people problem. Although they should be, not all project managers are familiar with the principles and tools of Lean.

Looking at it from the other side, continuous improvement projects are rarely assigned a skilled project manager. Companies often assume that the individual leading a kaizen event or Six Sigma project possesses sufficient project management skills. Process improvement coaches facilitate A3 thinking, value stream mapping, and iterative problem solving. Their primary focus is on discovery and adjusting to new facts. These individuals are experienced in applying Lean principles and tools, but that does not always translate into good project management skills.

The skills and focus of a seasoned project manager are significantly different from those of a process improvement facilitator, including formal management of budgets, resources, risk, and issues escalation. Their

primary focus is on control and stability, and their skills are particularly useful when process improvement and IT projects extend beyond departmental boundaries, require significant investment, utilize shared resources, and introduce risk to the organization. However, many project management tools and methods are bloated with waste and add little value. Project managers should learn to utilize Lean principles and tools to reduce wasteful practices, improving project agility and responsiveness. Figure 9.4 compares project management and process improvement skills.

So how does an organization provide effective Lean facilitation *and* sound project management with limited resources? The PMO and the Lean Centers of Excellence, through training and coaching, are the ideal resources to ensure a suitable balance between control and flexibility. In most cases, given adequate training and guidance, two people are *not* necessary to fill the dual roles of project manager and Lean coach. All the skills listed in Figure 9.4 can and should be developed in project managers. Large, risky, expensive, cross-functional projects should be considered for a designated project manager and one or more process improvement facilitators.

When we review the performance of IT projects and continuous improvement efforts, often *the key differentiator* between success and failure is the capability and skill of the facilitator (project manager, sensei, black belt, coach, etc.). Project management delivers a proven framework for control, while Lean encourages flexibility and iterative team problem solving. Effective organizations combine these competencies to consistently deliver superior project results based on the bedrock of continuous improvement.

Project Management Skills	Process Improvement Skills
Control / Stability	Discovery / Flexibility
Project Planning	A3 creation and maintenance with team
Requirements Management	Value Stream Mapping
Budget/Risk Management	Root Cause Analysis
Resource/Change Management	Team-based Problem Solving (PDCA or DMAIC)
Train and reinforce standard project management methods and templates	Train and reinforce Lean/six sigma principles and tools

**FIGURE 9.4**  
Project management and process improvement skills.

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## LEAN PROJECT MANAGEMENT

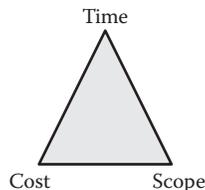
Lean project management applies the core principles of Lean thinking to reinforce the effectiveness of project management by emphasizing iterative discovery and problem solving, value delivery, and eliminating wasteful tasks, resulting in improved quality, reduced total elapsed project time, and reduced project costs. To explore this further, let's begin by describing a conventional project management approach and then apply Lean thinking to shift the paradigm.

### The Triple Constraints Model

Perhaps the most fundamental concept in project management is the *triple constraints model*, which suggests all projects are limited by three elements: time, cost, and scope. The classic adage here is, “We can complete the project quickly, be within budget, and have the deliverables you want—pick any two.” Fortunately, the situation is often more malleable than the cliché. As shown in Figure 9.5, the *project management triangle* illustrates the principal of project management trade-offs.

If we change project duration, it is likely that costs will be affected. If the budget is reduced, we may have to adjust the scope of the project. If we increase the work content of the project to support an expanded scope, it is likely to impact both time and cost. No element of the triangle can be changed without impacting at least one of the other elements.

When managing constraints, the first course of action is to determine the primary driver of the project and adjust accordingly. The art of project management is to blend these three factors to achieve the most critical needs of the organization. For example, if time is the most important



**FIGURE 9.5**

The project management triangle, or triple constraints model.

aspect of the project, the budget might be increased to support more resources and/or scope might be reduced.

## **Applying Lean Thinking to Project Management**

Lean project management focuses on reducing overall elapsed project time to break through the seemingly inherent tradeoff of time, cost, and scope. Lean project management applies process improvement to *both underlying business processes and project management methods*. As waste is removed, the impact of the triple constraints is diminished. Projects that focus on reducing total project time (versus individual task time) yield better quality results, in less time and for less cost, because improved quality translates into less rework.

The triple constraints trade-off remains but grows weaker as organizations adopt small, iterative project cycles to achieve targeted objectives. In doing so, the organization is choosing *what appears to be* more time and more cost, because more effort is invested in planning (*P-DCA*). In fact, our experience shows that smaller scoped rapid-cycle projects yield better results, in less total time and cost. As project work is done in rapid iterative learning cycles, deliverables generate value at each cycle's completion rather than only at the end of the project. In addition, there is less work in process, allowing simpler coordination of tasks and resources, while improving agility and flow of the overall project to ensure early realization of value.

From a Lean perspective, the critical element that drives project success lies beyond the triple constraints: *effective team engagement in root cause analysis and iterative problem solving*. A project can have sufficient time, adequate funding, an appropriate scope of work identified, and an engaged team, but without a team equipped to solve root causes of *underlying process* problems, the most skilled project management expertise will not generate sustainable results. Project managers, facilitators, and team members with the skills to see the whole value stream and grasp delivery of value to customers and stakeholders have a more insightful context in which to run the project.

All projects should apply Lean principles to the processes targeted for improvement in order to identify the most appropriate course of action. When projects start with a predetermined solution (like our GreatServices, Inc. story at the beginning of this chapter) without initially examining and improving underlying processes, the inevitable outcome is more efficient

throughput of broken processes—more unsatisfactory results delivered at a faster pace! This is particularly true with IT projects.

Lean should also be applied to remove non-value-added work from all phases of portfolio, program, and project management. We typically find wasteful practices in many activities throughout the project life cycle, including project administration, reporting, expediting, and documentation. At the project execution level, by eliminating wasteful project management tasks, more time is available to develop countermeasures, test results, and put improvement ideas into action. Wasteful project management practices include activities such as lengthy and unproductive project status meetings, collection of redundant or useless project data, and documents (stakeholder requirements, risk analysis, etc.) that are created but never referenced during the project.

Two common non-value-added practices are detailed schedule maintenance, which is not used to monitor and make adjustments to the project, and the preparation of consolidated weekly status reports, which are disregarded by senior management until a major problem has been flagged. Besides introducing non-value-added work, these periodic “push” reports create an artificial separation between those controlling project information and the team members and stakeholders who need access to one another.

In a Lean environment, the project team would rely on an *obeya room* to communicate project issues on a real-time basis (*obeya* is Japanese for big room). The approach is similar to a project war room used as a central meeting place to co-locate team members for the duration of the project. However, the focus here is on collaboration and communication. The walls (physical or virtual) of an *obeya room* are covered with visual charts and graphs depicting project issues, A3s, and other devices communicating actual progress versus the plan, burn down status, countermeasures, and other useful information. Rather than standard weekly meetings, members of the cross-functional team meet daily, using standup meetings (huddles) to discuss current issues and challenges as they arise. The goal of the *obeya room* is to speed up the PDCA cycle by making information accessible to all team members, so the team can detect and solve problems as early as possible.

### **A3 Thinking**

A classic maxim in project management maintains that organizations that fail to define project goals and objectives unknowingly plan to fail. Project management often begins with predefined objectives and applies

a standard methodology to implement the solution. Often these projects focus on symptoms rather than root causes. Before contemplating an IT project (or any project, for that matter) *with a predefined solution*, organizations should take a step back and clearly define the *problem* they are attempting to solve. A3 thinking is about having the awareness and tenacity to move beyond symptoms to take on root causes.

A3 thinking is the consistent application of PDCA problem solving to identify the best course of action to address challenges and opportunities. A3 thinking guides the team's activities toward a well-defined problem or opportunity and simultaneously builds flexibility into the project. As new facts are uncovered, project objectives are modified to meet *actual* needs instead of *planned* needs. Defining measures of project success up front is critical, so everyone can buy into the expected outcome/benefit. However, activities and performance targets evolve based on the team's understanding of how effectively current processes deliver value as defined by the customer; this is the essence of agility.

Flexibility in developing solutions based on reflective observation is a central principle of A3 thinking. Consider a project to implement a new invoice payment system. Applying A3 thinking and PDCA, the team discovers the software application works fine but current procedures include excessive steps and redundant authorizations, adding delays and errors to the process. It is essential that the project sponsor supports the team's evidence-based decisions as their understanding of the facts changes. When the team meets with the sponsor and shares its findings (through an updated A3), it is the role of the sponsor to critically challenge—and, if convinced, support—the team's recommended course of action. This may mean abandoning the initial "solution," which can create some pushback from stakeholders in the organization. It is the project sponsor who should address these issues, allowing the team to remain focused on grasping the situation, seeing the flow of quality work, developing countermeasures, and making improvements.

Both conventional and Lean project management focus on doing the right things (leadership) and doing them right the first time (management). Traditional project management creates a detailed work breakdown structure early in the project for budget and tracking purposes.\* In Lean project management, work tasks are also assigned, but they are expected to change

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\* See *PMBOK Guide*, 4th ed., Section 3.2.

based on discovery, rather than being entirely predefined. Lean provides the tools to support that flexibility. Applying PDCA creates a mechanism to do the right things *at the right time*. Lean project management means having the appropriate level of structure and control to enable progress toward measurable targets. Work assignments adjust based on the discovered facts. As teams verify that countermeasures produce desired results, emphasis shifts from problem solving to solution implementation.

It's important to note that, unlike a project, continuous improvement never ends; it simply begins another cycle. The focus of the next cycle is based on the results of the last cycle. If results are less than desired, another round of PDCA is started. If the results are satisfactory, sustaining measures are put into place to monitor performance and warn of deviations. Focus then shifts to another round of improvement effort based on the organization's priorities.

In our story at the start of this chapter the predefined objective was to *improve IT service request response time*, and the team's "solution" was to install a software application. Had the team started with A3 thinking, seeking to grasp core process problems, they would have discovered that process changes were necessary prior to evaluating a new technology intervention. Once consensus had been reached on the problem and improvements had been made to the underlying business processes, a clear and accurate determination of appropriate software (if needed) would have been possible.

There is tremendous leverage when IT professionals apply A3 thinking skills and engage in the entire PDCA process—rather than just the D (Do). This shift in focus sounds very simple but is fiendishly difficult to accomplish.

Often organizations adopt the A3 *form* but not A3 *thinking*. The A3 form, an example of which is shown in Figure 9.6, is a valuable tool to communicate the extent of the teams' understanding of the situation, project objectives, timelines, status, and results. A3 formats vary; however, the form should be viewed as a representation of the engagement, discovery, understanding, and problem-solving process experienced by the team or individual. When used to communicate project issues, experienced project managers new to the A3 are often surprised by its simplicity and effectiveness. (See Appendix D for a sample completed A3.)

When project managers augment the strengths of established project management practices with Lean thinking, project results are realized



	Conventional Project Management	Lean Project Management
Focus	Tactical execution	Strategic alignment / Voice of the Customer
Daily Directive	Task completion	Value creation/Problem solving
Benefits Definition	Fixed	Evolving
Change / Risk Management	Initial analysis, then reactive	PDCA, proactive
Emphasis	Stability	Agility and repeatability

**FIGURE 9.7**  
Leveraging conventional and Lean project management.

more quickly and are better aligned with customer requirements. While these principles may not be new to project management, they need to be reemphasized. As shown in Figure 9.7, Lean enhances project management through its emphasis on alignment, customer-defined value, iterative learning, and agility.

**Value Stream Mapping**

In our GreatServices, Inc. story, a group of people form a team and quickly reach the conclusion that a new software application is required. Perhaps the need for a new system was assumed even before they started. Without a defined approach to analyze the current situation, teams rely on personal experience, bias, isolated incidents, and anecdotes to develop an understanding of the problems they are tasked to solve. Team members with strong verbal skills and compelling stories may unduly influence team opinion, inhibiting thorough analysis and discovery. Armed with the best intentions, it is only human nature to identify *the solution* as quickly as possible.

Deming said, “Management of a system requires knowledge of the inter-relationships between all the sub-processes within the system and everybody that works in it.”<sup>5</sup> Value stream mapping graphically depicts the interdependencies of processes, providing the insight needed to develop innovative countermeasures to address root causes of problems. Mapping the value stream enables the team to identify non-value-added (wasteful) steps in the process, quality issues, and where work does not flow. Clearly understanding what current information systems provide in the context

of value creation is priceless. Value stream mapping also enables the team to identify, and potentially quantify, the value of the project deliverables. The focus shifts from delivering *features* to delivering *value*.

Project teams that use value stream mapping develop a common language to describe the problem, building consensus and team chemistry. Once the team has a solid grasp of the current state, seeing the whole and quantifying the problem from an overall systems perspective, they are in position to develop potential countermeasures and prioritize efforts. In most cases, project objectives and deliverables should not be finalized until value stream mapping has been completed.

## Plan-Do-Check-Act, DMAIC, and Project Management

The nature of project management is the timely execution of a solution to address a need, opportunity, or problem. All project management includes some form of problem solving, usually a great deal, but when teams encounter problems, responses range from ad hoc, shoot-from-the-hip reactions to methodical, structured problem solving.

Project managers should be aware of Lean and Six Sigma tools and methods. Figure 9.8 shows the five phases of project management matched with Lean PDCA, Six Sigma DMAIC,\* and some of the supporting tools. The following sections explore this in order of the five phases of project management.

### *Initiate*

The Initiate phase corresponds to the Plan stage of PDCA and the Define stage of DMAIC. During the initiation of the project, Lean and Six Sigma practitioners seek to understand voice of the customer to develop a thorough understanding of stakeholder requirements—avoiding a common source of project failure.

Project managers have always been aware of the importance of stakeholder requirements—this is not a new idea. The difference with Lean project management is the emphasis that is placed on identifying and validating customer requirements *throughout* the project life cycle.

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\* We discuss PDCA (Plan-Do-Check-Act) in Chapter 2 and Six Sigma's corresponding DMAIC (Define-Measure-Analyze-Improve-Control) in Appendix B.

Traditional PM	Lean PDCA	Six Sigma DMAIC	Lean/Six Sigma Tools
Initiate	Plan	Define	A3 / Voice of the Customer / Gemba
Plan	Plan	Measure/Analyze	PDCA / Root Cause Analysis / VSM
Execute	Do	Improve	Micro-PDCA
Monitor and Control	Check/Act	Control	SMART Targets / Statistical Analysis
Close	Act	Control	Lessons Learned / Hansei

**FIGURE 9.8**

Five phases of project management, Plan-Do-Check-Act (PDCA), and Define-Measure-Analyze-Improve-Control (DMAIC). VSM is value stream mapping. Lean/Six Sigma Tools are explored in Appendix B.

Often stakeholder requirements are defined by the project manager or a small part of the project team. Once gathered, a report is created, filed, and a checkbox is marked complete. The entire team may not even see the final report. Employing voice of the customer, Lean involves stakeholders and team members at a more intimate level throughout the project. With each PDCA cycle, customers are reengaged to further define value, validate understanding, and adjust to changing needs. This can only be accomplished when teams proactively engage with stakeholders and customers.

Far too frequently, teams perform their analysis of the current state without leaving the comfort of the team meeting room to talk with the people performing the work, those who supply the inputs, and those who receive their output. Lean stresses *going to gemba*, where the work is actually performed and value created, to witness firsthand the flow of information and work, to see what's really happening. Project teams should go to gemba regularly throughout the project to validate facts and develop deeper levels of understanding. In IT, this also includes observing users as they work with applications and walking through processes with associates step by step.

In multisite organizations, frequent visits to gemba may be impractical. The next best alternative is to regularly share the latest A3 and value stream map with other sites and follow up with conference calls and videos of gemba visits. Use technology to stay close to your stakeholders,

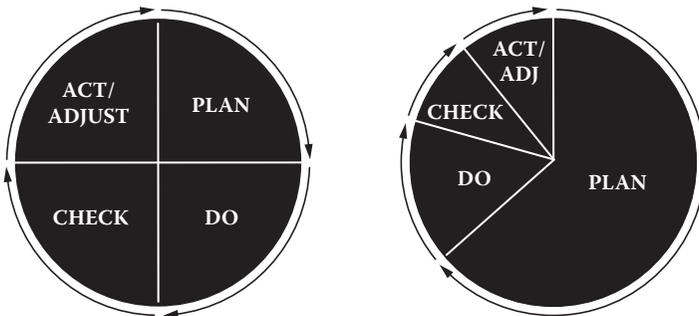
deepen your understanding, and hear the voice of the customer. A web-based obeya room is also effective to communicate issues and project status across multiple locations.

### Plan

In some organizations, planning is perceived as delaying *real* project work (execution) so we rush through the planning stage in order to get busy. The problem with this approach is that we end up *mistaking activity for productivity*. It's counterintuitive to many, but to speed up a project and successfully deliver value, you must first slow down! A common misperception is that the Plan-Do-Check-Act cycle is divided into four equal quadrants, each taking roughly the same amount of time. The left side of Figure 9.9 shows this common understanding, although in many organizations, planning doesn't even receive 25 percent of the total elapsed project time.

As shown on the right, more time should be invested in planning activities than in the other three steps combined. Projects have a significantly greater chance of success when teams thoroughly grasp the current state, go to gemba, understand stakeholder value, gather data, measure activity, and develop and test multiple countermeasures (all planning activities).

As the duration of a project increases, the chance of project failure also increases. Companies that apply Lean project management divide projects into shorter phases (this is also discussed in Chapter 8 as an element of Lean software development). To reduce risk, we recommend decomposing larger projects into 90-day stages of limited scope and specific milestones.



**FIGURE 9.9**  
Plan-Do-Check-Act time allocation.

This simple technique maintains team focus on current problems and deliverables, creating a sense of urgency while reinforcing the need for effective teamwork.

Shorter projects with a focused scope reinforce iterative learning and adjustments based on facts. In the *Harvard Business Review* article “The Truth about IT Costs,” Susan Cramm explains, “Limiting project scope makes projects less risky and more likely to succeed. That, in turn, increases buy-in for subsequent stages.”<sup>6</sup> This is not a Lean project management invention, but it is Lean in its approach: rapid iterations support rapid discovery and superior results.

Organizations need to be aware of cultural implications when adopting shorter, iterative-cycle projects. Many companies are accustomed to using fixed scopes, budgets, and schedules to hold people accountable for results. In order to gain buy-in and support, senior management must be comfortable with an iterative rapid-cycle approach. While accountability is created with smaller scopes and project phases, some cultures are not initially comfortable with a more fluid, recursive style. In Lean organizations, as shorter cycle projects become the norm, the PDCA cycle becomes standard practice.

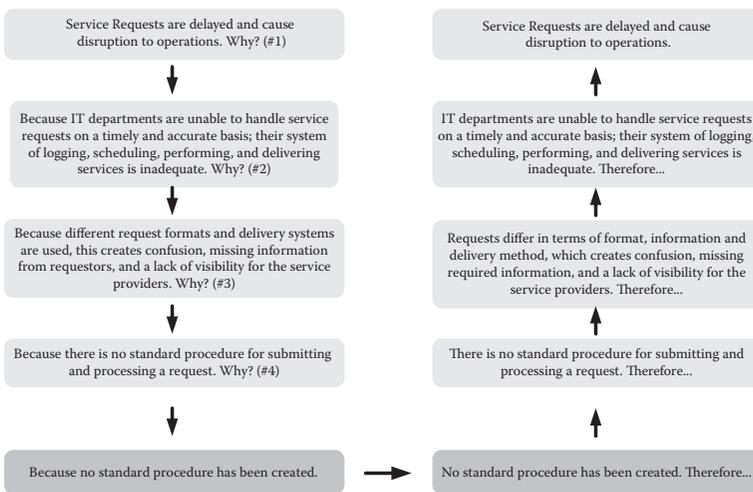
Both Lean product development and Lean software development utilize rapid project cycles. Each development round represents a complete PDCA problem-solving cycle. As cycles increase (duration decreases while speed increases), so do the learning, understanding of root causes, and value generation. For example, Lean software development (also known as *agile*, see Chapter 8) has transformed software development from lengthy, broad-scope, *big-bang* projects lasting many months (or years) to nimble, customer-driven, limited-scope, iterative development efforts lasting weeks or months.

During the Plan phase, Lean and Six Sigma stress current state measurement and analysis. Root cause analysis directs our focus beyond symptoms to systematically address the origins of problems. This is the heart of A3 thinking and PDCA, which are reflective in nature; an improvement is made, and based on results, the next step is determined. Two of the most effective root cause analysis methods are Five Whys and the Fishbone Diagram (see sidebar “The Five Whys”).

Value stream mapping plays a central role during the planning phase as the team grasps the current situation, builds consensus, and begins to develop potential solutions. During mapping the gathering of baseline

## THE FIVE WHYS

The Five Whys is the simple method of asking, “Why?” repeatedly until the root cause of a problem is uncovered. Normally the root cause is reached by the time we ask the fifth *why*. When the team believes it has identified a root cause, it works backward using “Therefore...” to test its logic and ensure it hasn’t missed a step in the sequence. For example, if the team investigating IT service request delays would have used the Five Whys, it might have gone as follows:



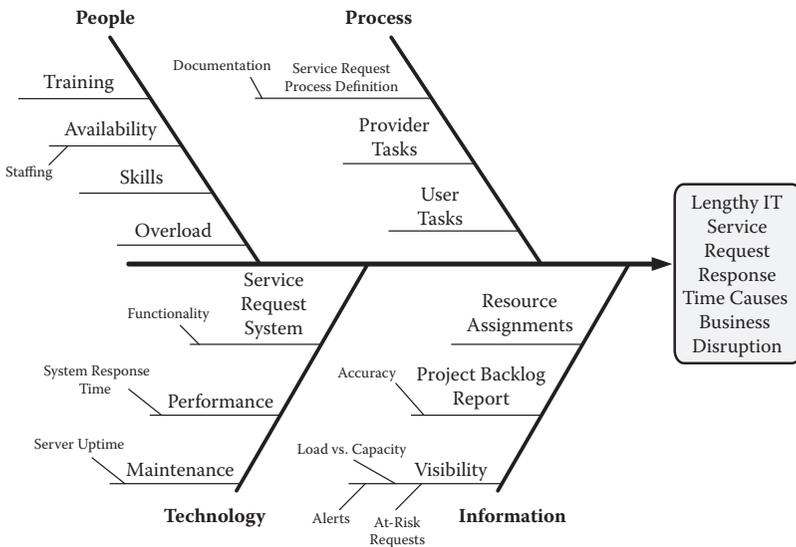
Had the team performed root cause analysis, it may have discovered that there was a need for improving underlying business processes and developing standard work *before* considering technology-based solutions (a common theme throughout this book).

## THE FISHBONE DIAGRAM

The fishbone\* diagram is an effective tool to identify potential causes of a problem. In the following diagram, the goal (improve IT service request response time) is analyzed using categories to identify and organize inputs and possible causes—in this case, people, process, technology, and information. Other categories might include measurements, information, policy, equipment, materials, maintenance,

\* The fishbone diagram was invented by Kaoru Ishikawa in the 1960s and is also known as an Ishikawa diagram or cause-and-effect diagram.

suppliers, systems, management, regulation, culture, and environment. Teams begin with a blank diagram showing only the fishbone skeleton and the problem, event, or goal. The team then applies brainstorming to fill in the diagram. Brainstorming is a problem-solving approach where a group defines a problem or goal and then captures as many ideas as possible around the potential cause or solution. The focus is on collecting ideas with no filtering, criticism, or evaluation during the brainstorming session. The power of this cause-and-effect analysis is that it sets the context for improvement, so technology and automation are not the first reaction.



Once the team has identified potential causes, and themes begin to emerge, it begins to envision potential improvements, develop a future-state value stream map, set targets, prioritize efforts, and take action.

data helps teams to truly understand how information, work, and materials flow to the customer to deliver value. The current and future state value stream maps are updated throughout the project as facts are gathered and comprehension deepens.

Before project execution, the team gathers baseline data for all targets, providing a fact-based starting point from which to assess project gains

and accurately apply PDCA. Teams often overlook this step in their excitement to begin making improvements. In our experience, discoveries during the collection of baseline data lead to a deeper grasp of the current situation, a fine-tuning of the measurements to be used, and ultimately the development of more effective countermeasures.

Lean encourages the use of *SMART* targets, an acronym which stands for specific, measurable, actionable, realistic, and time-based. For a measurement to be *actionable*, the team must have the accountability, responsibility, and authority to make improvements. In the Plan phase, during the creation of the A3 (or problem statement within a project charter), the team develops project metrics and works with the project sponsor to reach agreement on SMART targets.

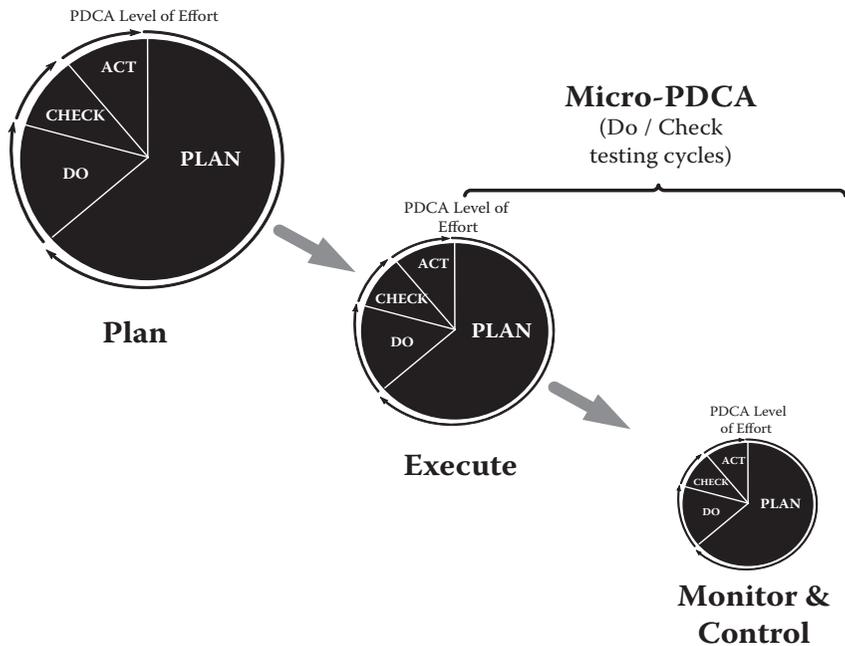
Many process improvement projects do not require the sophisticated measurements or precise statistical analysis offered by Six Sigma. However, when projects involve reducing the *variation* of a process, especially high-volume and transactional processes, statistical analysis may be appropriate. For example, returning to our hypothetical project to improve IT service request response time, statistical analysis could be used to assess such factors as the day of the week the request is made, or the type of service requested, to determine how strongly each affects response time. By ranking the probability\* of the correlation between the cause and effect of different variables, teams use statistical analysis to isolate root causes and prioritize improvements efforts.

### **Execute**

By the time the team has reached the Execution phase, predictions have been made, and potential countermeasures have been developed, tested, and prioritized. In addition, baseline data have been gathered and measurements are in place to objectively assess the impact of the improvements about to be made. During implementation, project teams are constantly responding to change and making adjustments. What is often missing is a closed-loop feedback discipline to assess the impact of actions taken, validate results, and provide the basis for future actions. During these phases, Lean project management employs rapid-cycle *micro-PDCA* to accelerate problem solving. Ideally, each successive cycle is faster and more focused than the last. Figure 9.10 illustrates this relationship.

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\* Six Sigma uses hypothesis testing to determine the probability that the correlation between dependent and independent variables is due to random chance.



**FIGURE 9.10**  
PDCA applied at three phases of the project life cycle.

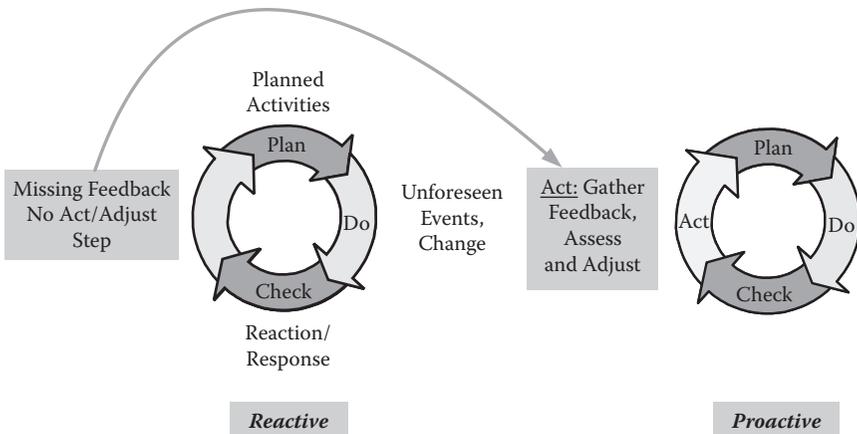
### **Monitor and Control**

During the Monitor and Control phase of a project, measurement of targets against baseline data collected during project planning provides invaluable feedback with which to make course corrections and adjustments. Lean and Six Sigma provide a rich set of measurement techniques ranging from simple observation and checklists to advanced statistical analyses.\*

To effectively monitor and control the impact of unforeseen events and planned change, PDCA is applied at a micro level,† making a complete cycle *within* the project execution phase (see Figure 9.3). Figure 9.11 compares proactive PDCA with the informal reactive system we frequently encounter.

\* See *Six Sigma Statistics with Excel and MINITAB*, by Issa Bass.

† Macro-PDCA refers to the entire process of solving a problem, from problem definition through implementation and adjustment. Micro-PDCA loops occur within the testing cycle of each proposed countermeasure—the iterative Do-loops within the macro-PDCA cycle.



**FIGURE 9.11**  
Reactive versus proactive project execution, measurement, and control.

The left side of the illustration depicts the reactive approach to unforeseen events and the impact of unanalyzed change. Without feedback and intentional evaluation, the energy of the team is spent responding to unanticipated events. These projects experience a self-inflicted chain of reactive activity (unplanned work), distracting the team from delivering value, causing delays, and increasing costs. Project management frequently includes a formal assessment of results, but this is often at the *end of the project*. Our experience suggests that the degree to which project teams proactively gather feedback and assess the impact of change *during the project* varies greatly. Lean addresses this issue head-on with micro-PDCA.

On the right side, proactive Lean execution, measurement, and control are shown. Based on the scientific method, the appropriate next step is determined by observed feedback. Simply by closing the loop, reflection and learning take place. Projects that apply this rigor stay focused, making informed adjustments based on the facts.

### **Close**

The final phase of project management hinges on the acceptance of project deliverables by the system users, process owners, customers, and other stakeholders. A review meeting usually is held to identify *lessons learned*—what went well, what challenges were encountered, and what was learned

along the way. Process documentation is updated, and project records are completed and archived. Often lessons learned are filed away and never seen again. Lean uses lessons learned to make adjustments, applying continuous improvement to project management practices—standardized work. Some organizations utilize knowledge management systems to share lessons learned in order to leverage the experience in other projects and situations.

Lean project management goes beyond lessons learned by applying the concept of *hansei*—Japanese for mindfulness or critical self-reflection. From an individual perspective, you could say *hansei* is *personal kaizen*. *Hansei* cultivates an awareness of your own behavior, reflection on your mistakes, and mindfulness of your impact on others. *Hansei* is being honest with yourself about your own limitations and assuming personal responsibility to improve. They say there is no *kaizen* without *hansei*—you must identify your weaknesses before improvements can be made.

In Lean project management, *hansei* is performed by the team at key milestones throughout the project and should also be done frequently on an individual basis. In fact, the most effective project managers practice *hansei* every day, continually learning from both their successes and setbacks.

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## LEAN PROJECT MANAGEMENT ENABLES THE LEAN ENTERPRISE

At its core, the Lean enterprise is a learning organization. Critical self-reflection cultivates learning. *Hansei* also emphasizes humility; a Lean enterprise is infused with an organizational humility that moves beyond defending individual positions and ownership of ideas, serving the greater goals of the team, the organization, and its customers.

Lean IT and Lean project management reinforce Lean thinking and behavior through the planning and execution of information systems. Waste is removed from information flows, supporting efficient value creation and the unconstrained flow of value to the customer.

Lean project management is an essential component of Lean enterprise transformation. Important not only to large projects, it is a mental discipline necessary for small *kaizen* events as well. For complex, cross-functional, high-risk projects, sound project management is indispensable, but it is not enough.

Think of a challenged or failed project you have experienced or are familiar with. Returning to our list of reasons why projects fail (presented at the beginning of the chapter), ask yourself how many of these hazards could have been avoided if the focus was placed first on understanding and solving underlying process problems through the routine application of A3 thinking, voice of the customer, PDCA, and value stream mapping integrated with sound portfolio, program, and project management.

Applying the principles and tools of continuous improvement, Lean complements the power of conventional project management. Focusing on strategically aligned tactics and value creation, project managers and teams leverage Lean thinking to generate superior project results on a repeatable basis. Lean project management is a capability that should be encouraged across all levels of the organization.

## ENDNOTES

1. Project Management Institute, *A guide to the project management body of knowledge (PMBOK guide)*, 4th ed. (Newtown Square, PA: Project Management Institute, 2008), 9.
2. Project Management Institute, *A guide*, 9.
3. Project Management Institute, *A guide*, 5.
4. Project Management Institute, *A guide*, 6.
5. W. Edwards Deming, *The new economics for industry, government, education*, 2nd ed. (Cambridge, MA: MIT Press, 2000), 50.
6. Susan Cramm, "The truth about IT costs," *Harvard Business Review*, March 2009, <http://hbr.harvardbusiness.org/2009/03/the-truths-about-it-costs/ar/pr>.



## **Section IV**

# **Leadership Roadmap**



# 10

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## *Leading the Lean IT Transformation*

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### CHAPTER OBJECTIVES

In this chapter we will examine the nature of transformational Lean leadership, effective management systems, and the information systems that support them. We will:

- Examine the importance of clear strategic intent in guiding a Lean transformation.
- Explore the Lean management state of mind.
- Establish the importance of leader standard work, and the essential Lean management systems from an IT perspective.
- Learn how to focus Lean IT change efforts on those factors that drive innovation and competitive advantage.

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### HOW TO LAUNCH A LEAN ENTERPRISE TRANSFORMATION

So your organization has decided to embark on the Lean journey. Or perhaps someone in your organization has already started. You've probably heard the stories of enthusiastic change efforts that somehow lost momentum, gradually slipping back into old habits. You want to avoid this common fate, doing what it takes to achieve *escape velocity*, launching yourself toward a self-sustaining Lean enterprise transformation.

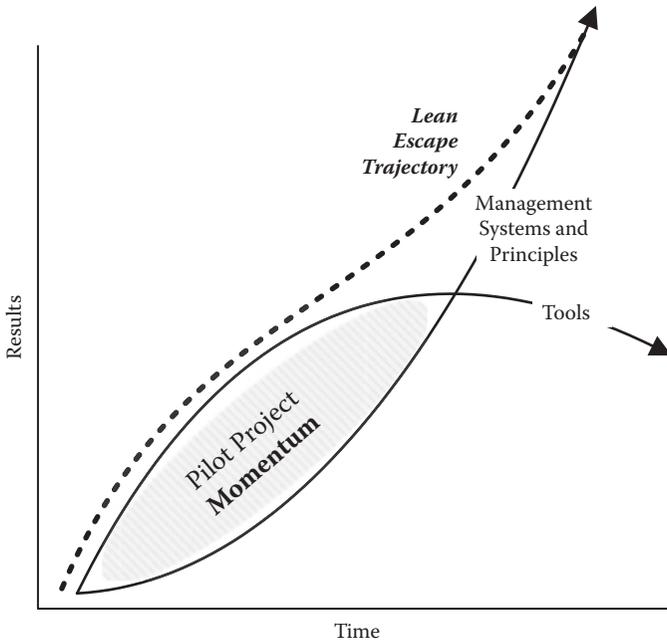
So what is it you're escaping *from*? Like the relentless pull of gravity, there are many sources of inertia that keep organizations firmly entrenched in wasteful behaviors: complexity, complacency, command-and-control management, silo thinking, and conflicting measurements and incentives—backsliding into these old habits is a serious threat to a Lean transformation.

In our experience, most transformations begin with a focus on Lean *tools*, to establish new behaviors and demonstrate quick results. Small teams are given basic training, then concentrate on pilot projects in known problem areas. Led by skilled coaches, these energized teams harvest low-hanging fruit. They rapidly establish initial momentum, promoting early successes to build the widespread awareness and support necessary to expand the effort enterprise-wide. But following this initial launch, an organization must follow along with practical, standardized management systems to sustain progress, and with shared values, principles, and strategic direction to guide continuous, organic, inside-out improvement efforts.

Consistent with our own experience, the Shingo Prize finds that organizations usually begin a Lean transformation at the tools and techniques level (the “know how”) in specific areas of the organization. Ideally, the Lean journey then proceeds to the systems level, creating a more integrated and sustained improvement model. Eventually all employees develop a deeper understanding of principles (the “know why”).<sup>1</sup> At this point, the organization is learning to see waste across entire value streams, as they begin adapting Lean to their own culture.

Experience has taught many Lean practitioners that while tools are relatively straightforward to learn and implement, they alone do not sustain transformation. While some companies may eagerly claim early victories, declaring themselves Lean by demonstrating proficiency with tools and heralding localized successes (islands of Lean in a sea of waste), many eventually slip back into mediocrity.

Introducing Lean management and information *systems* requires discipline, time and reflection. Lean *principles* are even more difficult to embrace, yet they eventually come to influence behavior throughout the enterprise. Values and principles must have time to become internalized within the unique culture of each organization. Nonetheless, it is difficult to begin with values and principles alone, because they are intangible. In order to achieve a sufficient escape velocity and trajectory, an organization



**FIGURE 10.1**  
Lean transformation escape trajectory.

should launch with a focus on problem-solving tools, then *bounce off the atmosphere* established by successful pilot projects (see Figure 10.1), giving the organization time, momentum, and confidence to develop sustaining systems and principles.

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## STRATEGIC INTENT

Research consistently shows that in most companies strategic intent is not clearly articulated, and this leads to a disconnect between strategic goals and daily activities. The better an organization communicates strategy in clear, actionable, and measurable terms, the more successfully the Lean transformation can focus on driving change where it matters most.

There are many perspectives and approaches to strategy, but it all comes down to a few simple questions. How does an organization define and

differentiate itself in such a way that customers prefer it over their competitors? What are the activities the organization must engage in to achieve this status? And how do they sustain competitive advantage over time, as their competitors constantly try to capture market share?

More important, in our opinion, than the details of an organization's strategy at any point in time is how well everyone in the organization understands the *strategic intent*, and how this understanding guides their daily thoughts, behaviors, and decisions.

Strategy and strategic intent are very different. Strategy is often defined as a *specific plan* toward a goal, based on a current-state assessment of resources and the opportunities to utilize them to greatest advantage. Two commonly noted weaknesses of the traditional strategic-planning process are that it generally encourages a top-down perspective, and it is usually incremental in nature—next year's strategy is often overly influenced by this year's challenges. In addition, excessively regimented strategic-planning and budgeting efforts sometimes stifle the very innovation they hope to inspire.

On the other hand, strategic intent is about *purpose and resourcefulness*, based on the collective vision and creative potential of the entire organization. Strategic intent harnesses the *wisdom of the anthill*, the idea that shared goals lead to decentralized coordination within an organization. Shared goals guide daily decisions, where the entire organization is capable of coherent, systemic activity and self-guided evolution. Strategic intent catalyzes leadership throughout all levels of the organization by creating a shared purpose, pursuing objectives that are often below or beyond the horizon of the annual planning and budgeting cycle.

Strategic intent is fundamentally allied with the cornerstone Lean principle described in Chapter 2: *constancy of purpose*, which often leads toward challenging, even seemingly unattainable goals while inspiring teamwork, problem solving, and innovation. For example, constancy of purpose enabled Toyota, over decades of relentless effort and focus on unbending principles and values, to systematically overtake the U.S. auto industry. In 1961, President John F. Kennedy established constancy of purpose with a measurable target: *challenge an entire country* to land a man on the moon and return him safely to earth within the decade, saying, "In a very real sense, it will not be one man going to the moon, it will be an entire nation. For all of us must work to put him there."

Neither of these efforts seemed possible when the strategic intent was communicated, nor was there a detailed plan to get there—that too would have been impossible and, in fact, would have inhibited the necessary process of experimentation, discovery, and learning. But these challenges harnessed and guided enormous, sustained, collective resourcefulness toward a shared vision, one small experimental step at a time.

In 1989 Gary Hamel and C. K. Prahalad published the classic *Harvard Business Review* article “Strategic Intent,” where they declared, “Strategic intent is like a marathon run in 400-meter sprints, providing consistency to short-term action, while leaving room for reinterpretation as new opportunities emerge.”<sup>22</sup> For a learning organization, strategy is a rapidly moving target—which is very difficult to compete against. To support this agility, every activity of the enterprise should be reinforced through continuous, rapid feedback cycles (PDCA) triggering instant, adaptive responses—the essence of an enterprise-wide digital nervous system.

Once an organization formulates its purpose, and effectively communicates this as its strategic intent in terms of long- and short-term goals, it must then establish measures that assess progress against those goals, supported by management systems that quickly signal and address deviations. While financial measures are important for many reasons, sole reliance upon them is not only incomplete but also harmful. Our recommendation for a comprehensive measurement approach is based on the Balanced Scorecard (discussed in Chapter 6) where performance is measured across four complementary dimensions: financial, operational, customer satisfaction, and employee learning and innovation. For an organization to be healthy in the long run, these four dimensions must be kept in balance. If any one dimension is neglected, it leaves a flank exposed for the competition to exploit. Especially important to strategy, and challenging to measure, are the dimensions of customer satisfaction and employee innovation and learning. These are vital to driving continuous improvement, since they represent the voices of your customers, and your organization’s ability to listen and respond to them appropriately.

To the extent that an organization can define its strategic intent and establish effective measurements, it has the necessary foundation to *standardize* strategic execution. Measures become the targets that direct improvement and innovation. They guide IT prioritization decisions in particular, and *strategy deployment* in general, across all dimensions of the enterprise.

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## LEADERSHIP IS A STATE OF MIND

Effective management systems depend on effective leadership, and constancy of purpose provides the direction which enables everyone to focus on a shared goal. The essence of Lean leadership is to cultivate and coach people and teams, while developing management processes and information systems that shift problem solving and decision making deeper into the organization, into the hands of those on the front lines, and closer to the customer.

Senior management must *initiate* the Lean transformation from the top-down, demonstrating a commitment to the long-term challenges that true and lasting change will pose. But once begun, Lean transformation cannot be effectively controlled from the executive suite, in a top-down fashion. Nor can it be an outside-in process, driven by external consultants. Authentic transformation must grow from the inside-out, and *leadership* should be placed into the hands of everyone in the company.

According to Dr. Stephen Covey, true leadership is not something that automatically happens once a person is given a title. “Leadership is a choice, not a position,” he counsels. “Leaders who have to borrow their authority from their title will not be as effective.”<sup>3</sup> *Everyone* can practice individual leadership.

Effective leaders create positive energy. Rather than focusing on “What’s wrong with where we are?” effective leaders start with “What do we do well, and what will it take to get where we want to be?” Always beginning with an emphasis on what they do well, a positive-minded *solution orientation* develops openness and involvement, and an atmosphere best suited for generating creative solutions.<sup>4</sup> This spirit of *hansei*—humility, mindfulness, critical self-reflection, curiosity, and experimentation—characterizes an authentic Lean enterprise.

In *Good to Great*, Jim Collins rigorously analyzed the performance of 1,435 companies, searching for empirical evidence of a sustained company transformation that far outperformed the competition over 15 years or more.\* His team discovered many contributing factors to sustained greatness, but most surprising was the nature of extraordinary executive

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\* Collins and his research team began with 1,435 companies that had at some point been among the 500 largest, going back to 1965. They then searched for companies that made a shift from good to great performance—meaning they generated cumulative shareholder returns greater than three times the market average over 15 years. They found 11 companies that met these criteria.

leadership. This was not the high-profile, often overbearing leadership of celebrity CEOs; rather, just the opposite—what they described as *Level Five leadership*—was found to exist in *all 11* Good to Great companies.

Collins and his team describe a Level Five leader as one who “builds enduring greatness through a paradoxical blend of personal humility and professional will.” A Level Five leader is characterized as self-reflective, modest, and humble—yet extremely determined, with a nearly fanatical will to develop the company and his or her own leadership successors. In over two-thirds of the not-so-great companies, the chief competitors used for the comparisons, Collins and his team found the presence of a “gargantuan personal ego that contributed to the demise or continued mediocrity of the company.”<sup>5</sup>

These fundamental human characteristics of humility and self-reflection must be practiced and nurtured, starting at the very top. Senior management must consistently walk the talk every moment if they are to set an example that influences organizational culture in the desired direction. As the coauthor of *The Machine That Changed the World* (the book that originally popularized the term *Lean*), James Womack\* regularly visits organizations on the Lean journey. What he often finds are the tools of Lean, but not the authentic leadership practices.

For example, he often witnesses traditional management decision-making behavior from the top-down, going through rituals and applying habitual remedies to unique problems, which are then cut and pasted into A3 documents and strategy deployment scorecards, creating the *appearance* of disciplined problem-solving behavior and catchball-driven strategic alignment. While these deceptions may not be intentional or conscious, they demonstrate how traditional patterns of behavior can become deeply rooted in our thoughts and actions.

Womack describes four essential *Lean management states of mind* that must be cultivated for an authentic transformation:

1. The Lean manager eagerly embraces the role of problem solver.
2. The Lean manager realizes that no manager at a higher level can or should solve a problem at a lower level—problems can only be solved where they live, by those living with them.

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\* James Womack is founder of the Lean Enterprise Institute (LEI), a nonprofit education, publishing, and research organization dedicated to the promotion of Lean thinking worldwide (see [www.Lean.org](http://www.Lean.org)).

3. The Lean manager believes that all problem solving is about experimentation by means of Plan-Do-Check-Act.
4. The Lean manager knows that no problem is ever solved forever. Indeed, the introduction of a promising countermeasure is sure to create new problems at some other point in the organization. This is not bad. It is good, provided the critical, probing mind of the Lean manager keeps on the case in pursuit of perfection.<sup>6</sup>

The Lean manager bestows both problem-solving and many decision-making responsibilities where they belong, closest to the work and the customer. At its core, Lean leadership and transformation are thus more of a social than a technical process. But beyond this essential leadership state of mind, there must be standard work in the form of management systems that effectively link goal-setting and decision-making processes, with no wasted time, effort, and resources. And we all know how much waste plagues the typical management system.

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## THE IMPORTANCE OF EFFECTIVE MANAGEMENT SYSTEMS

According to Kaplan and Norton, originators of the balanced scorecard, a management system is defined as “the integrated set of processes and tools that a company uses to develop its strategy, translate it into operational actions, and monitor and improve the effectiveness of both.” They suggest that “breakdowns in a company’s management system, not managers’ lack of ability or effort, are what cause a company’s underperformance.”<sup>7</sup> In their *Harvard Business Review* article “Mastering the Management System,” Kaplan and Norton explore elements of an effective management system. They explain that successful strategy execution has two basic rules: understand the management cycle that links strategy and operations, and know what tools to apply at each stage of the cycle. This points to several themes familiar to Lean practitioners: cadence, flow, and leader standard work.

The cadence of a management system facilitates the smooth flow of decision making and should match the pace of change in the organization.

While some industries are naturally faster moving and more dynamic than others, the pace of change has increased for all; today no organization is immune to sudden disruption, threats, and opportunities. Thus a Lean enterprise relies on the management system's ability to match decision-making cadence to the tempo of the market, and of its customers, quickly responding to unanticipated events—ideally driving change rather than reacting to it. Short cycles of collaboration, problem solving, and decision making (PDCA) promote rapid learning and agility.

In our view, there are five essential management systems that guide the Lean enterprise transformation: strategy deployment, demand management, business process management, and project/program/portfolio management, all coordinated by sound governance practices.\* As you might expect, information, information systems, and the IT organization play a vital role in their performance.

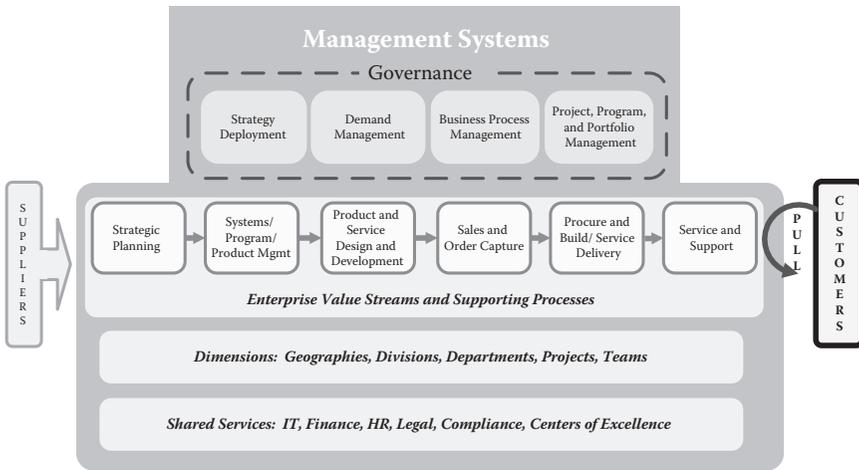
## Strategy Deployment

As we explored in Chapter 6, strategy deployment encourages a holistic focus across all dimensions of the organization (the Lean principle of systems thinking), acting as a compass to align daily activity with strategy. Through rapidly iterative goal-setting and review cycles, the catchball process encourages proactive two-way communication, rapid fact-based learning, and agility. From an organic perspective, strategy deployment acts as the organization's distributed nervous system, continuously scanning the environment for exceptions, problems, threats, and opportunities. (Figure 10.2)

Strategy deployment may first be established enterprise-wide, starting with an articulation of strategic intent and strategic objectives, communicated throughout the dimensions of the organization as measurable targets. On the other hand, progressive IT leaders may first introduce strategy deployment from within the IT organization, encouraging its integration with other functions of the enterprise over time. In this latter case, senior IT management must make a special effort to determine the strategic intent and goals of the enterprise, and how the IT organization best serves them—a necessary dialogue in *any* case.

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\* There are clearly many more management systems required to run a business, but we are focusing on those which are central to enabling and sustaining the Lean transformation.



**FIGURE 10.2**

Essential management system framework for the Lean transformation.

## Demand Management

As we explored in Chapter 5, every value stream should engage stakeholders to continuously level demand and balance capacity. The cadence of this balancing act should be synchronized with the delivery cycles of the particular industry, but generally the demand management process occurs on a standard monthly cycle. While demand management originally evolved in supply chain industries (as sales and operations planning [S&OP]), the fundamentals are now being successfully applied across many industries. After all, what organization does *not* need to balance demand from customers with their capacity to deliver?

When a disciplined demand management collaboration process takes hold, value stream flow is stabilized (mura reduced) and resource overload is avoided (muri reduced). Under these conditions, departments and teams experience a reasonable workload, so they can focus on the development of people and on the design of work processes that flow smoothly without interruption (muda reduced). Once the discipline and cadence of demand management become routine, organizations can identify and respond to changes quickly with limited disruption to operations, suppliers, and customers.

As Lean practitioners learned in the manufacturing world decades ago, just-in-time delivery can only be sustained when demand is reasonably

level, without frequent spikes and unplanned disruptions. For this reason, demand management plays a key role, actively engaging with the customers of the IT organization to identify and prioritize requirements. By minimizing schedule changes so the rate of demand is level (smooth over time, matching the capacity and pace of delivery), the backlog is kept at a manageable size and delivery of IT services and projects can be rapid, responsive, and continuous.

## Business Process Management

As we explored in Chapter 4, business process management (BPM) treats enterprise processes as vital, intangible corporate assets that embody the competitive advantage and intellectual property of the enterprise. A clear and relatively uncomplicated logical model of enterprise processes, interrelationships, ownership, and measurements helps to establish a necessary foundation for prioritization of improvement opportunities so that enterprise resources may be utilized to their greatest advantage. Put another way, until an organization can describe its portfolio of business processes, explain their strengths and weaknesses, and assess their relative impact on achieving strategic goals, there is little basis for *fact-based* prioritization regarding their improvement.

In many organizations, simply identifying the portfolio of processes can be difficult, since so many regular activities consist of undocumented practices, tribal knowledge, and habitual behavior, rather than documented standard work. On top of this, many organizations learn that the most difficult part of BPM is not identifying their processes, but determining who owns them and what their targets and relative priorities should be. Applying a formalized BPM approach\* (accompanied by value stream mapping, problem-solving tools, and clearly defined process ownership) provides a foundation that promotes understanding and consensus, leading to sound prioritization and decision making. In fact, we can argue that until the enterprise process portfolio is defined, the linkages of the strategy deployment process, where strategic goals are associated with processes and their targets, are not clearly understood (more on this later in the governance section).

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\* As we discussed in Chapter 4, in many cases this should not require a significant investment in sophisticated BPM software; focus first on developing a simple, manageable approach to cataloging your processes.

The IT organization often plays the natural role of process leaders and architects, providing oversight and guidance to enterprise-wide business process management. But business stakeholders must play the role of process owners, with accountability, responsibility, and authority for the continuous improvement and innovation of each value stream and supporting process.

## **Project, Program, and Portfolio Management**

As we explored in Chapter 9, sound project, program, and portfolio management discipline and practice are essential throughout the enterprise, not only to large-scale efforts, but also on the smaller kaizen activities. Teams should constantly practice A3 thinking in order to understand and address root causes of problems, rather than jumping to solutions and focusing on potentially non-value-adding deliverables.

## **Governance**

We are introducing this overarching management system here for the first time and will do so only briefly. *Governance* is a troubling word to some, evoking visions of regulation, bureaucracy, endless delays, and unnecessary complexity. As a result of many recent corporate scandals, though, corporate behavior is now under close public scrutiny. Beyond its ethical and regulatory implications, good governance practices are necessary to ensure that decisions are made in a consistent and high-quality manner. Governance is “the collective set of procedures, policies, roles and responsibilities, and organizational structures required to support an effective decision-making process.”<sup>8</sup> Every organization practices governance, whether formally or informally, transparently or mysteriously.

From the perspective of process improvement, good governance supports a process where accurate information about the cost, risk, and benefits of each proposed initiative is made available, so they can be weighed against the needs of other initiatives and operations competing for the same limited resources. Effective governance is essential for a Lean enterprise to function, providing transparency so all stakeholders have confidence in the decision-making processes that guide the enterprise. This does not mean that stakeholders will always agree on every decision, but if they believe the decisions are approached thoroughly and fairly, with an

opportunity for all parties to express a concern or suggest an alternative, then the likelihood of consensus and support is far greater. And remember, consensus is not unanimous agreement, but general agreement where dissenting opinions are respected (the Lean principle of *respect for people*) and where all team members agree to support the decision of the group through each PDCA learning cycle.

Leadership must walk a fine line, establishing sufficient governance to ensure thorough evaluation of initiatives, but with clear and simple decision-making rules and processes, so when the time comes for a decision to be made, it is done with clarity and confidence. In *The Toyota Way*, Jeffrey Liker describes the effective decision-making discipline of a Lean enterprise: “Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.”<sup>9</sup>

According to Peter Weill and Jeanne Ross in *IT Governance*, corporate governance regulates decision-making processes for six interdependent enterprise assets: human, financial, physical, intellectual property, IT, and relationships.<sup>10</sup> In a symbiotic relationship, IT governance is thus subordinate to corporate governance, yet at the same time IT governance (and the information and information systems managed by the IT organization) supports a properly functioning corporate governance process.

When corporate and IT governance are working properly, a framework is created for assigning *decision rights*, establishing formal responsibility and accountability for determining how scarce IT resources are allocated to operations, projects, and continuous improvement activities. Governance prevents the IT organization (as well as other functional areas) from independently making and later being held solely responsible for decisions, while at the same time ensuring that business stakeholders assume their responsibility to participate in making good IT decisions. To be effective, the governance process requires prioritized direction (strategy deployment), defined interdependencies (business process management), and the management of operational constraints (demand management) in order to make informed decisions on the allocation of scarce resources.

In addition, governance requires effective project, program, and portfolio management for planning and execution. The Project Management Office (PMO) is a common element of corporate and IT governance, where the Project Management Center of Excellence (CoE), the Lean CoE, senior management, and stakeholders from the business and IT organizations

come together regularly to make such resource allocation decisions, and in general manage the IT and other enterprise priorities including kaizen\* and project portfolios.

As we explored in Chapter 9, centers of excellence are not part of the management hierarchy, but are a shared service providing enterprise-wide competency and support in specialized disciplines. Smaller organizations may not maintain permanently staffed Center of Excellence support organizations; in this case, the functions of a CoE in various domains (such as Lean, project management, compliance, and safety) should be provided through internal subject matter experts, ideally with a formal role and time allocation. Even the smallest companies will benefit from disciplined practice and standard work in these important areas of enterprise competency, creating an environment of consistency and stability where continuous improvement and innovation may thrive.

Many large organizations, on the other hand, already have established CoEs and disciplined governance processes in place. But as we explored in Chapter 4, the nature of many of these governance processes is compliance oriented, attempting to *inspect* quality and compliance into the processes by monitoring outcomes, thus often contributing more waste than value. These organizations should apply Lean thinking to support the continuous improvement of their existing governance processes, and the activities they monitor and control, which leads to greater overall compliance as a natural outcome. The emphasis shifts from process outcome inspection and correction to process improvement, adding long-term value.

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## THE THREE LEVELS OF A LEAN MANAGEMENT SYSTEM

The management systems just described (as well as others commonly found within the Lean enterprise) must work together, with information, human interactions, and decisions flowing at a stable and sustainable cadence. But considering the many dimensions of the typical enterprise, and the many interactions and motivations of the stakeholders, the overall management

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\* The degree to which kaizen activity requires governance relies on its scale (system, process, or daily—see Chapter 2), scope (the amount of shared resources and cross-functional coordination required), risk, and resource requirements.

system framework can easily become overly complex and unwieldy, creating waste that hinders the effectiveness of the Lean enterprise we're trying to create. For a Lean management system framework to be effective, it must be simple to understand and execute, providing structure and guidance while not unnecessarily slowing progress. It cannot be too controlling or rigid; otherwise, it will suppress creativity and learning, hindering continuous improvement and innovation.

Considering the sophisticated and enticing information systems that are now available to automate the various management systems and processes of a modern, global enterprise, it's no wonder that many find themselves mired in information systems complexity. In our opinion, the quest for a completely unified and integrated enterprise-wide management information system composed of interlocking scorecards, dashboards, analyses, and other decision support tools is impractical. Such a 100-percent solution would by definition be too complex, inflexible, unmanageable, and certainly not Lean. Employees shouldn't need a Harvard MBA to understand how their management systems work. There is a historical precedent here: overzealous attempts to improve factory performance with material requirements planning (MRP), introducing sophisticated push scheduling and process control techniques, gave rise to more waste, confusion, and resistance to change, not less. Our recommendation is to strive for simple visual management, supported by an 80-percent software solution that is solid and adaptable, and let human collaboration, communication, creativity, and rapid adaptive learning cycles do the rest.

Thus the nature of Lean management systems, and the information and information systems that support them, must be based on *simple rules*, practiced consistently with minimal waste and at a sustainable, rapid, iterative cadence. In fact, some of the most effective Lean management systems we've seen don't employ computers at the level of daily work, but rely on frequent management gemba walks. While at the gemba, maintaining a focus on visual process measures and visiting teams where the work is done, Lean managers help to identify, solve, and ultimately prevent problems. Thus proactive process monitoring reduces a dreaded cause of waste—*postmortem* meetings where people gather to try and figure out what went wrong some time ago, and how to repair the damage that has been done.

Many managers resist the idea of structured leader standard work in their daily behavior and management systems, believing that it diminishes

their flexibility and authority. But in our experience, once managers truly assimilate Lean thinking into their daily practice, they realize that leader standard work creates stability while improving flexibility, quality, and performance. The effectiveness of *leader standard work* has been demonstrated in many industries where structure, authority, and agility go hand in hand, including airlines, law enforcement, and health care.

More than just providing necessary data for these management systems to operate across all enterprise levels and dimensions (particularly in matrixed organizations), properly designed information systems enable management system processes to *flow smoothly*. Like any other process, teams should value stream map management system processes, identifying workflow and information waste, and looking for ways to apply simple and effective manual, visual, verbal, and electronic information systems.

But more important than the supporting information systems, an effective Lean management system requires simple, clear roles and responsibilities across all levels of activity, to avoid unnecessary complexity and to help the value flow (Figure 10.3):

Executives:

- Set and communicate direction (strategy)
- Guide direction (strategy deployment catchball, system kaizen (kai-kaku) to drive breakthrough change)
- Enable value stream flow: reducing unevenness and variation (mura) and overburden (muri)
- Lead (as if they have no authority) and inspire others to lead with them
- Go see and ask why
- Actively engage in continuous improvement through the practice of leader standard work supported by a regular monthly cadence of PDCA
- Improve the work and improve themselves

Managers:

- Establish basic stability: level demand matched with capacity across value streams
- Communicate strategic direction, align with daily work and process improvement (strategy deployment catchball)
- Go see and ask why



**FIGURE 10.3** Business, Lean, and information systems focus.

- Actively engage in continuous improvement through the practice of leader standard work supported by a regular weekly/daily cadence of PDCA with their associates
- Make time for workers to regularly practice continuous improvement
- Coach change, improvement, and innovation; support cross-functional process kaizen activity; inspire others to lead with them
- Keep problem-solving at the right level, drive decision-making closer to the individuals and teams that interact with the customer
- Improve the work and improve themselves

Teams and individuals:

- Focus on waste reduction, sustain the gains
- Stop the process when an error appears, identify root cause, take corrective and preventative action (quality at the source)
- Improve the work and improve themselves

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## INTEGRATING LEAN IT

It is not enough to just do your best or work hard. You must know what to work on.

—Dr. W. Edwards Deming

Across many industries, billions of dollars are spent each year on IT investments that do not add value or offer differentiation to the customer. What actions can IT leadership take to redirect funding and focus from these routine and wasteful activities toward enabling innovation and competitive advantage?

To address this question, in 2007 the IT Process Institute\* conducted a survey, illustrating the degree of IT strategic integration in quantitative terms. Their methodology identified three IT archetypes:

- *Utility providers:* They provide primary shared services and infrastructure to support basic information management applications.

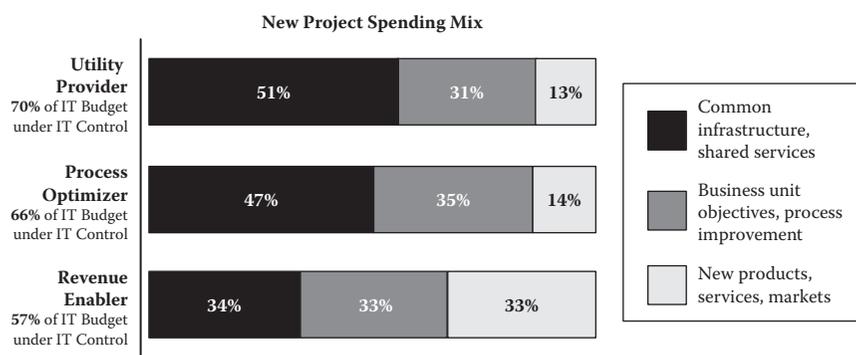
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\* See [www.itpi.org](http://www.itpi.org); this research was built upon earlier research conducted by Forrester Research and McKinsey.

- *Process optimizers*: In addition to the single emphasis of utility providers, process optimizers also focus on enabling business unit-specific objectives via applications that optimize key business functions and processes.
- *Revenue enablers*: In addition to the dual emphasis of process optimizers, revenue enablers also focus on technology to enable unique products and services that capture greater market share and enter new markets.

Among its many insightful discoveries, the survey shows (Figure 10.4) that revenue-enabling IT organizations consistently allocated spending equally among these three areas of emphasis: utility 34 percent, optimizing 33 percent, and enabling 33 percent. Thus, to effectively operate the IT organization as a revenue enabler, the focus, and the competencies it develops, should be balanced across these three dimensions. As the figure suggests, by pursuing operational excellence of utility services (waste reduction) effort and investment can be redirected to revenue-enabling activities. According to the survey, “The proven practices for this group paint a picture that indicates tight integration of IT with the business.”<sup>12</sup>

The results also indicate that revenue enabler organizations have the highest spending on new projects (43 percent, compared to 33 percent for process optimizers and 27 percent for utility providers). Revenue enablers also have a strong track record for rejecting bad projects. These two facts taken



**FIGURE 10.4**  
ITPI survey results.<sup>11</sup>

together suggest agility, complemented by a clear focus on business priorities, where the IT organization is quick to deploy new projects when the customer requests them and is also quick to terminate a project if necessary. The key to such agility (as we explored in Chapter 9) is to keep these projects small in scope and short in duration, so start-stop decisions can be made quickly without causing unnecessary cost, risk, or business disruption.

The results also illustrate the differences in strategic focus, governance, and budgetary control among these three archetypes. IT organizations that act as revenue enablers have less control over their own spending:\* only 57 percent for revenue enablers, compared with 66 percent for process optimizers and 70 percent for utility providers. This clearly indicates tighter integration and stronger collaboration of revenue enablers, since the business shares strategic prioritization and investment decisions with IT.

As the IT organization evolves from segregation, through alignment, toward full integration, the business naturally gains an increasing degree of control over the IT operational budget. This is because more decisions are made by business and IT together, toward shared strategic intent and objectives. Beyond the mechanics of moving more budgetary control from the IT organization to the process owner, there is a fundamental shift in thinking that must occur. IT should be responsible for managing its capacity and efficient delivery of functionality (operational excellence), while business units and process owners should be responsible for the ultimate success of each project—including IT-based improvements and automation of the business process.

When the business assumes ownership of technology-based business process improvement outcomes, a collaborative alliance ensues and the likelihood of project success is significantly increased. IT projects are thus conceived, approved, and funded based on shared strategic objectives—ensuring that constancy of purpose is translated into aligned action.

This indicates a tightly coupled relationship where IT plays two roles in relation to the business: supplier and advisor. On the supply side, demand is collaboratively managed, budgeted, and prioritized across business units, processes, and projects; then it is balanced against available capacity to ensure optimal results for the enterprise as a whole. And as a trusted advisor, IT plays an essential role in business strategic planning and budgeting

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\* Measured as the percentage of IT budget under the direct control of IT governance versus general corporate governance.

decisions throughout the organization. In this way, the business can apply systems thinking to all decisions (supported by A3 thinking, of course) and take advantage of every opportunity to utilize quality information and effective information systems to create value and stay ahead of the competition—or even change the game completely.

Based on the survey results, the authors make several recommendations for IT organizations desiring to achieve this exalted state of strategic integration and enablement, and these recommendations clearly resonate with the message of this book:

- Shift the CIO role toward greater participation in setting enterprise- and business unit-level strategy, goals and objectives.
- Train all IT personnel on business objectives, so they develop a visceral understanding of IT's contribution to competitive positioning and value delivery.
- Matrix IT resources into business units.
- Involve business stakeholders with IT planning and strategy.
- Integrate the IT budget process with the business unit and enterprise budget cycle.
- Match the pace of IT and business change; revenue enablers must shift the IT change paradigm to a velocity-based model.
- Utilize a portfolio management approach to invest in IT initiatives that balance the spending mix across the three areas of focus: utility and shared service, process optimization, and new revenue contribution.
- Formalize a process for assessing the changing needs of the business, and proactively responding to them.

This last recommendation bears close examination, since it suggests a broad goal that IT organizations have been pursuing, often with disappointing results, for years. This points to the value that Lean IT offers as an enabler, and often a driver, of customer-value focused continuous improvement and innovation throughout the enterprise. So, finally, let's turn our attention to how we make Lean IT happen.

## ENDNOTES

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# 11

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## *A Lean IT Roadmap*

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Every organization—not just business—needs one core competence: innovation.

—Peter Drucker

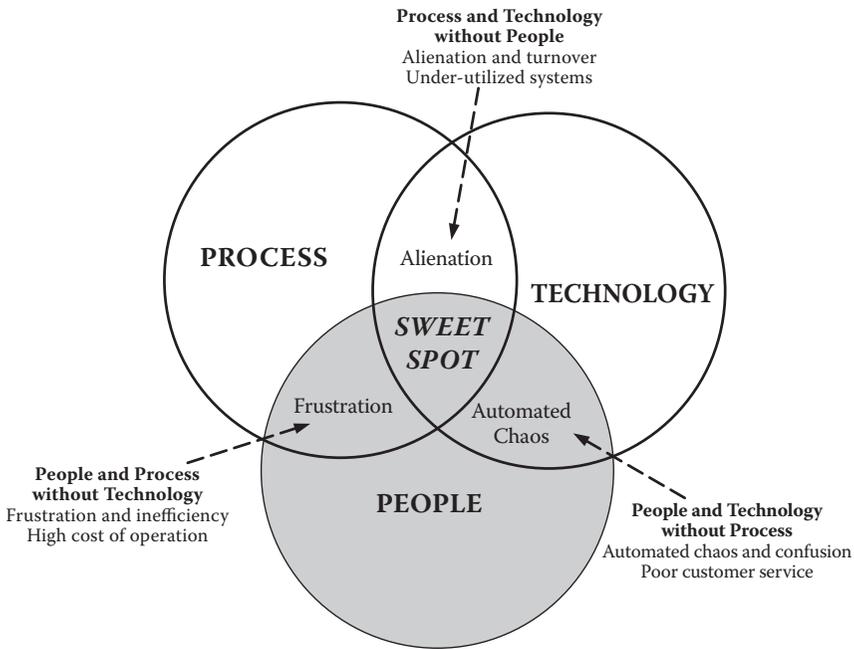
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### **PEOPLE LEAD LEAN IT CHANGE**

The Lean journey must begin with people. After all, people are far more creative, adaptable, and agile than computers will ever be. Lean thinking channels individual strength and collective diversity into continuous improvement and innovation through shared values, behaviors, and management systems—in a word, *culture*. Organizations that learn how to harness the creative potential of their employees can transcend from good to sustained greatness over time.

As Figure 11.1 illustrates, three essential elements—people, process, and technology—must be kept in balance. While no single element should be allowed to become dominant or weak, people must lead the way through the transformation. The bottom line is this: the success of Lean IT, and the future of a sustainable Lean enterprise, relies upon people, process, and technology, *in that order*.

In the landmark 1996 book *Leading Change*, John Kotter set the tone for contemporary thinking on organizational change. He stressed that most corporate change efforts achieve only modest results, while many fail miserably. Kotter cites the natural human tendency to move too



**FIGURE 11.1**  
Balancing people, process, and technology.<sup>1</sup>

quickly, impatiently accelerating change in order to achieve rapid results: “The change process goes through a series of phases that, in total, usually require a considerable length of time. Skipping steps creates only the illusion of speed and never produces a satisfying result.”<sup>2</sup> This is consistent with the Lean maxim: *in order to speed up you must slow down*. Kotter proposes a simple eight-step sequence; Figure 11.2 uses this approach to suggest steps that leaders should (and should not) take toward a successful Lean IT transformation.

We have applied the timeless wisdom contained in Kotter’s stages countless times in our own practice, as have many other Lean leaders we have met along the way. This approach addresses the subtle forces of human nature that are critical to lasting change. While this is an indispensable list, providing general rules for the road, alone it is not enough. A working roadmap needs more specifics to navigate a successful transformation.

Change Stage	IT Leadership Should:	IT Leadership Should Not:
1. Establish a sense of urgency	Help everyone understand that the Lean Enterprise cannot afford a non-Lean IT organization, and the key to IT alignment and agility is Lean Thinking	Underestimate the strength of peoples' comfort zones, and their fear of losing control or self-worth. This is especially important with technical specialists. Kotter notes that over 50% of companies fail on this essential first step.
2. Form a powerful guiding coalition	Educate and communicate with all managers, key stakeholders and subject matter experts, ensure you have critical mass to succeed, and address all concerns. Cultivate emerging leaders outside the existing management hierarchy.	Stop communicating vigorously as the Lean transformation picks up momentum, thinking that everyone understands what you're talking about and why it's important.
3. Create a vision	Get beyond the tactical and emphasize strategic value to the business. Develop a complete roadmap for the transformation, clearly articulate everyone's role and contribution, explain that it will be difficult but attainable. As Dr. Stephen Covey says, "begin with the end in mind."	Make the vision too complicated, seemingly impractical, impossible or unlikely to succeed.
4. Communicate the vision	Communicate often and through multiple channels, promote success stories, openly share lessons learned. Celebrate failures as well as successes to eliminate fear and encourage PDCA.	Undercommunicate, practice old habits of top-down management, communication behavior that sends the wrong message about change.
5. Empower others to act on the vision	Remove barriers, encourage and recognize creativity and innovation, cultivate holistic value stream thinking over localized measures and incentives.	Allow strong willed managers, organization structures, policies, incentives, and entrenched habits to undermine change.
6. Plan for and create short-term wins	Start with pilot projects that are important, but not your biggest challenges.	Under-invest in the factors that will ensure these initial efforts are successful: education on principles, training on tools, coaching, teams, measures.
7. Consolidate improvements and produce more change	Celebrate and promote initial successes, develop culture, principles, infrastructure, and management systems that standardize and sustain the transformation.	Declare victory too soon; the higher you climb, the harder the wind blows. Just when a transformation seems to be taking hold, the problems become tougher and entrenched resistance can become stronger.
8. Institutionalize new approaches	Apply A3 Thinking and PDCA to daily work and decision-making. Develop future leaders that think and act Lean. Emphasize business and IT partnership in all management systems and improvement projects.	Give up or let down your guard. Problems are clever; old habits die slowly. Lean is not a project, or a program, it's a new way of thinking that doesn't go away.

**FIGURE 11.2**  
Stages of the Lean IT Transformation

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## HOW TO START THE LEAN IT TRANSFORMATION

Over the past two decades, a variety of models (including ISO, CMM, and ITIL) have aimed to improve performance of the business and the supporting information and information systems. Some of these efforts have produced significant, though usually localized, results. In most cases, however, these well-intentioned efforts, based on best practice models and methodologies, *have not delivered sustained, enterprise-wide impact*. Why not?

Because a lasting transformation isn't just controlled from the top-down by following a best practices model or methodology, it must grow from the inside-out. A Lean enterprise is agile and adaptable; every individual and team throughout the organization possess *situational fluency*, quickly and naturally responding to changing circumstances with effective problem solving and decision making. Every solution, to be effective, must be unique in the sense that it is experienced, discovered and owned by the teams, who share their different perspectives on the problem and eventually develop a common understanding and goals.

Harmony cannot be imposed from the outside. In order to overcome the traditional separation of IT and the business and achieve integration, they must begin working closely together on critical business processes. This effort is a two-way street: business must take an active interest in information and information systems, and IT must learn to see information waste and value, frequently going to *gemba*—listening to the customer, and experiencing the business process firsthand. This working partnership is a catalyst for enterprise transformation.

So how does an organization deliberately achieve an inside-out transformation? There are countless books that will describe in detail what a Lean enterprise *should* look like: the thinking processes it should embrace, the tools it should use, and the management style and systems it should adopt. But despite all these encouraging prescriptions, the transformation process itself is very difficult to carry out, and even more difficult to sustain. In the end, there is no such thing as a one-size-fits-all prescriptive approach to Lean transformation; it is a fine balance between social and technical, between process and practice, and of repeatable behavior, experiential learning, and continuous adaptation and innovation. Every situation is different. The idiosyncrasies of people, organizations, customers,

and circumstances ensure that what worked last time, in the last organization, with the last team, on the last problem, very likely will not work with the next.

For example, representatives of the aerospace industry were attending a workshop on supply chain integration, a vital element of success in their industry. Speaking to the group was Hajime Ohba, general manager of the Toyota Supplier Support Center. After persistent questioning from the group, which was searching for a prescriptive set of instructions or a checklist approach to guide them, Ohba finally stressed, “Lean is a way of thinking, not a list of things to do.”<sup>3</sup> He insisted that first he would have to go to *gemba* and meet with each supplier to understand its own processes, strengths, and weaknesses before he could suggest a specific course of action.

In the end, strict adherence to an overly structured model or implementation approach alone is certainly not sufficient (and is usually counterproductive) to a lasting transformation. This, in our opinion, is why so many model-based efforts to transform and align IT have been disappointing, since the change was prescribed from without, rather than evolving from within. This is why Lean thinking does not impose a prescriptive approach, but instead offers guidance through structured experiential learning and shared leadership, founded upon timeless, universal principles.

Nevertheless, those seeking a transformation need a *general course* to follow, a roadmap for change charted by those who have gone before, so they can learn from their successes and, hopefully, avoid repeating common mistakes.

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## LEAN IT TRANSFORMATION ROADMAP

In this final section we outline an approach to help you transform your organization into a Lean enterprise, enabled by Lean IT. While this roadmap will not tell you every turn to make, it will suggest a general direction in which to travel and signposts to look for along the way.

So what makes a good roadmap? Foremost, it should provide general guidelines, while allowing autonomy and flexibility for teams and individuals to adapt to each situation—what Tom Peters and Robert Waterman in *In Search of Excellence* describe as *loose-tight*:

Autonomy is a product of discipline. The discipline (a few shared values) provides the framework. It gives people confidence (to experiment, for instance) stemming from stable expectations about what really counts. Too much overbearing discipline of the wrong kind will kill autonomy. The “rules”<sup>\*</sup> in excellent companies have a positive cast. They deal with quality, service, innovation, and experimentation. Their focus is on building, expanding, the opposite of restraining.<sup>4</sup>

Teams should be able to easily understand the intent of the roadmap, quickly making adjustments in response to new facts and circumstances. The roadmap must also adapt to an irregular pace and imbalanced acceptance, since some elements of the organization are usually faster than others to adopt Lean thinking and change their behavior. The *three transformation stages of strategy, planning, and execution* are thus not entirely sequential, but cyclical, continuously feeding back into each other as iterative PDCA loops, signaling slight course corrections with each new experiment and learning cycle.

Finally, a Lean IT transformation roadmap cannot be separated from the overall Lean enterprise transformation plan that it supports. Business and IT must take this journey together, and an effective roadmap must reflect this. Figure 11.3 illustrates our recommended roadmap, based on over 15 years of applying Lean thinking to information systems and enterprise change management.

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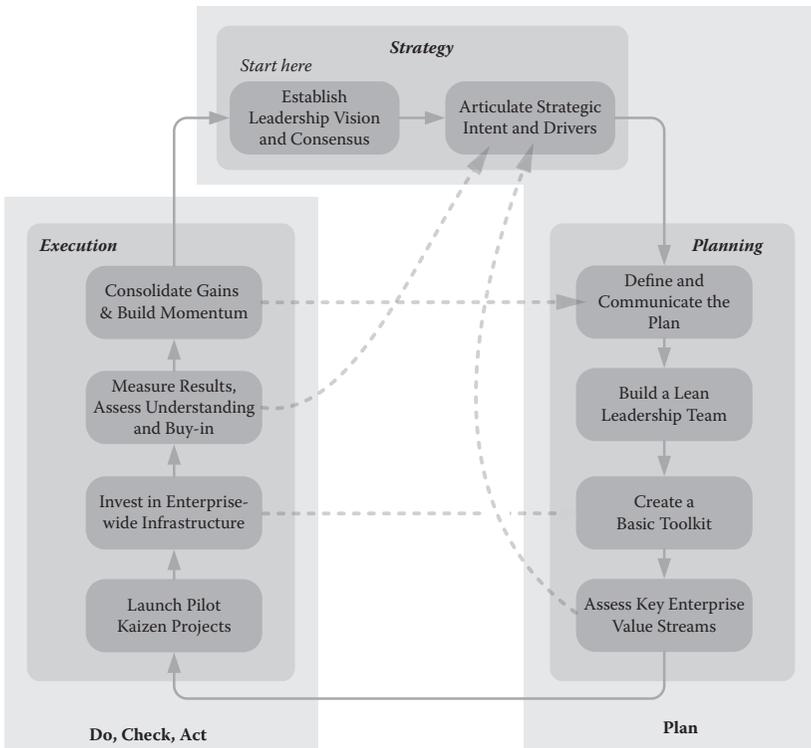
## STRATEGY

### Establish Leadership Vision and Consensus

This effort is usually driven by an executive champion, who initially establishes a sense of urgency; often called the *burning platform*, this is a compelling argument that the organization cannot afford *not* to change in a fundamental way. Consensus is needed on underlying values and principles that will never change. Build on existing beliefs within the enterprise when possible—if too many new principles and values are suddenly introduced, it may cause the existing culture to reject them as

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<sup>\*</sup> In this case, the “rules” are Lean management systems supported by leader standard work.



**FIGURE 11.3**  
Lean IT implementation roadmap.

contrived or disingenuous, just another *flavor of the month*. Where possible, seek to establish and constantly reinforce those timeless Lean principles described in Chapter 2. Senior management should form a Lean transformation steering team representing executive stakeholders from across the enterprise, including strong IT leadership involvement. We also advise that IT leadership form their own Lean transformation steering team, to oversee the IT organization's transformation and ensure its integration with the overall enterprise transformation effort. This is especially critical if the business has been on the Lean journey for some time, and IT is just starting.

Develop within the management team a clear understanding of the importance of a Lean management system, and leader standard work, particularly repeatable behavior, accountability, and cadence. Coach members of the management team, since invariably some will more readily

change their behaviors than others. While some managers may delay as they assess the Lean approach, others (let's be honest) may be consciously or unconsciously resistant to change. One careless senior management intervention opposing the new direction can seriously damage or even derail a transformation. This initial groundwork embodies Kotter's essential first step, creating a sense of urgency, and begins the process for step 2, the formation of a guiding coalition. But the coalition shouldn't end with senior management; it must also enlist all managers, subject matter experts, and thought leaders throughout the organization—more on this in a later step.

### **Articulate Strategic Intent and Drivers**

Senior management must clearly articulate the strategic intent and drivers (through strategy deployment), so stakeholders can focus Lean transformation activities on those issues that will most affect outcomes. IT leadership must actively engage in this process so the enterprise can leverage IT vision and capabilities to their fullest. A word of caution here: in some cases, management may think they know what activities will drive the intended outcomes, but later discover they are mistaken. Often it's not until teams start critically assessing core value streams (using A3 thinking and value stream mapping) that they will begin to clearly understand and quantify the underlying causal relationships hidden beneath layers of unchallenged assumptions. Management's role here is to articulate and constantly reinforce strategic intent, ensuring that teams understand what they're trying to accomplish and why. Management should not define the *how*—that is the work of the associates who must inevitably drive and own the transformation.

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## **PLANNING**

### **Define and Communicate the Transformation Plan**

First, a plan must be developed that identifies targets, and the timing and sequence of activities, while anticipating resource constraints and interdependencies. Although we earlier stressed that an overly prescriptive or rigid framework is inappropriate, nevertheless a plan is necessary to

## IT'S STOP-DOING LIST

Lean IT transformation takes time, so it's important to show some early successes to gain support and gather momentum. It's also necessary to free up time to accelerate the change, since an enterprise can't suspend daily operations just to make time for Lean. We've never encountered a client that had extra time in its schedule, so clearly something must give way. Here we borrow from *Good to Great*<sup>5</sup> the simple idea of a *stop-doing list*, to help you free up wasteful time and energy to focus on launching your transformation.

Let's start with an assumption: just suppose that at least 20 percent of the current IT projects, either underway or planned to start soon, are wasteful from a Lean perspective. The key is for IT and business stakeholders to quickly find these and stop doing them right away. (Of course, if the project is wasteful but necessary to temporarily fix a broken mission-critical process, then you may have no choice but to keep doing it for now.) Our advice is to immediately reevaluate every current project in your portfolio so that purpose and desired outcomes are clear and measurable, and investment is focused on projects that drive real value. And with the application of A3 thinking, ensure that each investment is focused on root causes, rather than mitigating symptoms with quick technology fixes while accumulating a growing burden of technical debt. Set yourself a goal of eliminating at least 20 percent of these projects, which should free up enough time, resources, and mindshare to invest in your initial Lean efforts. This bold step will also send a clear message to all business stakeholders that sound root cause analysis and justification (A3 thinking) will be required for all new project proposals.

communicate objectives and direct the effort. This plan should be developed under the guidance of the steering team to ensure executive support, developing a visceral realization of the breadth, magnitude, and duration of the undertaking. There must be buy-in from the top-down, with clear communication, consistent and supportive action, and focused measurement.

Sequence is important: senior management, middle management, and then associates must understand what is about to happen and why. Goals

must be clear so people are motivated by *strategic intent and shared purpose* rather than just the need to follow management dictates.

Create a high-level visual roadmap showing the steps of the transformation, and how they engage the various parts of the organization over time. Don't over-promise and under-deliver; rather, position the plan as a significant and thoughtful investment based on long-term thinking. Set expectations that an authentic transformation of behavior and culture takes time, discipline, and persistence. It is especially important that managers help their employees make an explicit commitment of time to continuous improvement.

Keep the message simple, visual, and memorable. Reinforce the vision and the reason for change. People must understand value and waste at a gut level, if they are to overcome years of organizational inertia and process scar tissue. Answer the questions that are on everyone's mind: "Why are we doing this?" "How will things be different?" "What challenges do we anticipate?" and "What's in it for me?"

One of the most common failures when leading change is to under-communicate. Update the plan periodically, regularly sharing progress through town hall meetings and other company communications. Senior management needs to take this out on the road and personally deliver the message to everyone, don't delegate this essential message across the layers of middle management. Show everyone where the organization is, where it's going, and the role each individual plays, so they can plan for the effort alongside their regular operating responsibilities. Be creative to catch people's attention, and keep their interest and curiosity.

### **Build a Lean Leadership Team**

Identify change agents that will become your first wave of Lean leaders, the core of your Lean Center of Excellence. Make sure IT associates are well represented here. Look everywhere, since transformational leaders are often found outside the formal management hierarchy. Invest in these people, and develop their coaching skills; they will become your front-line transformation team. You are essentially investing in the catalyst of enterprise change, those who will guide the re-architecting of your future state, so choose this team wisely. These individuals will eventually become your ambassadors, spreading Lean thinking across the entire enterprise, which means that they will eventually engage in areas outside their current

department. While a manager may be reluctant to lose their “best people” to this effort, if they have truly stabilized and standardized the processes within their own area, then they should be able to cross-train and transition another person into their role—first as a temporary backfill then later as a permanent replacement—which is a good human resource development practice.

Gather this team regularly to share their experiences. Send them to the occasional conference or education event where they’ll meet and learn from others who may be further along in the transformation journey. Senior leaders should assume the role of coaches and mentors to the Lean leadership team, actively participating, learning together, and helping to shape the adoption of Lean thinking. The Lean transformation will begin to take hold when this core group of internal Lean leaders develops a problem-solving mind-set, accompanied by the ability to tell compelling stories about the value and necessity of Lean thinking *within the context of your organization*.

### **Create a Basic Toolkit**

A few basic tools, well chosen and consistently used, are far better than many tools that are misunderstood or poorly applied. Start with the basics: A3 thinking, value stream mapping, 5S, problem solving and decision making, visual management, standardized work, metrics, and communications, supported by experiential learning. Let the core team select and learn new and advanced tools as they are needed. When a team member develops special interest and proficiency in a particular tool, ask him or her to document and share this knowledge with others.

### **Assess Key Enterprise Value Streams**

Value stream map the current state at a macro level; this mapping must identify and quantify the flow of work and supporting information of enterprise-wide core processes. Tie the strengths and weaknesses of these value streams to strategic goals; this alone is usually an enlightening exercise for cross-functional teams as they learn to see their contribution in the bigger picture of the enterprise and its customers.

Create a high-level process model to guide business process management (BPM, discussed in Chapter 4) efforts, to be used as the foundation

for communicating and discussing the interrelated nature of all core processes. But be careful not to go overboard: excessive mapping that does not drive improvement is wasteful—the objective here is to develop a reasonably simple, accessible, and coherent model of value streams and supporting processes that will help prioritize and sequence change efforts. If one does not already exist, establish an enterprise-wide framework for governance and prioritization. If it does exist, dovetail it into the new enterprise process model, so there is a clear relationship between strategic goals and enterprise processes. In any case, start with one or a few processes (pilots) that everyone knows instinctively are in need of attention and let BPM and governance evolve over time.

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## **EXECUTION**

### **Launch Pilot Kaizen Projects**

Choose meaningful problems whose success is achievable; don't tackle the hardest problems first. Focus on those areas of the organization that are most likely to demonstrate early support for the Lean transformation. Use initial pilots to standardize communications, training, and the use of basic tools and measurements. Develop your internal coaching skills, demonstrate early wins, and promote meaningful stories and lessons learned to spread interest and encourage wider adoption.

### **Invest in Enterprise-Wide Infrastructure**

While initial pilots are underway, continue developing the coaching team, while extending the infrastructure (tested and evolved during pilots, guided by the Lean CoE) to support expanding Lean efforts: a website, virtual and physical libraries, a knowledge base, collaboration and knowledge sharing tools, measurement standards and templates, communication tools, skills tracking, education and training materials, and so on.

### **Measure Results and Assess Understanding and Buy-In**

Measuring and openly communicating observations, trends, and results send a clear message that the Lean transformation is a strategic

## WHO GOES FIRST?

We are often asked the question “Where does Lean IT start?” Does Lean IT begin with the IT organization outwardly participating in enterprise value streams, improving IT operations only as they are identified as a hindrance to effective business process performance? Or does the IT organization focus inwardly first on cleaning up its own backyard, applying Lean thinking to IT services? Or should the IT organization do both at the same time, as resources and priorities allow? We’ve seen each approach work effectively, as long as leadership is mindful of resource requirements, timelines, and expectations.

A progressive IT organization can indeed initiate its own inwardly facing Lean transformation, even though the overall enterprise has not yet made the commitment. In doing so, the IT organization may realize significant, localized benefits. Examples of this can be found within organizations that have implemented Lean software development and the Information Technology Infrastructure Library (ITIL). Although these efforts engage portions of the enterprise (the direct internal customers of these activities), they usually lack an overall enterprise value stream focus, and thus return only localized (though often significant) benefits.

priority. In order to ensure a shared understanding of strategic intent, investigate teams and departments where measured results are *not conspicuously aligned* with strategy. Otherwise hidden legacy practices and attitudes (part of the culture but not the formal management system) may inexplicably hinder the transformation in isolated but important pockets of the organization (known in Lean circles as *anchor-draggers*).

Begin with the managers and supervisors to assess their level of understanding of strategic objectives at each step in the organization hierarchy, and clarify their linkage with localized objectives and daily behavior. Explain why you are assessing people’s understanding of strategic intent. Does each manager and supervisor understand and support the need for consistent reinforcement of specific objectives (constancy of purpose)? Has capacity been freed up to support the new improvement work that must be done? Let the managers and supervisors know you’ll be speaking with their teams during the next gemba walk, and what you’ll be asking.

During gemba walks, use one-on-one conversations with those closest to the work to assess their level of comprehension. Is there clear understanding of strategic intent and objectives? Does everyone understand how their daily work adds value and supports strategy? Is there a common focus? Is there buy-in? If not, why? Adjust communications with the goal of everyone in the organization understanding *what* they need to accomplish to support strategic intent and *why* they must be a part of the transformation.

### **Consolidate Gains and Build Momentum**

Communicate successes, failures, and lessons learned openly to establish trust and build support. Document and disseminate standard work and measurements.

Launch expanded cycles of improvement—move from the pilot phase to ongoing and self-sustaining kaizen activity. This often involves identifying those members of the senior management team who are most enthusiastic, using their energy and persuasion (backed by the steering team) to pull value stream improvements through cross-functional areas that are slow to adopt. Continuously invest in education and communication, introducing advanced tools and topics as needed.

Senior management should be especially vigilant at this time; the greatest risk for backsliding arises just when the transformation appears to be taking off. Accountability should be explicit and strong; integrate Lean management systems into enterprise management processes, and include kaizen planning and results measurement with the regular management review and planning processes. Emphasize strategy deployment and catchball to align strategy with action.

During this time, accelerate the integration of business and IT participants. Matrix IT associates into the business units they support. Break down the physical, virtual, and cultural barriers that often surround the IT organization. IT members should regularly attend kaizen events. In our experience, when IT associates are *not* involved, inappropriate technology solutions are often “tossed over the wall” to IT, that do not account for the underlying (and often hidden) systemic complexities of the process. This disconnect creates technical debt, which the IT organization must ultimately be responsible for. But when IT associates engage in a kaizen event from the beginning, it significantly improves the overall team’s understanding of the situation, and the effectiveness of the improvements that result.

Similarly, business stakeholders should regularly visit IT team meetings to better understand how IT thinks and works. This mutual understanding and empathy helps to integrate and synchronize IT–business change management, planning, budgeting, and performance management cycles—moving from utility investing toward continuous improvement and innovation that create real value.

Some areas typically adopt Lean IT more quickly and enthusiastically than others. Of course, the primary constraint that hinders IT involvement in kaizen is available time. An investment in Lean IT is an investment in quality at the source: slowing down to speed up, doing things right the first time. This illuminates a push versus pull dynamic when spreading Lean IT initiatives throughout the IT organization and across the enterprise in general. Managers must invest in the future, often making difficult tradeoff decisions, setting aside erstwhile priorities to make time for Lean improvements to take root. In our experience, however, if you “push” Lean onto managers, it becomes just another item on their to-do list, more load on their backlog, more anxiety. But if you properly convey the spirit of Lean, that it will ultimately relieve waste and pay back dividends in time, capacity, and quality results, then managers will (perhaps slowly at first) accept the up-front investment and create a “pull” toward active engagement in kaizen activity.

At later stages of maturity, as momentum starts building, use strategy deployment to begin directing kaizen activity toward supporting breakthrough (kaikaku) objectives.

Finally, we are often asked, “How long does a Lean transformation take?” The obvious answer is that continuous improvement never ends, and it also depends on your definition of success. But clearly, in order to embark on such an endeavor, we need to set measurable goals that justify the initial commitment and effort. Though every transformation is different and ultimately follows its own journey of discovery, we set initial expectations for “time to results” in the following manner:

- Six months for engaged pilots with kaizen success stories—localized paybacks and celebrated low hanging fruit achievements—supported by a preliminary Lean management system framework.
- Up to two years to spread basic kaizen proficiency supported by a sustaining Lean management system and strategy deployment framework across an extended organization.

- Three to five years to launch an authentic transformation—not just changing behavior but influencing the way individuals think about their work and how they seek out problems as opportunities for improvement.

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## SETTING THE PACE FOR CHANGE

It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.

—Charles Darwin

We have entered an era of process leadership, where the IT organization has an opportunity to drive meaningful change throughout the enterprise. Process *leadership* is not the same as process *ownership*; each process should have an owner with sufficient authority to drive improvement, someone who is accountable and responsible for outcomes. But process ownership is not sufficient by itself. Process leadership, the art of conceiving and guiding the overall enterprise toward value optimization, is essential, and it is a natural (though perhaps dormant) competency of the IT organization; no one else is better suited, and in a better position, to *see the whole enterprise from a systems perspective*.

As we illustrated in Chapter 1 (Figure 1.1), chief information officers (CIOs) now list *leading enterprise change initiatives* as a key priority for the future. This is well beyond the familiar focus on revenue growth and cost reduction, going right to the heart of innovation. The collaboration among process owners and process leaders naturally helps to integrate and mobilize business and IT efforts aligned with constancy of purpose.

As we have learned throughout this book, common characteristics of traditional IT include unnecessary complexity, instability, slow change cycles, and the impulse to lead with technology “solutions” rather than addressing business problems at the root. As advances in technology continue to accelerate, if these patterns aren’t changed, they will continue to cause friction, hindering enterprise-wide continuous improvement and innovation. At best, this resistance will impede the Lean enterprise

transformation, making it longer, more costly, riskier, and more painful, while introducing additional layers of unnecessary technical complexity. At worst, it will cause the transformation effort to falter, backslide, and eventually fail. In our opinion, the lack of IT engagement is one of the primary reasons many Lean transformations don't reach sustainability.

But when IT and the rest of the business become integrated, thinking Lean and acting in unison, something magical happens: quality information and effective information systems unleash the power of human potential.

Lean thinking helps everyone in the IT organization demonstrate leadership and develop a laserlike focus—inwardly on personal, as well as operational excellence, and outwardly to the continuous improvement of business processes—eliminating waste and delivering value to every customer.

*At the strategic level*, Lean IT leadership helps integrate and synchronize business and IT change, enabling a rapid, iterative cadence of collaborative management systems that set the pace, the drumbeat, of enterprise-wide improvement.

*And at the tactical level*, Lean IT leadership helps to institutionalize the Lean enterprise transformation through process standardization, error proofing, measuring, communicating, collaborating, and sharing knowledge—creating the foundation for a continuously learning and innovating organization.

When information systems naturally reflect Lean thinking, there is a continuous systemic reinforcement of Lean behavior throughout all workflows and information flows. The integration of IT and the business accelerates the organization's ability to learn, change, improve, innovate, and grow.

True transformation starts from within, with the business and IT focused on a shared strategic intent, discovering and solving problems together. The transformation begins with people, process, and technology—in that order.

## ENDNOTES

1. Steve Bell, *Lean enterprise systems: Using IT for continuous improvement* (Hoboken, NJ: Wiley, 2006), 373.
2. John P. Kotter, "Leading change: Why transformation efforts fail," *Harvard Business Review*, March–April 1995, 1–10.
3. Earll Murman, Thomas Allen, and Kirkor Bozdogan, *Lean enterprise value: Insights from MIT's Lean Aerospace Initiative* (New York: Palgrave, 2002), 87.
4. Thomas J. Peters and Robert H. Waterman, Jr., *In search of excellence: Lessons from America's best-run companies* (New York: Warner, 1982), 322.
5. Jim Collins, *Good to great* (New York: Harper Collins, 2001).

## **Section V**

# **Lean IT Case Studies**

Lean IT Topic	Barry-Wehmiller - Lean and ERP	Con-way - Virtual 5s Doc Mgmt	Con-way - Focused Value Streams	Group Health - Lean Software Dev	Ingersoll Rand - Order Quality	Steelcase - Product Data Mgmt	Toyota - Strategy Deployment	Virginia Mason - Lab Orders
Voice of the Customer	X	X	X	X	X	X	X	X
Waste	X	X	X	X	X	X	X	X
Kaizen - PDCA / DMAIC - Problem Solving	X	X	X	X	X	X	X	X
Cross-functional Teams	X	X	X	X	X	X	X	X
Standard Work	X	X	X	X	X	X	X	X
Problem Solving/Root Cause Analysis	X	X	X	X	X	X	X	X
Value Stream Mapping	X	X	X	X	X	X	X	X
Measurements	X	X	X	X	X	X	X	X
Quality at the Source		X	X	X	X	X	X	X
Flow/Pull		X	X	X	X	X	X	X
Systems Thinking	X	X	X	X	X	X	X	X
Strategy Deployment/Hoshin Kanri	X	X	X	X	X	X	X	X
Leveling Demand/Heijunka		X	X	X	X	X	X	X
Visual Controls			X	X	X	X	X	X
5S Workplace Organization		X	X	X	X	X	X	X
Lean Software Development							X	X

Case Study Topics.

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# Case Studies

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## **BARRY-WEHMILLER: LEAN AND ERP WORK TOGETHER**

Built on nearly 100 years of quality manufacturing history in Green Bay, Wisconsin, Paper Converting (PCMC) experienced a decline in growth and profitability in 2004. This company of approximately 900 associates and US\$200 million in sales had seen conventional manufacturing methods cause a run-up in inventory, placing the financial security of the company at risk. Management had attempted to streamline processes by implementing a large and well-known enterprise resource planning (ERP) system several years before, but overcustomization led to greater complexity and less visibility to daily work.

In 2005 PCMC became part of the Barry-Wehmiller organization. Founded in 1885, Barry-Wehmiller employs over 5,000 associates worldwide, with over US\$1 billion in revenues across four product platforms. Barry-Wehmiller had recently embarked on its people-centric Lean journey, and with their new vision to be a great American manufacturing company, leadership at PCMC led a dramatic turnaround in the business, moving from a large loss to a healthy profit in just one year. This turnaround was the result of many forces, including some restructuring of the business and a cyclical upswing in the business cycle, but no one force was greater than the ability of established PCMC associates to grow into new roles of leadership and communicate a vision of a sustainable future for the business.

As PCMC set its sights on sustaining the turnaround, its underlying business processes and ERP system would have to be addressed. Shortly after the acquisition, senior leadership prioritized the transition from their previous ERP system to Barry-Wehmiller's enterprise-wide standard ERP platform. This conversion was dually motivated by issues with the legacy system and alignment with the ERP platform throughout the balance of Barry-Wehmiller. Although leaders from sales, operations, and customer service

saw the importance of the project, they could not move beyond perceiving the project as another software implementation led by the IT organization, instead of an effort that would fundamentally impact business processes.

After a change in IT leadership and team composition, executive leaders soon realized that they had misjudged the scope; this was a *company-wide*, not an IT-centric, project. Using their existing hoshin kanri strategy deployment process, the ERP implementation was moved to the number one breakthrough priority at PCMC for six months. Resources were assigned from every department, and the vice president of operations became the project champion; in his words, “We had chaos; we had no well-defined process. But the project allowed us to implement brand-new standard work, to get consistent performance every single day.”

It was at this turning point that PCMC’s ERP implementation became a vehicle for transitioning to a Lean way of thinking. Cross-functional teams began to map the current system, finding waste in virtually every process. In one example, 10 steps involving five people were required simply for an engineer to create a new part number. These teams found that nearly every process in the organization relied on the ERP system as a source of information or as a communication trigger for an activity in another department. The only way to holistically improve their processes was to redefine how they used the ERP system.

And that is what they did. Multidisciplinary task forces were created for each major area of the organization: procurement, manufacturing, engineering, and assembly—breaking down silos for the first time. Each task force utilized Lean tools to get to the root cause of common frustrations, brainstorm solutions, and create a future state plan. Meanwhile, the teamwork in each group nurtured empathetic relationships where more people than ever before within the organization understood the essential functions of all departments.

After ERP go-live in April 2008, the implementation team encountered several difficulties; the project had not solved every challenge, but Lean had created the process and team-oriented attitude necessary to address them. Task forces quickly met and found solutions to lingering issues. The ERP implementation concluded in August with glowing praise from corporate operational and IT leaders, who called it “the greatest business implementation in the history of the company.”

As PCMC continues moving forward, the value of utilizing a Lean approach to drive the implementation and ongoing ERP change management is more apparent than ever. The entire reporting capabilities of the

ERP system changed, producing a handful of real-time, actionable reports to replace the reams of ignored reports of the past. The number of process handoffs and delays has been reduced. Moreover, value stream stakeholders throughout the organization feel that the ERP system works for them, rather than the other way around. In the end, PCMC accomplished much more than the successful conversion to a new ERP system; it institutionalized the processes and support structures necessary to transition to a Lean and sustainable future.

**Brian Wellinghoff**

*Director of the Lean Journey, Barry-Wehmiller*

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## CON-WAY: DOCUMENT MANAGEMENT VIRTUAL 5S

Con-way, Inc. is a US\$5 billion freight and logistics company delivering less-than-truckload regional delivery, truckload long-haul freight, and third-party logistics and warehousing services. Although Con-way, Inc.'s corporate headquarters are based in San Mateo, California, many of the centralized corporate functions are based at Con-way Enterprise Services (CES) in Portland, Oregon. This location provides the majority of the information technology, finance and accounting, and human resource activities for Con-way, Inc.

The Information Technology division at CES includes departments for each of the three business units, plus infrastructure, the web team, and desktop services. Within these departments are dozens of workgroups that create customer specific applications, maintaining and enhancing existing systems to keep worldwide freight moving on schedule. Internally, these departments provide full services to the 25,000 Con-way employees scattered around the globe.

Over time a lack of organized document storage procedures, standardized templates, and standard operating procedures (SOPs) created a host of problems and waste for the organization. Documents and procedures were stored in personal hard drives, various SharePoint sites, shared servers, and a variety of other locations. Team members often spent hours each week searching for documentation. Upon finding documentation

there was no guarantee that it was the current revision, which led to an investigation process requiring more time and energy. Compounding the problem was the common practice of using e-mail attachments to deliver files to coworkers, rather than providing links to specific locations where a master document was located. Several copies of files would be housed in various locations, none of which had revision control or a clear owner. In other cases documentation could not be located and would need to be recreated, adding hours of rework to what should have been a simple request.

Along with wasted time and frustration came additional business risk to Con-way and its customers. For example, disaster recovery procedures were difficult to locate and lacked standard formatting, which could create delays during a recovery effort. Team members were especially frustrated with the lack of organization around after-hours start-up procedures. Frequently the on-call support person would be required to call other team members throughout the night in order to locate specific documentation for a system that had gone down. This was exacerbated by the number of systems that were supported by the organization. Confusion, misdirection, wasted time, and frustration were daily occurrences as teams fought to locate information that kept Con-way, and the customers they support, up and running.

During the rollout of Lean office to the organization, one of the initial efforts was a virtual 5S activity for many of the workgroups. Following the 5S methodology, the teams made great improvements to the organization, upkeep, and accessibility of information. Here is a brief description of the standard approach we developed, as we have rolled out this initiative across the entire campus.

*Sort:* Compounding the storage and retrieval problem was the sheer volume of files that had been created over time, most of which were outdated or no longer needed. Groups used file or directory searches and cataloguing tools to analyze the information and identify unwanted files. These unwanted files were either deleted or placed in archives, where they would be purged if not accessed within a given amount of time.

*Set in order:* A common location was established for workgroups, typically a SharePoint site or a shared drive accessible by all team members. Using tools such as card sort exercises, folders and structures

were established for the specific needs of each workgroup. The process involved having team members sort cards labeled with contents or functions into groups that made the most sense for that workgroup.

*Shine:* Files were placed in the appropriate location and hierarchy, based on the structure each group had created. In many cases, several layers of the folder structure were restricted in order to avoid team members “dumping” files at a top layer.

*Standardize:* An SOP was created for each storage site indicating file structures, proper data storage protocols, and ownership for each workgroup. Work groups also determined standards for document sharing, such as sending links to a master file rather than sending the file itself. Standard templates and naming conventions were also created so that similar documents had the same look and feel.

*Sustain:* In order to maintain the improvements, a number of sustaining measures have been put in place. Several layers of the folder hierarchy are secured and assigned to an individual with the responsibility for managing the new storage format and structure. In addition, the top-level folder contains an SOP document outlining the storage procedures. Teams participate in quarterly reviews of their storage locations, ensuring that the standard work is being followed.

Best practices are now shared across the organization, allowing teams to implement 5S methodology faster and in a standard format. As a result of these activities, thousands of wasted hours have been avoided, amounting to over US\$200,000 each year in labor costs. In addition, many intangible benefits have been realized: improved understanding of many common workflow processes, reduced employee frustration, faster response to critical situations, and less risk to the organization should disaster recovery ever be necessary.

Con-way Enterprise Services continues to implement the virtual 5S program throughout the organization, reaping the benefits of what was once considered a manufacturing methodology.

**Aaron Brown**

*Lean Manager, Con-way Enterprise Services*

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## CON-WAY: FOCUSED VALUE STREAMS

The Con-way IT organization supports a global enterprise of nearly 25,000 employees and is composed of application development and maintenance teams for each major business unit within Con-way, Inc. Freight, Menlo Logistics, and Truckload IT teams are supported with a shared services group for enterprise architecture and computing infrastructure. This case study focuses solely on the IT application development group for the Menlo Logistics line of business, a third-party logistics service that offers outsourced supply chain engineering, design, and transportation and warehouse management services.

Menlo IT is composed of several functional teams that manage client-facing, specialized, and highly configured software applications (e.g., Warehouse Management Systems) and that oversee internal business processes for sales support, customer on-boarding (start-ups), and customer ongoing operations. This creates a matrix structure with highly skilled and often specialized individuals assigned to multiple customer projects, internal projects, and IT support tasks.

### Current State

A senior IT executive observed the following challenges within his IT group through observation and discussion with his subordinates:

- Excessive “thrashing”: People were spread across too many efforts, experiencing frequent interruptions and task switching that caused waste, lack of focus, and frustration.
- Customer enhancement projects of less than 400 hours had lead times from 22 to 34 weeks, considered unacceptable by both internal and external customers.
- Production support issues frequently drew people away from time-critical start-up projects, negatively impacting customers and the perceptions of IT.
- New start-ups were often started suddenly with little advance notice, negatively impacting all other work in the queue.
- Customer work was all consuming, and software development teams were not able to focus sufficient time on improving their own internal processes.

- There was limited standardized work across software development teams.
- The organization was challenged to establish and meet commitment dates.
- The work environment was stressful due to the factors described above.
- Resource scheduling was overly complex, because employees worked on multiple projects simultaneously. The dynamic nature of large projects required frequent changes to work plans and resource assignments.

### Proposal to IT Management

The senior IT executive made a proposal to his managers in early 2008, outlining a vision for change based on Lean principles of cost reduction, waste elimination, standardization, cycle time reduction, and improved quality. Specifically, the executive wanted to emulate a familiar approach from Lean manufacturing called the *focused factory* and isolate the more stable IT processes (production support and small- to medium-sized enhancements) from chaotic processes (customer start-ups). He believed the focused factory concept offered a promising alternative and envisioned three value streams within IT. The objectives of this realignment were to:

- Reduce cycle time for each logical IT delivery (value) stream
- Reduce complexity associated with resource scheduling and demand management
- Improve visual controls for each value stream
- Level the work within each value stream, even though aggregate demand was naturally variable
- Reduce waste associated with individuals constantly shifting between projects and production support. Excess switching was estimated to add 25 percent effort to tasks, causing unnecessary lead time and quality problems.
- Reduce waste associated with reprioritization
- Increase focus on production support efforts that would improve service availability (quality) and reduce defects
- Reduce waste associated with excess overtime due to poor resource utilization
- Better balance individual workloads
- Address workforce frustration and stress

The IT managers collectively met in a workshop to discuss the vision and identify key concerns, risks, and alternatives. The managers were initially supportive but also apprehensive, since their teams were fully loaded and there was no slack capacity to buffer problems should they occur during the introduction of this new approach. So considerable time was invested to clarify the goals and fully vet the issues. The managers developed issues lists and prioritized them based on severity and impact. They ultimately agreed to a modified version of the original approach by starting with two value streams: production support, and projects and enhancements. It was envisioned that enhancements could be segregated from start-up projects into a third value stream at a later date. The managers identified subprocesses and specialized resources that were to be shared across the value streams.

Much consideration was given to several key issues. First, the teams were concerned about being co-located with others in the same value stream. It was felt this would be too disruptive and limit the sharing of technical information. Second, the team recognized the need to ensure technical continuity across the value streams. Third, the production support value stream (PSVS) was seen as being of less value; employees expressed concern about being asked to make what was perceived to be a downward career change. Fourth, the managers were concerned about the volatility of demand in the projects and enhancements value stream (PEVS). Countermeasures were developed to address each of these concerns.

The management team identified the major activities required to launch the value stream structure:

- Clearly define the role of *value stream* owner
- Socialize with employees for feedback using a consultative decision-making model
- Inform the infrastructure organization of the changes that were taking place, as they provide the support to the production systems
- Assign employees across the value streams
- Finalize the key success metrics for both value streams
- Build the annual budget according to the value stream model
- Modify the customer work intake processes for each value stream to make demand more visible
- Enhance the workload demand management process and firm up the master-scheduling role

- Establish time-tracking conventions
- Ensure no negative impact on production control and change control processes

Owners for each value stream were selected, and roles and responsibilities were established. Since it was agreed to retain the existing functional structure in the beginning, the team also determined the roles and responsibilities between value stream owners versus functional managers (matrix model).

A team of individual contributors was formed with representatives from each functional group. These are the individuals whose jobs would be changed under the value stream model. These employees reviewed the value stream concept and were given time to provide feedback to management. Managers met individually with teams to answer questions and explain the proposed benefits. Employees provided feedback via the representatives, and management presented a formal written response to all 200+ employees addressing their concerns. This seemed to satisfy the employees, who greatly appreciated the participatory model that allowed them to comment on the proposed change. Management clarified its intent to move forward with the rollout.

The managers then built their annual budgets, based on the value stream structure, and determined the size of each team represented in each value stream.

The value stream owners launched the structure by identifying one representative from each functional team to be a core team member in the value stream. This core team worked through success metrics, produced “as-is” and “to-be” value stream maps, identified potential kaizens, and completed a continuous improvement roadmap. Each functional team also finalized its employee rotation model. In some cases, the value stream teams had to complete kaizens to establish standard work processes required for a value stream structure. After 12 months of development, feedback, buy-in, and preparation, all teams were successfully split along value stream lines with new work intake and coordination processes in place.

To support these changes, the IT sales and operations planning model was modified so that only resources in the PEVS were built into the capacity plan. This reduced by one-third the number of resources that required complex workload scheduling. In addition, time to work on continuous

improvement activities was built into each team's workload plan, and visual controls were added to show weeks of backlog and employee utilization.

Under the value stream structure, cross-team representatives identify high-priority kaizen opportunities and execute them. Their progress is reviewed with IT management each quarter.

Key benefits seen so far (given the structure has been in place for a few months):

- The production support value stream has experienced less fire-fighting and overtime, because staffing is more dedicated and is sized appropriately.
- There is less “thrashing” caused by people moving between value streams, but it is not completely eliminated because of specialized technical skills of shared resources who must work across both streams.
- The projects and enhancement value stream teams can focus on projects without interruptions from production support, and the production support team members are able to stay more focused on production incidents, providing faster overall response time. The teams (and their customers) are already seeing the benefits.
- Team members are able to clearly see the lack of standardization across their teams and the inefficiencies created.
- Teams are able to successfully identify, plan, and complete value stream (cross-functional) kaizens with success. The functional structure originally inhibited cross-functional kaizens.
- There is improved cross-team collaboration when an incident spans multiple teams. Having a production support gatekeeper monitor e-mails and handle assignment and ownership of production issues ensures that every reported incident or service request is addressed. This has reduced effort associated with each team monitoring incoming report incidents.
- Although some teams are still having trouble finding time to work on root causes to problems in the new production support process, the teams report that capturing the root cause gives them visibility and focus when categorizing the issues. This will yield many benefits in the future for Pareto analysis and prioritized kaizen events.

Menlo IT will continue its Lean journey using the value stream model. With time, IT expects to achieve all its stated objectives. Key success factors include the slower pace of implementation, allowing more time to engage employees in the change process. Assigning a designated owner for each value stream has provided a point of focus and accountability that will drive proactive change and continuous improvement forward.

**Richard Carroll**

*VP Applications, Menlo IT*

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## **GROUP HEALTH: LEAN SOFTWARE DEVELOPMENT ALIGNS WITH THE BUSINESS STRATEGY**

Group Health provides health care and medical insurance coverage to over 500,000 residents in Washington State and northern Idaho. Nearly two-thirds of Group Health insurance plan members receive care in Group Health–operated clinics, benefiting from their investment in electronic medical records and other technology-enabled practice innovations. The synergy and information sharing between health care delivery and insurance enable Group Health to provide seamless, comprehensive, and cost-effective service to their members, while helping to identify many opportunities for patient-focused continuous improvement. Our collective aspiration is to help define the future of quality and affordable health care.\*

We began our Lean journey in the summer of 2006. The operational area of the Health Plan was designated as the “model line” to pilot Lean efforts, and within the Health Plan three value stream segments were selected to be the first out of the gate, including the Application Management value stream, which provides software development and maintenance to support health plan operations. Application Management was chosen as a primary focus because the smooth flow of information is vital in a health insurance “information factory” and frequent changes to provider agreements

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\* Kevin Sack, “Health co-op offers model for overhaul,” *New York Times*, July 7, 2009.

and regulations drive constant change in business rules and systems. Bill Siemering (IT) and Mike Manis (Business) together led teams in defining the current and future states, representing the activities of business and IT throughout the value stream.

## **The Current State**

The current state was a typical scribble of waste and delay, long on managing the backlog and creating detailed requirements documents, but short on releasing quality software on schedule. Not that work didn't get done; it just wasn't the work on the list. Instead priorities were "red-phoned" in from a vice president or pushed under the door to a programmer friend. Customers were unhappy, work was not visible, and there was no discernable prioritization or delivery process.

In the initial phase of the model line deployment, we wanted to accomplish a limited set of objectives:

- Make the work visible
- Control work intake
- Create a visible daily work management system
- Implement Lean techniques, such as last-minute requirements focusing on value
- Change the culture by tearing down silos and creating cross-functional work cells

To help us quickly close the knowledge gap, we brought in a Lean consulting group and invited a team of developers, architects, and business analysts for training. We then engaged the team in discussions on the "what," "why," and "how" of our mission. While we knew the "what" in a broad context (using a Lean/agile approach) and we could articulate the "why" (we needed to become more efficient in supporting organizational goals), the "how" we had to develop as a team.

## **The Future State**

The future state was developed using a Rapid Process Improvement Workshop (RPIW) approach where the teams spent many hours over the course of five days working together to design the new process and plan

the implementation. Although the work was at times a little contentious, we emerged with a well-documented plan that was ready to implement. We began immediately, providing last-minute training to business managers who had new work to submit into the backlog, using detailed process flows and targets developed during the RPIW to keep us on track. Everyone who participated in the RPIW was included in one or more aspects of the new process and helped guide the remaining participants. We converted existing project manager positions to take the role of scrum masters, identified product owners, and created three work teams: one for maintenance, one for smaller enhancements, and one for strategic work. We were not at all sure that this was the best configuration, but decided that it was as good as other ideas and we could fine-tune later with PDCA.

As we began the implementation, we established a work intake system that accepted only the highest prioritized work in the backlog: up to three sprints, where each sprint represents approximately four weeks' work. In other words, our planned backlog is maintained at a stable three months' work. Identification of potential projects came from business owners who would describe the high-level business need, the expected return, and any other significant drivers of the work. Business owners from multiple departments from across the value stream would then prioritize each work item against all others in the backlog. Work was then completed in rapid sprint cycles, achieving a just-in-time approach to meeting our customers' highest priority requirements. Contention in prioritization decisions was minimized through group discussion; if a business owner thought his or her work should be set at a higher priority, he or she was required to justify the change at the meeting based on value. If consensus could still not be reached, a vote would be taken. Occasionally, issues were elevated for resolution.

## **Our Progress So Far**

The cornerstone of our methodology is prominent visual systems in all work areas containing backlogs, front burners, and burndown charts, supported by teams dedicated to keeping them up to date. Internally developed software (mostly Excel based) is used to track all activity, produce reports, and print artifacts on colored cards that are posted on the visual boards.

Each month we host a day-long work-planning and intake session where business owners bring new Use Cases: a brief description of the

desired business outcome and expected return. Use Cases are reviewed and prioritized by the business owners, and then unfolded into “stories,” or buckets of work necessary to complete the Use Case. Stories are sized by technical staff with business owners present to provide additional information as needed. The backlog is updated from the planning and intake session.

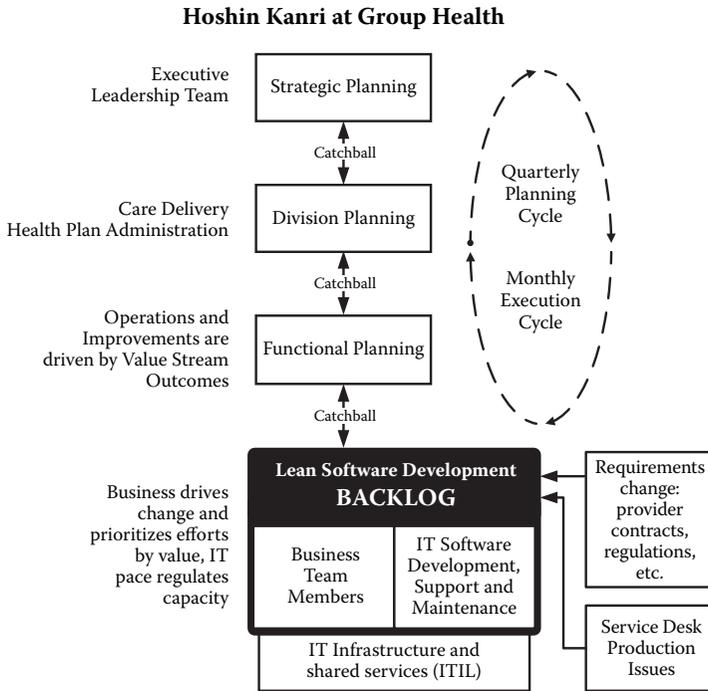
The next step is sprint planning. Available hours of staff capacity are determined for each sprint. Then, starting with the highest priority, stories are further unfolded into tasks, and each task is assigned a time estimate to complete. The sprint is full, and the “front burner” filled when scheduled tasks fill available hours for the sprint. We plan for slack (nondevelopment time) by building time standards for scheduled meetings, regular e-mail, and other necessary activities into our available capacity calculations. No additional buffer is built into the work plan.

Work is divided among three self-contained work teams, each of which includes architects, developers, and business analysts. Each team maintains its own visual display area containing all of the stories for the sprint and index cards for each task. Developers “pull” work simply by moving the kanban card for the highest priority story into the in-process section. Unexpected production support requirements can be pulled into process at any time, without causing disruption to the schedule. This can happen since there is a dedicated work cell for production and maintenance that has scheduled time for unexpected problems. This flexibility is also supported by a heijunka schedule which allows us to shuffle the sequence of work in the queue at any time until it is released to production.

Progress is tracked daily via *burndown charts* that graphically display the hours remaining in the sprint against the hours of work left to complete. Teams huddle daily to review burndowns (ensuring progress is on pace for the sprint cycle) and to evaluate what work was completed yesterday, evaluate what will be worked on today, identify remaining hours to complete, and discuss any constraints or barriers.

## Going Forward

In late 2007, our CEO made the commitment to deploy Lean throughout the entire organization, using hoshin kanri (strategy deployment) as a standard management system, while leveraging our progress in health



**FIGURE 12.1**  
Hoshin Kanri guides software development priorities.

plans as a solid foundation. Over the past 18 months we have constructed a tiered hoshin kanri plan that encompasses the whole enterprise. We have just launched a significant business intelligence initiative, designed to provide quality information to support continuous improvement and the hoshin kanri planning cycle. (See Figure 12.1)

Strategic priorities cascade through divisions and layers of management, feeding the application management backlog and providing business case justification and prioritization guidance. The backlog is also fed directly with production problems identified through various sources, including the IT service desk (where we are currently implementing ITIL). Our Lean Management System is helping the teams responsible for Applications Management, as well as other areas of the IT organization, focus on delivering services that are most needed in order to provide the best health care to those who matter most: our members and patients.

While we have been on this journey just a few short years, we have already begun to realize significant benefits in many ways as Lean behaviors and culture take hold.

**Bill Siemering**

*Executive Director, Health Plan Information Technology, Group Health*

**Mike Manis**

*Director, Health Plan Administration, Group Health*

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## **INGERSOLL RAND SECURITY TECHNOLOGIES: LEAN SIX SIGMA IMPROVES ORDER QUALITY**

Ingersoll Rand (IR) is a US\$13 billion global diversified industrial company, driven by employees who are proud to offer products and solutions people use every day to create a positive impact in their world. Driven by a 100-year-old tradition of technological innovation, we enable companies and their customers to create progress. Our Security Technologies sector provides state-of-the-art security solutions for residential and commercial markets.

This case study describes the challenges of entering complex order information into a business system with the goal of achieving 100 percent accuracy. It describes the problem-solving process undertaken, and the tools utilized to dramatically improve the process for manufacturing industrial doors and related hardware.

### **Problem Description**

There are an unlimited number of product configurations and order possibilities that may be required to meet our customers' needs. The placement and fulfillment of a customer's order require the entry of the customer requirements into the manufacturing and business information system. Critical parameters that must be accurate include size, shape, material, color, finish, and key locations for locks, closers, and other associated hardware, and a correctly calculated price for the configured item. Customers often provide product specification information in their own

format, which typically does not match the format of our system, creating the potential for additional errors introduced during data translation and entry.

Orders are received into the sales support area via fax, e-mail, and traditional mail. The first step is to understand what the customer is trying to order. This is not easy, since there are myriad ways to describe what is actually desired. Order entry associates must also determine if what the customer orders is truly what is necessary to meet fire, safety, and weather-related requirements. This requires an understanding of the customer's specific application, as well as regulations in locations worldwide.

Once the order has been clarified and reviewed, next it must be entered into our information system. A product configurator has been developed to enable us to meet many of our stock offerings; however, it is virtually impossible to predefine all likely combinations. When a configuration isn't available, the order entry personnel must then key in the order manually. This tedious process requires a great deal of product and application knowledge; order entry personnel must understand products and how they are constructed, specific applications, specific door construction techniques, and specific hardware locations and requirements. This manual process creates a fairly high risk of error.

There are many consequences from this error-prone process: delays, errors, and rework. The high occurrence of defects via manual order entry can cause disruption within the order entry function, in manufacturing, and also with customers. Variation of the ordering process is the enemy. Understanding what causes the variation and dealing with root cause issues comprised the focus of this problem-solving effort.

IR took on the task of improving the order entry process, utilizing the DMAIC approach (below) and Six Sigma tools (see Appendix B for more on Lean and Six Sigma)

### **The DMAIC Approach**

- Define the issue
- Measure and quantify the impact of the issue
- Analyze the issue: Determine root cause
- Improve the process
- Control the process

### ***Define***

Deal with quality issues (defects), improving the overall order entry accuracy and a reduction in variation.

### ***Measure and Analyze***

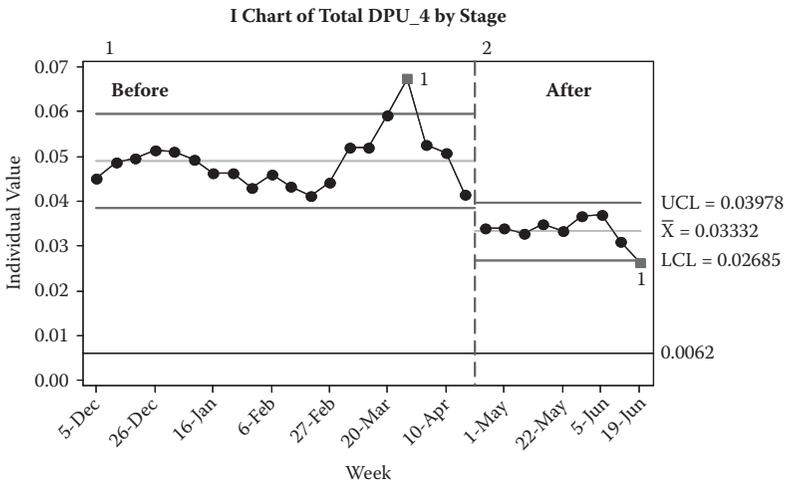
With the aid of an outside consultant, the group established a metric for counting total defects. The process was mapped, and defects were recorded at key internal process points. Understanding where defects occurred in the process was vital to solving and addressing the issue. Key tools utilized were process maps, supplier–input–process–output–customer analysis (SIPOC), operational definitions, and quantitative methods. Statistical process control was used to trend errors and highlight special causes of variation. Probability analysis was also applied to predict total defects by type. Fishbone diagrams were used to analyze potential defect causes. Data collection showed that one of the key process variables was the influence of operator knowledge and skills. Several experienced operators had developed a “knack” of entering, checking, and providing defect-free orders.

### ***Improve***

Once this knack was discovered, it was captured, standardized, documented, and spread throughout the department through a mentoring program. Creating standard work enabled the process to initially drop defects by 50 percent within the first six months of the project. Key tools utilized were control charts, which were used to identify patterns and trends over time, and Pareto analysis.

Process specialists were also engaged to determine where additional information systems improvements could be made. These individuals made many suggestions on ways to mistake-proof the order entry software. By engaging the operators in a cross-functional team, specific intelligence was built into the software, making it easier to enter the order correctly the first time.

Early involvement by the IT organization, establishing a collaborative relationship between IT and the operators, enabled rapid and simple enhancements to existing software. Look-up tables and search functions were added to the system, which helped order entry operators find key



**FIGURE 12.2**  
Order Quality Control Chart

information much easier and faster. IT was also able to add enhancements to mistake-proof key error sources in the entry process.

As a result of these efforts, defects have been reduced dramatically. The process itself is approaching a 70-percent reduction in defects, moving from 0.5 sigma to 3.53 sigma. Customer satisfaction has also improved tremendously.

### **Control**

A plan was put into place to help sustain the gains. Improvements in quality, stabilization, and consistency enabled the effective use of traditional Lean tools for continuous improvement efforts now underway. (See Figure 12.2)

### **Lessons Learned**

Early involvement of IT resources with the inclusion of operators and support personnel in a combined team effort, was instrumental to our overall success. Understanding the process, involving those who work the process, and seeking outside advice were vital to making the process better. Having the discipline to adhere to the DMAIC method generated significant gains, delivering value to our customers.

**Rajesh Solanki**

*Director of Lean Six Sigma, Ingersoll Rand Security Technologies*

**William Kemerer**

*Lean Six Sigma Manager, Master Black Belt, Ingersoll Rand Security Technologies*

**Brent White**

*Master Black Belt, Ingersoll Rand Security Technologies*

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## **STEELCASE: PRODUCT DATA MANAGEMENT LEAN TRANSFORMATION**

Steelcase Inc., headquartered in Grand Rapids, Michigan, leads the world in office furniture sales and manufacturing with over US\$3 billion in annual revenue. One element of our success is a wide offering of products, options, and finishes. Supporting this large variety of selections in the company's portfolio (estimated at over 22 quadrillion variations) creates many challenges throughout the development cycle. The Product Data Management (PDM) group is charged with maintaining all of the product information within SAP and other supporting systems. The challenges became critical when new development projects were delayed because the data could not be built fast enough—PDM had become a product development bottleneck.

In 2002, the chief information officer (CIO) appointed a new leadership team that recognized the potential to apply Lean concepts from manufacturing to solve problems in the PDM office processes. The product data responsibilities were originally fragmented across several departments which reported to separate leaders. The departments were merged into one, but the responsibilities still remained largely within functional silos. Then, during a Lean workshop in the spring of 2003, steps of the new product development PDM process were posted on a large conference room wall. The wall, littered with hundreds of supporting documents, showed the complexity of the current state, evidence of rework estimated at 50 percent, and numerous handoffs resulting in delays while people waited for information. The “wall of shame,” as it became known, exposed the problems, but they were not solved until value stream mapping techniques

documented the current state and envisioned a future state. The future state map spawned multiple kaizens, which provided the initiative for change. One initial kaizen quickly improved the data building of customer service parts, and another addressed the speed and efficiency of creating data for a new product that was being designed.

Initial kaizen experiments were designed to avoid batch processing by creating cross-functional teams, enabling work to flow across functional boundaries. Using the value stream map, handoffs were analyzed, and many were eliminated by changing work responsibilities or placing workers in closer proximity. Initial experiments proved successful, revealing the need to reorganize the entire PDM department. In May 2004, the PDM group restructured to better support the business, dividing into five teams to align with the business categories of seating, furniture, work tools, wood, and small business furniture. These new PDM teams each supported the entire product development process for their category, and management accepted new roles in managing across functions instead of by expertise. Now, individual experts, resident on each team, create marketing data, edit catalogs and specification guides, and build the manufacturing data. The five teams work in close proximity to each other, reporting to a single director, using a common fileshare and intranet, and sharing discoveries and improvements with each other. The results were rapid and dramatic. Just five months later, the teams eliminated the project backlog. Through ongoing kaizens, the PDM group doubled their productivity and reduced the lead time from 36 weeks (nearly nine months) to just four weeks, removing the bottleneck from the new product development process.

Additional kaizens focused on data quality at their source. The teams created a checklist for data readiness, determining at what point in the product development life cycle data should be loaded into the system based on the accuracy of the information provided by the business category. The way that data are delivered to the teams is now standardized with a spreadsheet template, used by all marketing personnel across the business. By not starting work early, the teams avoid the wastes of repeated data changes, delays, and false starts. Management validated that the initial rework estimates of 50 percent were accurate. As a result of improvements to data quality, rework was reduced to 8 percent, which significantly contributed to the teams' increased productivity and throughput.

A new role, titled the *information funnel*, now exists on each of the five category data teams. The individual fulfilling this role works with other departments in engineering and marketing to complete the data readiness checklist, also providing valuable project coordination. The information funnel role, modeled after the zone leader in a Lean manufacturing cell, facilitates a daily team meeting at a visual control board to track the flow of data through the process, the production of data in the systems, and any flow interrupters within the process.

Initially, all product development projects were scheduled in batch mode, and the recurring three-month deadline created a predictable and dreaded pinch point. Now the team creates data as soon as they are ready, and downstream processes, such as catalog creation and planning symbols (used by architects to place furniture in office layouts), naturally flow in sequence afterward, leveling the demand and workload. PDM has reduced their cycle time by 33 percent, delivering updates at a frequency of two months instead of three.

In 2008, the teams turned their attention to the process of building the catalog data. The Steelcase product offering is cataloged in over 40 documents—each several hundred pages in length. Imagine a shelf of encyclopedias from A to Z; this resembles the row of catalogs. They exist in both paper (printed annually) and electronic media (updated bimonthly). The large quantities of furniture images, product descriptions, and pricing in these catalogs are updated and manually synchronized with several other data sources, such as enterprise resource planning (ERP), catalog data, and a catalog-authoring tool (manual integration waste is on the list for a future kaizen). Because of the complexity and specialization of the work to update the catalogs, an outside vendor traditionally completed the task. To streamline this process, the teams borrowed the concept of a visual heijunka schedule from the manufacturing plants, tracking the progression of work through catalog building and releasing catalog sections to printing only when they are ready. The heijunka visually shows the status of each catalog moving through the process, signaling the upstream processes when one completes and the next cycle can begin. With the perfected heijunka board in place, the catalog production process flows more smoothly, speed and efficiency have increased dramatically, and all of the external work has returned inhouse, bringing savings to the bottom line.

Improvements such as these have generated hard, bottom-line savings of over US\$3 million just within the PDM group since the start of the initiatives. The removal of the PDM bottleneck eased pressure in the new product development organization and helped to ensure that products are released to market on schedule. Besides monetary savings, every other key performance metric improved and the team became a model of a Lean transformation within IT and across Steelcase.

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*Co-authors of Innovative Lean Development*

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## **TOYOTA AUSTRALIA: HOW IT HELPED IMPLEMENT BREAKTHROUGH STRATEGY MANAGEMENT**

Toyota Motor Corporation Australia (TMCA) is one of Toyota Japan's global manufacturing centers with a long-term commitment to the domestic and export markets.

TMCA's head office function and manufacturing and engineering activities in Melbourne are complemented by comprehensive sales and marketing operations based in Sydney. Additionally, TMCA has sales and distribution branches in all mainland Australian states. TMCA employs over 4,500 people, and thousands more are employed through its supplier and retail networks.

As well as its locally built Camry and Aurion, Toyota imports a wide range of passenger, 4WD, and commercial vehicles including the Kluger, Yaris, Corolla, Tarago, RAV4, LandCruiser, Prado, HiLux, HiAce, and the revolutionary hybrid model Prius. TMCA has also been successful in adding to its local manufacturing capability the Hybrid Camry from 2010.

Toyota is Australia's largest vehicle exporter, and in 2008 exported 101,668 cars to over 20 countries worldwide. This strong export drive contributed over AU\$1.9 billion (including parts and accessories) in revenue for TMCA in 2008. TMCA's domestic sales in 2008 were 245,000 vehicles (including the Lexus). In addition, TMCA distributes and sells the luxury Lexus brand of vehicles.

## Strategy Management at Toyota Australia

Strategy management is about setting and prioritizing mid- to long-term management plans and annual targets, while engaging all levels of the organization to clarify their own measures and targets. Strategy management at Toyota emphasizes the concept of breakthrough thinking.

In 2000, TMCA implemented a “whole-of-company” strategy management process to all 700 executive staff. Over a five-year period, the Corporate Strategy Division worked with Board and C-level executives and their management teams to create clear corporate goals, long-term objectives (two-year fixed, and three-year aspirational), supporting key performance indicators (KPIs), and action plans. TMCA did this by combining the Balanced Scorecard (BSC) method with Toyota’s best-practice processes for continuous improvement, problem solving, and people development. At the core of this initiative was a sophisticated end-to-end strategy management process, with significant focus on strategy visualization, communication, and execution.

The key challenge faced by Toyota was how to align senior management to “breakthrough” corporate strategy so that everybody understood their responsibilities and was personally committed to delivering the plan. Toyota approached this challenge by implementing a logical and consistent process for setting targets, managing initiatives, and rewarding for achievements at all levels of the company. This process was “visualized” in a simple but very effective Online Balanced Scorecard application, which was built inhouse as an agile collaboration between Corporate Strategy and IT.

### Balanced Scorecard History

Through better strategy management, TMCA aims to be an organization which is capable of sustaining high performance, as well as achieving the specific results required for TMCA to be what is known in the Toyota world as a “self-sustaining” affiliate. To this end, TMCA first deployed the Balanced Scorecard as its strategy management tool in 2000. Since that time, TMCA’s online strategy management system has:

- *Increased visibility of strategy:* With an Online BSC system composed of over 150 integrated scorecards and more than 2,000 targets

- *Aligned strategy processes*: Using BSC as a “strategy hub” linking the president’s goals, the long-term business plan, budgets, the individual performance development process, and the short-term incentive process
- *Improved strategic balance*: With more emphasis on the “people” window
- *Introduced president’s strategy reviews*: Annual visits to each division by the president to review BSC performance
- *Streamlined strategy management process*: With the introduction of a simple user interface and standard management process, supported by a central database and standard reporting and analysis tools, the time invested by each employee in the strategy management process becomes more focused, leading to improved insights, greater opportunity to take corrective action or develop emergent strategy, and more time to focus on other activities

### **Evolution of Hoshin Kanri (Breakthrough Strategy Management)**

Toyota has a well-documented history of Lean thinking, continuous improvement, and people development. As Toyota rapidly expanded in the 1990s and 2000s, Toyota’s leaders realized that the transformation from an *international* company into a truly *global* company required a vital reliance on new Toyota employees who had different ways of working due to their varied experiences and cultures. The days of Toyota being a “Japanese” company were over.

Increasingly, it was necessary to reinforce and reteach the fundamental principles that made Toyota such a successful and respected company. To achieve that goal, the Toyota Institute was formed in 2001. The Toyota Institute’s purpose is to increase the *global* understanding and application of the Toyota Way, through the four components of the Toyota Management System:

- *Toyota Way Foundations*: Values, beliefs, and principles such as continuous improvement, problem solving, respect, and teamwork
- *Toyota Business Practices*: Problem-solving thinking, tools, and techniques
- *Hoshin Kanri*: Problem solving applied to the achievement of long-term “breakthrough” goals

- *On-the-Job Development*: Stretching and growing individual and organizational capability

Once the hoshin kanri thinking, tools, and techniques were documented and delivered through Toyota Institute training courses (called *global content*), each affiliate was expected to integrate the practices into its existing business processes.

In 2007, this prompted TMCA to refine existing processes and tools such as the president's goals, the long-term business plan, the Balanced Scorecard, and the performance and development process to fit with hoshin kanri language, thinking, and principles—supporting the one Toyota global standard system for breakthrough strategy and people management.

Importantly, the Balanced Scorecard system used by TMCA was a *system* in the broader sense of the word—covering people, process, information, and technology—as the enabler. So the transition to hoshin kanri was essentially tweaking the terminology and templates without needing to change the underlying philosophies or processes.

So what is hoshin kanri? *Hoshin* means “direction or needle,” as in a compass; and *kanri* means “management.” So *hoshin kanri* means “direction management,” with a focus on “new” or “breakthrough” objectives. Hoshin kanri principles are:

- Mid- to long-term viewpoint: focus on priority goals
- Vertical alignment: unity in direction
- Horizontal coordination: ownership by all
- Human resources development: people growth through on-the-job development
- Process management: sustained results through Plan-Do-Check-Act (PDCA) and problem solving

## Evolution of the IT Solution

It required two full years of business process design, redesign, development, testing, and continuous improvement to create a company-wide process that was ready to be automated in 2002. The solution was developed internally using existing TMCA IT resources. Balanced Scorecard software was available off the shelf in 2002, and most of the existing systems we examined focused on turning masses of structured data within

business core systems into precious gems of strategic insight. But missing was a system that was very simple for people to use, and importantly one that enabled them to enter their own strategy information—most of which was *unstructured data* (commentary) such as results, successes, struggles, countermeasures, and future activities.

For this reason, TMCA committed to the continuing development of our own inhouse system, which over time has evolved as a key component of our internal management systems and communications. TMCA's goal was to create a strategy management system that would enable knowledge sharing and collaboration rather than a sterile database of highly structured data. It had to look and feel “human” or “personalized” to be accepted and used by front-line employees.

To build a system that was “human,” it was preferable to use a development method that was rapid, flexible, and cost-effective. As the architect of the Balanced Scorecard management system was willing and able to be highly involved in the development process, and as there was no precedent for the software design, the development process followed an agile method. Following many white-boarding sessions and design discussions with key stakeholders, the initial version of the Online Balanced Scorecard was delivered within 12 weeks. Importantly, senior management were shown the first release so they could see the working product as soon as possible, helping to build understanding and sponsorship for what would become the “corporate” strategy management application.

It is worth noting that while the Online Balanced Scorecard system was regularly enhanced from 2002 to 2006, the core functionality and *look and feel* remained constant for the next five years, demonstrating a key Toyota principle of *get it right the first time*.

In 2007 the Online Balanced Scorecard was renamed the Online Hoshin System, and the terminology was aligned to match the Toyota Institute training material. For example, business objective descriptions were restated in the “Why, What, and How” hoshin format to improve the hoshin cascade process, and the column called “Countermeasures/Future Activities” was broadened to be “Countermeasures/Future Activities/Expected Results Next Period” to improve management’s ability to follow up actual versus expected results in the next management meeting (PDCA).

## Strategy Management Processes

The Online Hoshin system has two key views:

- A “scorecard” containing objectives, measures, targets, and performance ratings
- A “planning sheet” for each measure containing the initiatives to support the measure together with commentary on successes, struggles, countermeasures, etc., and attached supporting data to visualize performance (e.g., graphs, tables, and A3 one-pagers).

The process to build a hoshin scorecard is a combination of Western strategy thinking and Japanese Hoshin planning—so it is a good example of East meets West. Put simply, the process has five main steps:

- Step 1.* Assess current environment and identify key challenges—stakeholders; strengths, weaknesses, opportunities, and threats (SWOT); corporate priorities; mission; market and environmental changes; vision; and reflection on the previous year’s performance (PDCA).
- Step 2.* Express challenges as “concrete” problems to be addressed, with tangible measures and targets.
- Step 3.* Identify root causes of these problems and set countermeasures (by whom and by when) to address root causes.
- Step 4.* Capture “problem” measures and targets in hoshin plans at the relevant level.
- Step 5.* Capture “countermeasure” or initiative measures and targets in hoshin plans at the relevant level.

Spinning wheels *normally* indicate a lack of traction, but at Toyota it is the spinning PDCA wheel that accelerates strategy execution. Throughout all steps in this process, there is constant “catchball”; regular use of the system encourages and facilitates consensus and understanding, visualization, and problem-solving thinking.

If you take a look at the daily and monthly standard management processes that support strategy execution, you will see some pretty basic practices that you would expect any management team to apply. The difference with Toyota is that there is a big cycle of PDCA with smaller cycles within each phase, as shown in Table 12.1.

**TABLE 12.1**

Toyota Strategies and Management Processes

Strategy (S) Management Phase	Supporting Management (M) Processes
S-Plan (Q1)	M-Plan: Align long-term, short-term, and operational planning processes M-Do: Create the plan M-Check: Test understanding and commitment to the plan through “catchball” (Online Hoshin System) M-Act: Adjust the plan based on catchball feedback
S-Do (Q1–4)	M-Plan: Create action plans to support higher level initiatives M-Do: Manage action plans using project management and problem solving M-Check: Visualize status using charts, tables, and A3 one-page reports (Online Hoshin System) M-Act: Take corrective action to keep activities or tasks on track
S-Check (Q1–4)	M-Plan: Schedule regular strategy review meetings up to one year in advance M-Do: Senior management leads by example to check on progress (genchi genbutsu) M-Check: Conduct strategy review meetings—identify countermeasures (Online Hoshin System) M-Act: Continuously improve quality of review meeting (e.g., coaching and mentoring participants)
S-Act (Q1–4)	M-Plan: Set countermeasures (by whom and by when) to address root causes of performance issues M-Do: Deliver countermeasures M-Check: Visualize effectiveness of countermeasures (Online Hoshin System) M-Act: Address recurring problems in the next round of strategy planning

One of the greatest challenges with strategy execution is how to make the strategy visible, so it can be proactively managed. The Online Hoshin System is a key driver of business strategy because it makes it easy for everyone from the front line to the executive board to see what the strategy is and how are we doing. The basic question in the strategy game is

“Are we winning?” Toyota leaders and managers alike are *always* expected to know whether or not they are winning—and *why*.

### **IT as a Customer of the Hoshin System**

With Toyota’s relentless focus on Lean operations, all shared “support” functions such as IT are required to argue their case at least annually (and more frequently in the current economic climate) for capital funding, operating funding, and people. Status quo is not the norm—*real* value creation is expected.

One of the greatest challenges any IT operation faces is how to demonstrate the value that IT brings to the business. In TMCA, IT needs to be a true business partner, and one of the simplest but most powerful ways of doing that is to start the conversation with the business about their business strategy and determine how IT adds value, not just cost.

Understanding the real business priorities builds relationships, trust, and confidence. Generally speaking, businesspeople can be cagey about their strategy—especially when the questions are coming from a service division like IT. So when a business leader is asked, “So—what’s your strategy?” a likely response is “Why are you asking?” or even “None of your business” or worse.

With access to each division’s hoshin plans, IT (and other service functions) has the information it needs to explain to the business *how IT can help the business* achieve their objectives, without an enormous effort to extract the key elements of the strategy from the business leaders. One example of this approach is the Hoshin/IT Solution matrix (Table 12.2).

Another example of this approach is the IT Solution Roadmap (Table 12.3).

### **Portfolio Management and Project Prioritization**

One way to “balance” the IT portfolio is to allocate the expenditure based on generic categories such as run, grow, and transform. Another way is to give priority to projects that deliver tangible benefits to a specific hoshin strategy. By having a system that “staples” business objectives and KPIs to corporate, operating arm, and divisional hoshins, greater priority can be given to projects that directly support group strategy.

**TABLE 12.2**

The Hoshin/IT Solution Matrix

	IT Solution A	IT Solution B	IT Solution C
<b>Business Objective or KPI per Hoshin System</b>			
Strategy 1	O	O	Δ
Strategy 2	—	O	—
Strategy 3	—	Δ	O

Legend: O = Strong support; Δ = some support; — possibly no support.

**TABLE 12.3**

The IT Solution Roadmap

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Business Objective / KPI per Hoshin System</b>					
Strategy 1	IT Solution A	IT Solution B	IT Solution C		
Strategy 2		IT Solution B			
Strategy 3		IT Solution B	IT Solution C		
<i>Legend:</i>		Strong Support	Some Support		

Boards and IT investment committees are normally interested in aggregate value for money for IT investment, so it is easier to report investment at the rolled-up group hoshin level rather than as a project-by-project fragmented view. Having an IT service management approach to organize how business objectives combine to support group hoshin enables TMCA's IT division to communicate the value-for-money story at the group, operating arm, division, or project level.

IT resource planning, loading, and balancing are also made easier by aligning and prioritizing the “wish list” projects from the development pipeline with specific hoshin plans. A greater focus on projects with tangible benefits that are linked to hoshins assists IT to negotiate for the right level of resourcing with the right skills to deliver value back to the company.

### **It’s Not All about IT**

Toyota relies on talented people and good process—not computers—to achieve great things. The Online Hoshin System is not a substitute for analysis, communication, questions, and answers. It never will be, and it is not meant to be. The Online Hoshin System is a tool to help efficiently focus the attention of people on what’s important—the strategy, and the necessary actions to achieve it. If leaders and managers do not care about strategy or are too busy or distracted from strategy, then the information technology investment in the planning system will be wasted.

Information technology has a crucial role to play, but it is part of a broader mix. The Toyota Way focuses on human interactions—face-to-face wherever possible. All Toyota people are encouraged to go to the *gemba* (physical workplace) and see, touch, and feel for themselves (*genchi genbutsu*). The principles of teamwork and collaboration are very strongly present in the day to day of the Toyota Way.

The TMCA Online Hoshin experience has demonstrated that IT systems can help busy leaders, managers, and workers come together in a constructive way to solve strategic or *important* problems that are far too often hidden by the sheer volume of *urgent* “daily management” activities.

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## VIRGINIA MASON MEDICAL CENTER: LABORATORY ORDER PROCESS AND SYSTEM IMPROVEMENT

### Background

Virginia Mason is a not-for-profit, integrated health care system with a 336-bed hospital and nine locations, including the main campus and regional centers. More than 450 physicians are on staff, and there are 5,000 employees. Virginia Mason is also a teaching institution with a robust graduate medical education program and a world-class research center.

The health care industry has a defect rate of 3 percent or more, a rate unacceptable in any other industry. Defects have a high human cost, and they also have a huge business cost. For example, a study in 2000 showed that six types of preventable inpatient complications cost US\$9 billion annually. That's just the tip of the iceberg.

In 2001, Virginia Mason adopted the Virginia Mason Production System (VMPS), a management method that seeks to continually improve how work is done to ensure zero defects in the final product. Using this method, Virginia Mason (VM) identifies and eliminates waste and inefficiency in the many processes that are part of the health care experience, making it possible for VM staff to deliver the highest quality and safest patient care. VMPS is based on the Toyota Production System (TPS).

### Improving the Laboratory Order Process

In July 2008, stakeholders from the Laboratory and Information Systems departments at Virginia Mason met and agreed that improving the process for ordering outpatient laboratory tests was crucial. The number of Patient Safety Alerts (PSAs) related to orders for tests was climbing. (PSAs are part of a system at Virginia Mason that empowers all staff to report situations that do, or might, put a patient at risk of harm.) Although several creative steps were implemented to mistake-proof the current ordering process, errors continued to slip through, and the teams trying to improve this process felt that the continuing errors occurred due to inherent defects embedded in the design of the system. The long-term solution would be the implementation of a computerized provider order entry (CPOE) system. That, however, was still some years away

due to capital and resource constraints. In addition, parts of the current information system in use were scheduled to be phased out. As a result, it was decided to design and implement an interim test-ordering process that could minimize ordering errors and at the same time streamline the current order process. It was understood that this interim process would not delay in any way the future implementation of CPOE in the ambulatory setting.

Using VMPS tools, the IT department and the laboratory together conducted a root cause analysis to document exactly where and why the current process and system were failing, and to understand what an ideal interim process (until CPOE was implemented) might look like. The root cause analysis found a process riddled with defects leading to the PSAs:

- Lost orders, double orders, defective orders, and illegible orders
- Patients arriving without orders
- Orders that were not executed, making it necessary to call patients back to the lab
- No coherent, consistent method for performing laboratory order surveillance, or for verifying if and when patients had the tests ordered by their doctor
- Cumbersome process for identifying expired orders and notifying provider of expirations

The laboratory test-ordering process consisted of e-mail order forms delivered via Virginia Mason's intranet, and paper forms completed by doctors and carried to the laboratory by the patient. The information on the paper form was manually entered into the electronic laboratory system by staff when the patient arrived. Paper forms make errors more likely (due to being incomplete, incorrect, illegible, etc), and reentering data is time consuming, causing delays, and is a recipe for mistakes. Orders arriving via e-mail were usually for tests to be done in the future, typically before the patient's next appointment.

While e-mail programs help with the message transport, they are not designed to enable this sort of workflow process. For example, the weak search function in the e-mail program, combined with the number of destination mailboxes, made it difficult to find orders for patients coming in for tests, as well as future orders, duplicate orders, and expired

orders. For every patient who presented for tests, laboratory reception staff throughout VM's clinic system had to search through thousands of orders in every downtown and satellite online order group e-mail box. This search process was extremely cumbersome, time consuming, and prone to errors. In addition, a staff member sorted through orders every day to identify the 100–150 orders that had expired. This required searching through 26 separate folders in a group e-mail box and forwarding the expired orders to the originating department. Figuring out where to send the orders often depended on tribal knowledge rather than information contained within the order documents themselves. Once the provider's office received notification of expired orders, the physician determined if the order should be resubmitted, which required rework on the part of the physician to notify the patient and resubmit the orders.

During the current state assessment, it also became clear that the paper-based part of the system was extremely wasteful: 500,000 paper orders were generated annually. Regulations require that seven years of paper orders (3.5 million paper records) had to be stored off-site at any given time. These records needed to be boxed, labeled, moved, arranged, archived, tracked, occasionally searched and copied, and finally moved again for disposal—causing tremendous labor and environmental waste. The reduction and eventual elimination of the paper system also became an important goal for the team.

These software design and paper flow issues were exacerbated by human ones: typing errors, accidental deletions, and failure to reschedule tests when an appointment was changed, demonstrating a lack of standard work in the overall process. Simple mistakes by staff and patients, as well as poor process design and software weaknesses, caused delays and rework, ultimately putting patients at risk.

## **Solution Called for Collaboration**

Following the root cause analysis, definition of requirements, and discussion of the lab's needs, information systems staff recommended that the pre-CPOE interim solution should be based on a relational database structure, so that it could effectively search, sort, manage workflow, prevent common data entry errors, assist with queuing and scheduling, and securely support this high-volume activity across multiple locations. IT

developed such a database to document, communicate, store, and search orders. They knew, however, that the database alone was not the solution. IT and the laboratory invited the Kaizen Promotion Office (KPO) to participate in defining an optimal business process for laboratory test ordering. (KPO is responsible for guiding work using the Virginia Mason Production System.)

KPO set up a one-day kaizen event in April 2009 to do this work. The team included staff from the laboratory, IT, general internal medicine, and other areas. The task was to define the current process and how the future state should work, resulting in the ideal system functionality. This voice of the customer exercise illustrated what patients, providers, support staff, and the laboratory needed the system to do for them. Developers then created a working prototype of the new system, which the users then tested against these criteria to be certain it could receive all laboratory orders submitted online, track when tests were drawn, and alert clinical staff when surveillance was needed.

After a 90-day IT development cycle with frequent laboratory department input, a one-week Rapid Process Improvement Workshop (RPIW) was held in July to make refinements and corrections and to plan the roll-out of this new ordering system. During the week, the team designed the actual process that physicians and staff would use to place an ambulatory order using the new online process. They also addressed the patient flow from the placement of the order through patient arrival at the laboratory for their blood draw. Patients now simply report to the laboratory, where their electronic orders are retrieved by the receptionist, tube labels are printed, and the patient's blood is drawn. This new process was implemented less than 90 days later with no significant challenges. Further IT testing and exploration will track whether the system is working as designed—a crucial element in all VMPS work (Plan-Do-Check-Act, PDCA).

A member of the IT team estimated that involvement of KPO and use of VMPS tools may have saved as much as two months of work by IT analysts, as the new system was designed, built, and tested in an iterative fashion with frequent customer input. Two positions in the laboratory were reassigned to more pressing patient care duties because the time-consuming and non-value-added online order-tracking and sorting work no longer was needed. In addition, paper generation and storage costs were reduced due to the paperless nature of the new

electronic ordering system As a result of this implementation, the laboratory gained much needed efficiency in how orders are processed upon patient arrival. The two freed full-time employees were redeployed to much needed phlebotomy duties, which decreased the need to hire additional staff, thus keeping their operating margin intact. The laboratory is also closely monitoring error rates, using the new system, to assure that the process changes are successful.

It should be noted that post rollout, the original RPIW team met several times and continued to refine the process, making changes that further improved efficiencies both in the physician's and medical assistant's process and in the laboratory processes. This work continues today.

The work described here is a fairly simple example of the power of the improvement system pioneered by Toyota and now in use at Virginia Mason. The team consisted of staff who actually use the laboratory order system, including doctors, VMPS specialists, IT analysts, and others. This diversity brought together a wide range of experience and ideas and allowed the team to gain a thorough understanding of the functions needed and to test ideas in the real world before deciding on a solution.

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# Appendix A: A Brief History of Continuous Improvement

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The birth of modern-day continuous improvement began at the turn of the twentieth century during the Industrial Revolution.\* An industrial engineer, Frederick Taylor, developed techniques to identify the variables impacting a specific task, thereby defining the most efficient way to perform that task. During the same period, Frank and Lillian Gilbreth introduced time and motion studies, significantly reducing production time. Then in 1908, Henry Ford incorporated process flow, interchangeable parts, and standard work to support the first conveyor-driven assembly line to produce the Model T.†

This innovative period of *scientific management* led to significant gains in productivity by applying standardized methods, simplified work, and division of labor. However, workers often found the simplified, repetitive work dull and meaningless. The scientific approach was highly efficient but only engaged people's hands and not their minds, causing quality problems, poor morale, absenteeism, and management-labor conflict.

In the 1920s, Dr. Walter Shewhart of Bell Telephone Laboratories broke new ground by applying statistical analysis to control process variation, revealing how deviations in a production process caused irregularity in product quality—a major paradigm shift at the time it was introduced.

During World War II, the U.S. Department of War instituted Training within Industry (TWI) to accelerate war production. (For more information on TWI, see *The TWI Workbook: Essential Skills for Supervisors* by Patrick Graupp and Robert Wrona.<sup>1</sup>) TWI introduced standardized job instruction, productivity-driven problem solving, supervisor training, worker safety,

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\* Lean can be traced even further back in history, to the mid-1500s in Venice, where standard design, standard production processes, and interchangeable parts were used to flow the production of hundreds of warships (galleys). In 1793, Eli Whitney applied interchangeable parts to his revolutionary invention, the cotton gin, giving birth to the concept of mass production.

† See *Today and Tomorrow* by Henry Ford, first published in 1926.

and ongoing improvement programs that accelerated output and enhanced quality. These programs were shared with European and Asian countries to support the reconstruction effort.

Postwar Japan was in short supply of capital, materials, and labor. To make matters worse, their products were perceived as cheap, low-quality imitations by consumers throughout the world. In 1950, the Japanese Union of Scientists and Engineers invited several quality experts from the United States to visit and share their expertise. Among them was Dr. W. Edwards Deming, who suggested that Japanese industry could turn around their quality issues and become competitive in five years. The Japanese embraced Deming's ideas of quality and process improvement, helping them to achieve significant gains in only four years, though competitiveness with the Western industrial nations was still many years away.

Although Deming did not introduce the term *Total Quality Management* (TQM)\* in his classic book *Out of the Crisis*,<sup>2</sup> many of the fundamental ideas of TQM are contained within it. The essence of Deming's work is contained in 14 principles:

1. Create a constancy of purpose.
2. Adopt the new philosophy (a new way of thinking about running your business).
3. Cease dependence on mass inspection.
4. End lowest tender contracts (do not award business based on price alone).
5. Improve every process.
6. Institute training on the job.
7. Institute leadership.
8. Drive out fear.
9. Break down barriers.
10. Eliminate exhortations (slogans).
11. Eliminate arbitrary numerical targets (quotas).
12. Support pride of workmanship.
13. Encourage education.
14. Develop top management commitment and action.

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\* Total Quality Management (TQM) refers to the quality improvement discipline founded on the ideas of Deming, Juran, and Feigenbaum, stressing that quality must be actively managed by focusing on customer needs and engaging all employees.

Deming, with influence from his mentor Shewhart, also promoted the *Plan-Do-Check-Act* (PDCA)\* cycle of problem solving.

In 1951, Armand Feigenbaum pioneered the concept of Total Quality Control in *Quality Control: Principles, Practice, and Administration*.<sup>3</sup> Feigenbaum stressed quality as defined by the customer, and as a fundamental management philosophy. He also introduced the idea of *cost of quality*,<sup>†</sup> suggesting that the cost of maintaining high quality is offset by reducing the costs of poor quality.

Joseph Juran made significant contributions to quality management, also emphasizing the human element of quality (employee resistance to change), the need for management training, and the application of quality management to functional areas beyond manufacturing. (See Juran's *Managerial Breakthrough* and *Juran on Quality by Design*.)<sup>4</sup> Juran also presented to the Japanese Union of Scientists and Engineers in 1954 and was a major influence on management training in Japan throughout the 1950s and 1960s.

The principles and tools articulated by Deming, Juran, and Feigenbaum, which later came to be known as Total Quality Management, formed the foundation of Lean and Six Sigma.

By the mid-1950s, many Japanese companies had embraced the Quality Movement, none more than Toyota. Kiichiro Toyoda, then president of Toyota Motor Corporation, had been influenced by Henry Ford's writings.<sup>5</sup> He planted the seeds of the Toyota Production System (TPS) in the 1930s by introducing flow-style production, worker training, and a revised factory layout. His cousin, Eiji Toyoda, toured U.S. factories in 1951, spending three weeks at Ford Motor Company; Eiji returned to Japan with a vision. Ford's plants were models of efficiency; however, they were only capable of producing one product. Every Model T was virtually identical. Ford eventually lost market share to General Motors because of its inability to address both volume and product variety.

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\* Plan-Do-Check-Act (PDCA) is a structured approach to problem solving which applies the scientific method: observation, development of a tentative description of cause and effect (hypothesis), prediction, testing, and evaluation. Also known as Plan-Do-Study-Act (PDSA). For a discussion of PDCA, see Appendix B.

† Cost of quality includes the costs of prevention, appraisal, and internal and external failure.

Toyota believed that it was possible to achieve both flow and product variety without sacrificing time, quality, or cost. At Toyota,\* these concepts were first applied in 1951 by Taiichi Ohno, a machine shop manager who would later become a Toyota executive vice president. Over the next 25 years, Ohno worked with Shigeo Shingo, an industrial engineering consultant, pioneering approaches for waste elimination, flow, visibility, structured training, just-in-time production, workplace organization, and standard work. Shingo is credited with documenting Toyota's improvement procedures, which later became known as the Toyota Production System (TPS).

The focus on quality improvement continued in Japan throughout the 1960s and into the 1970s, when the OPEC oil embargo suddenly plunged the Japanese economy into crisis, sending Western consumers scrambling for fuel-efficient vehicles. Among the major companies in Japan, Toyota was one of the few to make a profit during this time. Beginning in the 1970s, companies from all over the world started touring Japanese plants (particularly Toyota) attempting to discover what they were doing right.

The term *Total Quality Management* was first used by the U.S. Navy in 1984 to describe the Japanese-style management approach to quality improvement. TQM focused on holistic quality themes, including employee involvement, continuous improvement, a focus on customer requirements, and quality management within daily work. Many of these concepts were developed in parallel with the principles and tools Toyota had developed over the past 30 years.

During this period, another field of process improvement emerged, the *Theory of Constraints* (TOC). In 1984 Dr. Eli Goldratt introduced the concept of managing the pace of production and supporting process improvements around constraints (bottlenecks) in his landmark novel, *The Goal*.<sup>6</sup> The premise of TOC is that productivity is improved as a result of identifying and managing bottlenecks as pacemakers to regulate production. By eliminating constraints, the speed at which information and materials move is increased, improving quality, cycle time, customer satisfaction, and cash flow.

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\* Modern-day Toyota Motor Corporation began in 1933 as a department of Toyoda Automatic Loom Works focused on the production of engines and then automobiles under the direction of the founder's son, Kiichiro Toyoda. Toyota Motor Corporation was established as an independent company in 1937.

Six Sigma emerged in the 1980s; its well-publicized success at large companies such as Motorola, Allied Signal, and General Electric created broad interest. Many organizations aspired to increase profits by improving their quality to a Six-Sigma level (3.4 defects per million), investing heavily in training and creating an internal resource pool of specialized green and black belts. Six Sigma created a rigorous data-driven methodology to link improvement activities with bottom-line financial results. (See also Appendix B on Six Sigma and Lean.)

During the 1980s, Japanese automakers' quality and market share continued to improve. The Sloan\* Foundation funded a five-year, US\$2 million study by the Massachusetts Institute of Technology, resulting in the 1990 publication of *The Machine That Changed the World* by Womack, Jones, and Roos.<sup>7</sup> This landmark book explained the principles behind the Toyota Production System, and coined the term *Lean*. Then in 1996, Womack and Jones published *Lean Thinking*,<sup>8</sup> introducing a five-step process for Lean improvement:

1. *Specify value* from the perspective of the end customer.
2. *Identify all the steps in the value stream*, eliminating those activities, processes, and policies that do not create value.
3. *Flow* products and service smoothly toward the customer.
4. Let the customer demand *pull* value from the next upstream activity.
5. *Pursue perfection* through continuous improvement.

From a broad perspective, continuous improvement began with a scientific focus on efficiency and then shifted to a humanistic focus on creating quality through respect for people. What Deming, Juran, Feigenbaum, Ohno, Shingo, and others discovered was that significant lasting improvement is achieved by engaging the hearts and minds of everyone in the organization. As continuous improvement methodologies evolve, they adopt new names and tools: Total Quality Management, Toyota Production System, Lean Manufacturing, Lean Office, Theory of Constraints, Six Sigma, Lean Six Sigma, and so on. Whatever the label, these disciplines are all natural advancements of process improvement and quality management principles and tools that have evolved over the past 100 years or

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\* Alfred P. Sloan was the longtime president and chairman of General Motors.

more. While there are differences among them, the key point is that all these improvement methods are *complementary*, comprising a rich collection of ideas to be drawn upon where appropriate.

## ENDNOTES

1. Patrick Graupp and Robert Wrona, *The TWI workbook: Essential skills for supervisors* (New York: Productivity Press, 2006).
2. W. Edwards Deming, *Out of the crisis* (Cambridge: Massachusetts Institute of Technology, Center for Advanced Engineering Study, 1982).
3. Armand Feigenbaum, *Quality control: Principles, practice, and administration* (New York: McGraw-Hill, 1951).
4. Joseph Juran, *Managerial breakthrough* (New York: McGraw-Hill, 1964); and Joseph Juran, *Juran on quality by design* (New York: Free Press, 1992).
5. Henry Ford, *Today and tomorrow* (Garden City, NY: Doubleday, 1926).
6. Eli Goldratt, *The goal* (Great Barrington, MA: North River Press, 1984).
7. James P. Womack, Daniel T. Jones, and Daniel Roos, *The machine that changed the world* (New York: HarperCollins, 1990).
8. James P. Womack and Daniel T. Jones, *Lean thinking* (New York: Free Press, 1996), 16–26.

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# Appendix B: How Lean and Six Sigma Work Together

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Six Sigma is a process improvement methodology emphasizing data analysis with a primary objective of reducing process variation to improve quality. The Greek letter sigma ( $\sigma$ ) represents variability. The sigma level of a process indicates the probability of defects; the higher the sigma level, the more stable and reliable the process and the lower the likelihood of defects. A process functioning at a Six-Sigma level equates to 3.4 defects per 1 million opportunities, which is equivalent to 99.9997 percent defect-free work. As sigma levels increase, there is less need for inspection, testing, and rework, which reduces costs while improving cycle times and customer satisfaction.\* Six Sigma and Lean share many similarities: both seek to establish ongoing continuous improvement, focus on delivering customer-defined value, and pursue the reduction of non-value-added work. They also apply a disciplined closed-loop† improvement methodology.

The improvement methodology used in Six Sigma is *DMAIC* (pronounced dee-may-ik), which stands for *define, measure, analyze, improve, and control*.

DMAIC is a structured approach which begins with the *define* step, which typically includes a comprehensive project charter.‡ During the *measurement* stage, current-state processes are identified and investigated, baseline data are gathered, and process mapping is often performed. Metrics used to determine the effectiveness of current processes are also developed.

In the *analyze* stage, the process is examined for sources of variation and wasteful non-value-added activity in order to identify opportunities

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\* For a comprehensive review of Six Sigma, see *Six Sigma Demystified* by Paul Keller. For a brief but thorough overview, see *The Lean Six Sigma Pocket Toolbook* by George et al.

† A closed-loop feedback system provides information on the effectiveness of a process by supplying output information on quality, time, cost, variability, or other criteria. The information is used to make improvements to the system as conditions change.

‡ The project charter includes a problem statement, project objectives and anticipated results, scope, stakeholders, sponsor, team members, resource requirements, metrics, and project milestone dates. Project scope defines the project's boundaries: what will be addressed and what will be excluded.

for improvement. During the *improvement* phase, new processes are developed, implemented, and tested to ensure they function as planned. Finally, during the *control* phase, improved processes are documented and workers are trained in new standard work practices. Lessons learned are captured, and controls put into place to monitor changes, creating a feedback loop for ongoing improvement, verifying results, and tracking financial returns. At the conclusion of the project, a formal report out is presented to a steering team or senior management, and results are evaluated against the anticipated outcomes defined in the project charter.

In contrast, Lean applies the *Plan-Do-Check-Act* (PDCA)\* cycle improvement methodology. During the *planning* stage, a draft A3† problem summary is prepared and presented to a steering team or project sponsor for approval. Usually, Lean improvements do not require a formal project charter beyond an A3. During the development of the A3, the team asks, “What is happening and what should be happening?” Specific, measurable, actionable, realistic, and time-bound (SMART) targets are developed to measure baseline performance and later the impact of process improvements. During the *do* stage, the team analyzes the current state (often using value stream mapping) identifies value-added and non-value-added work, isolates root causes of problems, gathers baseline data, and develops, prioritizes, and tests potential countermeasures. The most promising countermeasures are selected for implementation.

During the *check* step, results are compared with the SMART targets to determine the effectiveness of the improvements. Finally, during the *act* stage, if the results are acceptable, the improved process and supporting metrics are put into practice and become the new standard work. Employees are then trained in the new procedures. However, if the results indicate that the countermeasures are inadequate, an adjustment‡ needs to be made based on the results and the team enters into another round of problem solving—the hypothesis has been disproven and the PDCA cycle begins anew. At the conclusion of each PDCA cycle, a report out is provided to the steering team or project sponsor.

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\* A variant of this is Plan-Do-Study-Act (PDSA), also known as the Shewhart cycle, Deming cycle, or Deming wheel.

† See Chapter 2 for a discussion of the A3 thinking process and Appendix D for a sample A3.

‡ Some Lean practitioners like to say the A in PDCA stands for adjust. This implies a more active role in assessing results of countermeasures and responding appropriately.

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## FOCUS

DMAIC and PDCA are equally effective process improvement methodologies. While DMAIC offers a more formal project deployment model applying additional rigor in the *define* stage, PDCA is a very effective problem-solving method that can be applied with less formality and overhead. Both have their appropriate place in continuous improvement and should be chosen according to the scope, cost, complexity, and risk of the undertaking.

A major difference between Lean and Six Sigma is their principal focus: Six Sigma emphasizes quality through controlling process variation, while Lean's primary focus is flow attained from eliminating non-value-added activities (waste). In most organizations, the vast majority of improvement opportunities are found in wasteful business processes. It is not surprising that many companies discover that focusing on waste (not process variation) is the best place to begin their improvement efforts. Lean quickly prepares organizations to address obvious *low-hanging fruit* improvement opportunities that are relatively easy to achieve and deliver a noticeable impact. Harvesting these opportunities creates early wins, preparing employees for more challenging projects.

After non-value-added activities are removed from a process, it is easier to identify high-value problems deserving rigorous attention.

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## ROLES

In Six Sigma, projects are typically led by certified black belts and staffed with green belts.\* Specialists drive improvement activity and are thoroughly trained in improvement tools and methods. However, the people closest to the work may lack a sense of ownership and responsibility to solve problems while waiting for the Six Sigma experts to arrive (generally speaking, Six Sigma

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\* Black belt and green belt are Six Sigma designations. Black belts have traditionally completed advanced training (4–6 months) and successfully completed two large-dollar-value projects. They provide training and mentoring to green belts and other employees. Black belts work full time on Six Sigma projects. Green belts have received basic training in Six Sigma (often 5 days) and support black belts by providing project facilitation and guidance. Certification is offered by a number of professional organizations, universities, and private companies.

usually engages about 30–40 percent of the workforce). In Lean, all employees are trained in basic improvement skills and are expected to take an active role in daily improvement and problem solving. Because Lean is generally more intuitive and less quantitative, the tools and methods are often perceived as *common sense* and less intimidating to employees. In some organizations, Lean is perceived as being more accessible, engaging the entire workforce.

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## PROJECT SIZE AND DURATION

Lean improvement activity, called *kaizen*,\* ranges in duration from a few hours to a few months, while the typical Six Sigma project lasts from three to nine months. *Kaizen events* are focused short-term improvement efforts that typically involve a cross-functional team and several weeks of preparation followed by a week of PDCA activity. *Kaizen* also occurs on an as-needed basis as problems and improvement opportunities are encountered. These *daily kaizen* are short, focused improvements lasting just a few minutes or a few hours. Some Lean efforts require more than a week to execute. These *kaizen projects* can last from several weeks to several months. Generally speaking, Six Sigma projects take longer to complete than Lean projects due to the effort invested in formal project management (e.g., project charters), data sampling, and analysis. Lean is about hitting frequent *base hits*, while Six Sigma strives for *home runs*.†

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## PROJECT SELECTION

Because Six Sigma projects make use of trained black belts (a finite resource), projects are limited. Six Sigma projects are regulated based on alignment with organizational goals, risk, and return on investment (ROI). It is not uncommon for Six Sigma projects to target annualized

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\* *Kaizen* is ongoing continuous improvement of a value stream (system *kaizen*) or a single process (process *kaizen*). In general, system *kaizen* is the primary focus of management, while process *kaizen* is the responsibility of associates formed into teams.

† For more information on *Kaizen*, see *Kaizen: The Key to Japan's Competitive Success* by Masaaki Imai.

returns of \$150,000 or greater. With Lean, the emphasis is on continuous improvement occurring throughout the organization on an ongoing basis; focus shifts from a few carefully chosen large projects to an unlimited cycle of incremental improvement activities. Occasionally, Lean improvements include large-scale projects representing radical, even revolutionary change—called *Kaikaku*.\*

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## COMPLEMENTARY COEXISTENCE

Can Lean and Six Sigma coexist in one organization? Absolutely! Many companies today have a *Lean Six Sigma* program. In the final analysis, Six Sigma and Lean complement each other by providing the tools and methods necessary for sustained improvement throughout the enterprise. Our experience shows that Lean is often the entry point due to its primary focus on waste, low initial startup costs, company-wide participation, and rapid results. Initial Lean efforts often focus on achieving quick wins. These early successes foster support and enthusiasm for additional improvement efforts. Once the initial gains have been realized, companies recognize the need to address more challenging constraints and process variation. These complex problems often require disciplined analysis and formal project management. This is where Six Sigma provides the quantitative tools and thorough deployment methodology needed.

On the other hand, several of our clients began their journey with Six Sigma, finding the structure, discipline, and focus a good fit with their established culture. After they successfully created a foundation of continuous improvement with Six Sigma, they expanded the effort to all associates by introducing Lean to the rest of the company. Lean became the general approach to improvement, while Six Sigma was applied when specifically suited to the problem at hand. Whether your organization embarks on its process improvement journey by employing Lean or Six Sigma, it is important to understand that both these improvement methodologies are complementary and have their appropriate place.

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\* *Kaikaku* is breakthrough and radical improvement (initiated by senior management), as contrasted with *kaizen*, which is gradual, continuous, and often initiated by the people closest to the work.



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# Appendix C:

## Information Wastes

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Following is a list of information wastes we have compiled during our own practice, along with input from many IT professionals we have worked with over the years. We hope this list helps you learn to see waste in your own work environment—the first step toward eliminating it.

This is by no means a complete list, and we'll continue to update it on our website: [www.steadyimprovement.com](http://www.steadyimprovement.com). The list is available for download and free distribution.

If you would like to submit your own examples of information waste, please send them to [info@steadyimprovement.com](mailto:info@steadyimprovement.com)

### Inventory

- Backlog accumulating in electronic and physical inboxes
- Old or obsolete electronic and physical files and messages that should be stored, disposed, or recycled
- Clutter: physical and virtual disorganization wherever work is done or knowledge is stored and shared
- Endless spreadsheets and other “productivity enhancing” documents that encourage local optimization while fragmenting the overall process, increasing the number of delays, handoffs, and errors
- Excess information across local drives, shared drives, SharePoint sites, data warehouses; duplication of the same data in multiple forms (e.g., electronic and paper)
- Sending attachments rather than links, which creates multiple versions of a document (also causing version control and security problems)
- Work waiting to be reviewed, approved, and forwarded
- Software that's purchased but never deployed
- Unnecessary, unclear, incorrect, obsolete, or unused documentation
- Projects and programs that are not being considered but are still on the backlog

- Backlog accumulating in the software development, support, or enhancement queue
- Partially completed development work—uncoded documentation, unsynchronized code, untested code, undocumented code, undeployed code
- Multiple software code objects that perform the same function
- Introducing excessive tools, technologies, or methodologies
- Unused/unnecessary software user licenses
- Excessive inventory of ink cartridges and other consumables that require space and may become damaged or obsolete before they are needed
- Excessive parts inventory

**Overprocessing** (doing more work than the customer requires)

- Mandated but unnecessary or overly complex processes and activities
- Inspection and correction activities required to catch and correct errors that should be prevented by building quality into the process
- Producing and distributing reports that contain information which is not used
- Sending people unnecessary messages, such as selecting “reply all” to an e-mail message, when “reply” (or no response) is sufficient
- Unused functionality designed into software
- Failure to cancel a project when it is determined to be no longer viable
- “Gold plating” system design and performance striving for perfection rather than practical adequacy
- Excessive or unused reason or categorization codes configured into the software
- Entering redundant information into the same or multiple systems
- Workflow approval routings that are not necessary
- Unclear lines of decision making responsibility/authority that cause unnecessary changes, time, cost, errors, and rework once a project is underway
- Management reporting systems (e.g., hierarchal scorecards and dashboards) that do not align strategy with daily activity, and thus do not effectively prioritize action, leading to effort that does not contribute to organization goals (doing the wrong work, but doing it well)

- Frequent switching between incomplete jobs, also known as multi-tasking, thrashing, task switching
- Ineffective or repetitive meetings that add little value and don't resolve lingering issues
- Inviting people to unnecessary meetings, or meetings where they don't need to be involved
- Trying to govern or manage systems or processes that are unreliable, unstable, undocumented, or too complicated to understand
- Searching for information or materials that are difficult to find
- Excessive automated exception notifications and alerts that cause distraction, but do not drive effective action or decision making
- Multiple reports containing the same or similar data
- Excessive analysis that does not add value to a decision
- Helpdesk troubleshooting that addresses symptoms but not root causes
- Non-value-adding control activities solely for compliance purposes
- Cost accounting efforts that track and calculate cost per unit/order/event rather than the value stream cost
- Unnecessary transactions, capturing more information than is needed to complete the process or to support decision making (e.g., capturing standard cost variances and calculating overhead allocations in order to support a process that flows)
- Gridlocked or unclear matrix management practices
- Unnecessary monthly closing activities
- Lack of system and process integration that causes unnecessary work
- Budgeting tasks that do not lead to better decision making
- Excessive, unnecessarily invasive, or complex security policies and procedures
- Printed information where electronic is sufficient, for example, presentation slides and handouts
- Writing something, then entering it into a computer system
- Printing information from one computer system then re-entering it into another
- Capturing data at various points along a process, rather than capturing at the source
- Information addiction, excessive e-mail, web surfing, social networking, and so on . . .

**Overproduction** (producing more / sooner than the customer requires)

- Unnecessary or early work performed due to unclear priorities, interdependencies, or sequence
- Software requirements that are specified long before coding
- Producing and distributing a document days before a meeting, that is then modified based upon later information and redistributed
- Printing collateral materials that are quickly obsolete
- Making extra copies
- Printing single-sided versus double-sided
- Processing paperwork or information before the downstream operator is ready for it
- Making and locking decisions in too early that commit resources and limit flexibility

**Waiting / Delays**

- Searching for information (which often consumes a half hour or more of every individual's time each day)
- Delays from excessive review and approval steps
- Delays in receiving, transmitting, and storing information
- Slow application response
- Unnecessary distractions and interruptions
- Unclear lines of decision-making responsibility/authority that cause delays (e.g., project approval)
- Delays between coding and testing
- Waiting for hard copies that could have been handled electronically
- Metrics that are not real-time, having to wait to take action
- Missing, incomplete, incorrect, obsolete, or unclear information from upstream processes that require time for clarification and correction
- Overnight batch processing of data
- Reports that take a long time to run
- Waiting for a specialist who is currently working on another task or project (shared resource)
- Discussions or decisions that take too much time because a team is not co-located or does not have the capability for online communication/collaboration
- Long helpdesk hold and callback times

- Using shared equipment; waiting time for availability, plus time required to reconfigure/reboot/login
- Delays in determining correct groups or individuals needed for process or problem resolution
- Missing, incorrect, unclear, or obsolete process documentation which causes delays when a procedural problem or question arises

### **Motion/Transport/Transfer**

- Walking to/from printer, copier, fax machine, filing cabinet, archival storage
- Poor user interface or process design that causes unnecessary keystrokes, mouse clicks, or navigation steps
- Nonstandard handoff of information from one process step to another when it requires some form of change or re-interpretation of the information
- Intercompany handoffs of nonstandard, nonintegrated information (e.g., supply chain transactions)
- Security barriers to flow of nonsensitive information
- Filing or moving physical documents that could be stored and forwarded or linked electronically
- Providing a spreadsheet or report to more people than actually need it
- Needing to split email attachments into smaller segments due to file size limitations
- Toggling between disconnected applications
- E-mails sent/responded to uninvolved people
- Unnecessary movement of electronic information
- Sending attachments rather than links to documents
- Printing information from one computer then re-entering it into another
- On-site visits to resolve system issues that could be resolved (or prevented) with remote monitoring and correction
- Using multiple emails for dialogue when a conference call or face-to-face meeting is more effective
- Manual expediting of documents—walking documents through the approval process
- Poor ergonomic design of work stations

### **Errors/Defects/Rework**

- Incomplete, incorrect, obsolete, or unclear information from upstream processes that must be corrected
- Inspection and correction processes
- Poor project execution
- Not understanding customer/user requirements and expectations, thus delivering ineffective “solutions”
- Unstable software, hardware, communications, devices, etc., that make it difficult for people to get value-added work done
- Lost information
- Mixed messages from management about the importance of doing work right the first time, while also doing all daily work “on schedule”
- Excessive productivity standards, measurements, and incentives that emphasize volume/speed over quality
- Forming a kaizen team to improve an automated business process without including a representative from IT, often resulting in incorrect system requirements and change requests
- Application bugs and design flaws
- Unauthorized changes to software and systems
- Inadequately tested changes to software and systems
- Testing introduced too late in the lifecycle of a project
- Software patches applied simply to correct errors introduced by the previous patches
- Assuming customer needs / requirements instead of getting it directly from the customer (not asking for information, or asking for the wrong information)
- Measures that lack valid prescriptive guidance
- Time and effort required to identify and correct bad data as it propagates across multiple data sources
- Entering conflicting information into the same or multiple systems
- Reconciling conflicting sources of data and subsequent disagreements over whose data is right
- Consequences of estimating, pricing, forecasting, or scheduling errors (to name just a few) based on incomplete, incorrect, irrelevant, or obsolete data or assumptions

- Helpdesk knowledgebase information that is incorrect, incomplete, unclear, or obsolete resulting in a failed intervention, potentially causing additional harm and lost user productivity
- Helpdesk interventions that do not solve the problem due to misunderstanding, unclear communication or problem definition thus requiring further troubleshooting and correction
- Missing, inaccurate, incomplete, unclear, or obsolete specifications or process documentation
- Errors resulting from insufficient or improper analysis and reflection
- Meeting conflicts and subsequent rescheduling caused by misuse of the scheduling system
- Inability to receive email attachments that exceed file size limits, causing rework
- E-mail, spam, and the problems that result from excessive filtering
- Free text fields instead of drop-downs, check boxes, etc. that allow user error and the propagation of bad data throughout downstream systems
- Requiring workers to memorize or write down data from one source to be entered into another source

### **Unnecessary Complexity / Overengineering**

- Over design of software applications
- Over automation of processes
- Premature technology intervention to improve a process, before the process is well understood, simplified, and improved by the people responsible for it
- Developing complex solutions to simple or nonrecurring problems
- Spreadsheets with unnecessarily complex formulas, macros, and multiple dimensions that give the appearance of sophistication while masking potential errors and invalid assumptions
- Overly complex governance, funding, prioritization, and control processes
- Lack of systems thinking: focus on departmental optimization rather than overall process performance
- Inappropriate or overly complex IT chargebacks that cause ineffective behavior and misguided IT investment decisions

- Rigid and lengthy system change/upgrade cycles that encourage user workarounds and offline systems
- Attraction to newest, latest technologies rather than existing systems that serve their purpose
- Not distinguishing between symptoms and root causes
- Proliferating improvement initiatives that are not strategically aligned, prioritized, or adequately resourced

### **Underutilized Human Potential**

- Information overload
- Unnecessary process, data, or system complexity
- Dull, repetitive, or mundane activities that could be eliminated or automated
- Unnecessary or complicated top-down rules and process controls
- Lost, conflicting, or underutilized knowledge that must be rediscovered and relearned once a problem occurs
- Excessive approvals needed or other bureaucracy that discourages improvement and innovation
- Lack of guidelines or work standards to empower employees
- Too much time spent on daily work, with not enough time allowed for individuals to improve the work
- Not communicating targeted objectives to all associates involved in a process
- Excessively detailed standards that do not allow flexibility
- Lack of visuals and measures to indicate where problems need to be solved
- Not asking for ideas
- Not capturing and sharing ideas
- Not making knowledge easy to locate and apply
- Not investing in education and training
- Not encouraging cross-functional communication and collaboration

### **Environmental Waste**

- Electricity consumed by IT assets
- Paper consumed by unnecessary printing
- Printing single-sided versus double-sided
- Ink, toner cartridges, and other recyclables that are disposed prematurely . . . or not recycled!

- Improper disposal of materials, including hazardous materials found in many electronics
- Using paper coffee cups instead of ceramic mugs
- Document storage, archive, and disposal waste
- Overnight shipping expenses and carbon footprint that could be reduced through electronic transport
- Transportation (fuel, carbon, and other costs) that could be reduced through telecommuting and remote meetings
- Business processes causing environmental waste, that could be improved with thoughtful application of information and information systems



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# Appendix D: IT Service Desk A3 Example

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## A3

**Theme**

Helpdesk wait time is often very long (average of 17 minutes) and the percentage of first call problem resolution is low (27%) causing lost productivity, user frustration, and occasionally harmful system workarounds.

**Boundaries**

**In:** Employee helpdesk calls from North America, desktop systems

**Out:** First round of improvement excludes international calls, trading partner calls, server and telecommunications issues, application integration and DGA services

**Voice of the Customer**

Customers want stable systems that don't need support in the first place, meaning better prevention and look-ahead to problems that might occur when system changes are made. Many customers want to solve their own problems by searching the knowledgebase, while others want a friendly voice to help them with the more technical issues. When a call to helpdesk is needed, customers want wait times to be short, quick routing to the proper technician, and swift diagnosis of the problem and help with a solution when the problem has been encountered before.

**Current State**

Ave calls per day	4900
Peak calls per day	14200
Ave queue wait time	17 min
Call abandonment	38%
First call resolution	27%
> Three retests required	38%
Ave Knowledgebase Search Times	2.8 min
Searches that do not yield results	32%
Searches yield conflicting/incorrect results	54%
# of Documents in Knowledgebase	8754
# Directories in Knowledgebase	289
Unresolved cases	14%
Call due to nonstandard configuration	18%
Call due to login or password trouble/reset	11%
Helpdesk staff turnover	42%
User satisfaction survey	14%



Management is evaluating a SSM investment in a new call center system.

**Problem Analysis (Root Cause)**

Value Stream Mapping and brainstorming resulted in over 100 issues identified, which team explored and charted on a cause and effect (fishbone) diagram, then prioritized using Impact/Ease and Pareto analysis. Several of the key causes are listed below.

Lack of knowledgebase standard documentation protocol and keyword
Lack of knowledgebase maintenance allowing for obsolete information
Insufficient helpdesk employee orientation, training or mentoring
Lack of cross-training and support creates pockets of technical specialization
Underenforcement of purchasing and configuration standards
Unclear initial call information capture and qualification
Inability to anticipate load and match with staffing levels
Overload on staff causes insufficient knowledge capture before taking next call
Insufficient training and first line assistance at department level
Insufficient tracking of user configurations and licenses



Date:	dd/mm/yy
Sponsor:	Tracy Brown
Coach:	Ron Johnson
Team Lead:	Lori Jenkins
Team:	Paul Richie, Julie Turnbull, Ben Franks, Andre Money, Lisa Mendelson, Bill Miller



Future State and Target Measures		
<b>Six Month Targets</b>		
Ave calls per day (reduce by 50%)	2400	
Ave queue wait time (reduce by 50%)	8 min	
First call resolution (improve by 100%)	50%	
Conflicting/incorrect search (reduce by 60%)	20%	
# of Documents in Knowledgebase (reduce by 70%)	2600	
Call due to nonstd config (reduce by 90%)	13%	
Call due to login or password trouble/reset	11%	
Helpdesk staff turnover (reduce by 50%)	20%	
User satisfaction survey (improve by 100%)	25%	
<b>Future State Value Stream Map</b>		
<b>Kaizen (PDCA Test Cycles)</b>	<b>Target Outcome</b>	<b>Team Lead</b>
Hotline for Login and Password issues	Reduce helpdesk load by 13%	PaulR
Investigate non-standard config with dept heads	Reduce by 50%	BenF
SS Knowledgebase	Organize and maintain	LisaM
Standardize Knowledgebase usage	Reduce info errors by 70%	LisaM
Helpdesk staff mentoring and coaching program	Reduce turnover by 50%	LoriU
<b>Implementation Plan - What</b>	<b>Who</b>	<b>Due Date</b>
Non-standard Configurations	BenF	dd/mm/yy
Communications Plan	Team	dd/mm/yy
Hotline improvements	PaulR, TracyB	dd/mm/yy
Knowledgebase Ss and standardization event	LisaM + Team	dd/mm/yy
Staff mentoring and coaching	LoriU + Team	dd/mm/yy
Based on testing results: standardize, implement and sustain countermeasures as we validate our understanding (through PDCA test cycles) of what changes are needed to achieve the target state.		
<b>Value Realized</b>		
<b>Standards team will use in value calculations once outcomes are measured:</b>		
One hour user call wait time = \$100/hr in labor cost		
Each hour that a problem isn't resolved = \$250/hr company productivity loss		
Cost avoidance: added capacity of existing helpdesk staff = \$40k/yr per prevented new hire		
Cost avoidance: reduced employee turnover = \$15k/event in hiring, training, and lost productivity		



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Through many years of hands-on experience assisting their clients with large-scale IT projects, the authors realized that effective change had to be based first on improving underlying business processes before technology could make a positive impact. In the proving ground of IT project implementation, they discovered how to effectively apply the principles and tools of Lean and Six Sigma to IT efforts across many industries.

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*“This book will have a permanent place in my bookshelf. In my ten-year study of high performing IT organizations, I’ve found that businesses rely on IT far more than they think. The impacts of poor flow from application development into IT operations can be devastating: ever-increasing cycle times and amounts of rework, and an ever-increasing amount of heroics required in IT operations to preserve the illusion of stability and reliability.”*

—Gene Kim, Chief Technology Officer, Tripwire, Inc.

*“There has never been a more critical time to improve how IT integrates with the global business enterprise. This book provides an unprecedented look at the role that Lean IT will play in making this revolutionary shift and the critical steps for sustained success.”*

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—John Bicheno, Program Director MS in Lean Operations, Cardiff University

*“... a comprehensive view into the world of Lean IT, a must read!”*

—Dave Wilson, Quality Management, Oregon Health & Science University

An IT organization is expected to “align with the business.” That is, IT is supposed to enable business performance and innovation, improve service levels, manage change, take advantage of emerging technologies, and maintain quality and stability, all while steadily reducing operating costs. Yet when an enterprise begins a Lean transformation, too often the IT department is either left out or viewed as an obstacle. What is to be done? This book shares practical tips, examples, and case studies to help you establish a culture of continuous improvement to deliver IT operational excellence and business value to your organization.



**CRC Press**

Taylor & Francis Group  
an informa business  
[www.crcpress.com](http://www.crcpress.com)

6000 Broken Sound Parkway, NW  
Suite 300, Boca Raton, FL 33487  
270 Madison Avenue  
New York, NY 10016  
2 Park Square, Milton Park  
Abingdon, Oxon OX14 4RN, UK

K10912

ISBN: 978-1-4398-1756-8



[www.productivitypress.com](http://www.productivitypress.com)