Best Practices Fusion: Lean Six Sigma and ITIL®

By Gary A. Gack

Use of Lean Six Sigma in software development and IT in general has increased significantly over the last several years, and many organizations are learning to leverage the relationships between Lean Six Sigma and other approaches to software process improvement, including the Software Engineering Institute's Capability Maturity Model Integrated (CMMI®), the IT Infrastructure Library (ITIL®), the Project Management Institute's Project Management Body of Knowledge (PMBoK®), and others. Integration of Lean Six Sigma with ITIL® and the PMBoK® are addressed in other White Papers in this series and are available from the author. Lockheed Martin, Motorola, Raytheon, and many others have reported significant gains by combining the best features and ideas from several different best practices models and methods, in several cases creating a "local brand" of integrated process improvement methods.

The current state of the art in proven process improvement methods is defined by the synthesis of Lean and Six Sigma, collectively known as "Lean Six Sigma", hereinafter, "LSS".

Lean

The Lean thought process has been thoroughly described in the books *The Machine That Changed the World*[1] and in *Lean Thinking*[2]. The authors, Womack and Jones, summarize the key ideas of Lean into five core concepts:

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

Lean has evolved significantly beyond its origins in manufacturing and is now widely used in services industries and "transactional" applications across all industry groups. In the software field Lean

[1] *The Machine That Changed the World* by James Womack and Daniel Jones, Scribner (October 10, 1990)
[2] *Lean Thinking* by James Womack and Daniel Jones, Free Press; 2nd edition (June 10, 2003)

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concepts have been influential in the formulation of "Agile methods"[3] and Lean Software Development as illustrated most recently by the work of Mary and Tom Poppendieck[4]. Lean, in a general sense, focuses on issues that effect cycle time.

Six Sigma

Originated at Motorola in the mid 1980s and subsequently elaborated mostly notably by GE (and many others), Six Sigma has evolved to include three primary elements:

- A deployment strategy that defines roles (Champions, Yellow-Green-Black and Master Black Belts), describes a process for selection of improvement projects explicitly linked to the organizations strategic imperatives, and provides a governance process that emphasizes financially measured benefits and institutionalization of gains.
- A process improvement approach often referred to as a "roadmap" known as DMAIC (Define, Measure, Analyze, Improve, Control) – most often used to improve an existing process or product
- A new product/process design approach known generally as "Design for Six Sigma" and described by several different "roadmaps" including DMADV (Define, Measure, Analyze, Design, Verify), IDOV (Identify, Design, Optimize, Validate), and DMEDI (Define, Measure, Explore, Develop, Implement) – despite impassioned arguments by their respective proponents, all are equivalent in practice.

Six Sigma, in a general sense, focuses on reduction in variance and reduction in "defects", defined in the broadest sense to include any deviation from customer requirements or expectations.

At least in the context of software and IT, the state of the practice has effectively combined Lean and Six Sigma into an integrated process improvement method that we will refer to as "Lean Six Sigma" (LSS) in the remainder of this article.

Three key concepts form the foundation for Lean Six Sigma success: (1) Management by Fact – decisions based on data and analysis, not opinion; (2) the equation $Y = f(x_1, x_2, x_3, \ldots x_n)$ where "Y" is an outcome, not directly controllable, while "x's" are the root cause controllable factors that drive outcomes – LSS is a method for discovering the significant x's; and (3) "Show me the money" – projects are selected and evaluated based on financially measured results.

Lean Six Sigma (LSS) is widely regarded as the premier state of the art process improvement methodology. Unlike ITIL® it is a specific method – it provides proven 'roadmaps' for design and improvement of products and processes that are demonstrably responsive to customer's "Critical to Quality " requirements (CTQs). Lean Six Sigma explains how to operate an IT Service Improvement Program ("SIP"), but does not address any aspect of "what" is included in IT Service Management.

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[3] *The Agile Manifesto*, by Kent Beck, Mike Beedle, Arie van Bennekum, Alistair Cockburn Ward Cunningham, Martin Fowler, James Grenning, Jim Highsmith, Andrew Hunt, Ron Jeffries, Jon Kern, Brian Marick, Robert C. Martin, Steve Mellor, Ken Schwaber, Jeff Sutherland, and Dave Thomas http://agilemanifesto.org/ These individuals and others have authored dozens of books on this topic.

[4] *Implementing Lean Software Development: From Concept to Cash*, by Mary and Tom Poppendieck, Addison-Wesley (2007)

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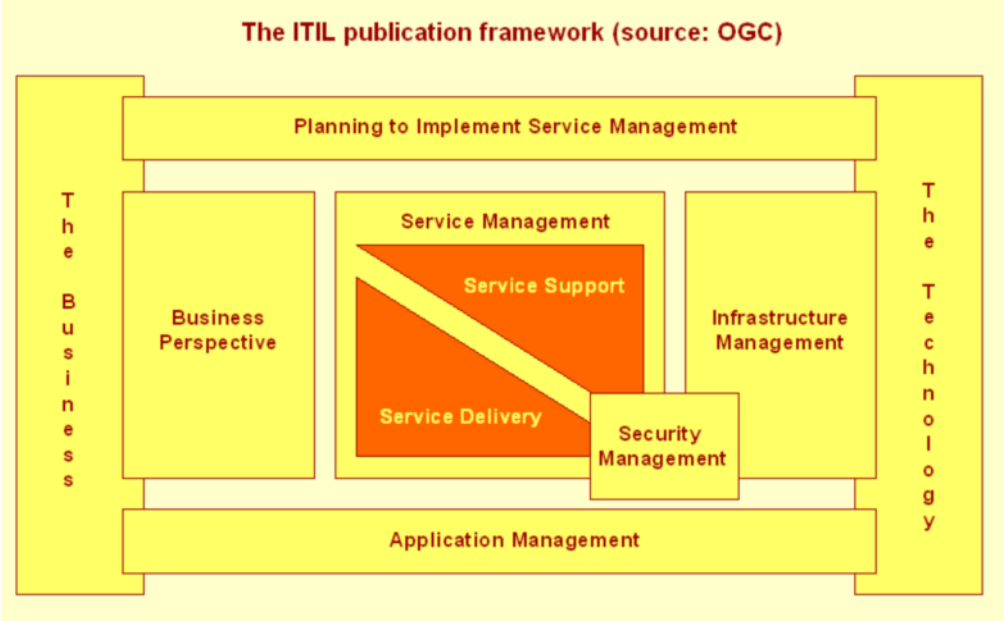
Part 1 below provides a brief introduction and overview of ITIL® for those who may not be familiar with it. Part 2 examines the "DMAIC" roadmap connections to ITIL® using an example case. A glossary of terms is included at the end of the article.

Part 1: Introduction to ITIL®

ITIL® is a UK Crown Copyright that was originally created by the Central Computer and Telecommunications Agency (CCTA) of the UK government. This unit has since been absorbed into the Office of Government Commerce (OGC), part of the UK Treasury. The Information Technology Service Management Forum (itSMF) is an internationally recognized independent user group, owned and operated by members, dedicated to IT Service Management. This organization has chapters in more than 30 countries. The itSMF organizes conferences, publishes a newsletter, and operates a web site (International - http://www.itsmf.org/ USA - http://www.itsmfusa.org/mc/page.do).

A formal Certification process for IT Service Management has been developed jointly by two independent certification bodies, the Dutch Exameninstituut voor Informatica (EXIN) and the UK Information Systems Examination Board (ISEB) working in cooperation with the OGC and the itSMF. Three levels of Certification are offered – Foundation, Practitioner, and Manager. A small industry has emerged to provide preparatory training for the Certification exams. Seven publications defined version 2 of ITIL. Version 3 was release in June 2007 and essentially restructures the earlier content into a life cycle view. These publications fully describe the standard and provide the basis for education and Certification. Version 2 Certifications continue to be valid under Version 3 – while various improvements have been introduced and the content has been restructured, the substance of Version 2 is retained in version 3.



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ITIL Publication (Version 2)	Topics Covered
Service Delivery	Service Level Management Financial Management for IT Services Capacity Management IT Service Continuity Management Availability Management
Service Support	Service Desk Incident Management Problem Management Configuration Management Change Management Release Management
Security Management	Design & Planning, Deployment, Operations, Technical Support
Infrastructure Management	Design & Planning, Deployment, Operations, Technical Support
Application Management	Life Cycle Guide
Business Perspective	Continuity Management, Partnerships and Outsourcing, Surviving Change and Transformation
Planning to Implement Service Management	Business Alignment Continuous Improvement Project Management Business Cases Alternative Evaluation

"ITIL provides a set of best practices to deliver and support IT services, but it does not define the quality of your performance or how to improve it. Though it does urge IT Service Organizations to have a Service Improvement Program (SIP) it does not explain how they should operate such a program in practice."

itSMF, *Six Sigma for IT Management*

Lean Six Sigma provides the "how to" measure, improve, and sustain performance – a specific methodology for execution of a Service Improvement Project and Program.

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Part 2: Connecting Lean Six Sigma DMAIC and ITIL®

As indicated earlier, both the DMAIC and DfLSS roadmaps are executed within the context of a deployment process that includes a formal process for project selection that engages the business to ensure appropriate projects are undertaken – i.e., those that can deliver a meaningful benefit to the business. Project selection precedes DMAIC and is critical to success.

All of the activities within the scope of the CIO are candidates for application of Lean Six Sigma, and all are also addressed by other industry standards and best practices. Skillful blending of all these methods gives the greatest leverage overall.

LSS DMAIC is a proven process for the improvement of any product or process – in other words, it can be applied to the improvement of any and all elements of IT Service Management. In this section we will briefly describe and step through the DMAIC roadmap with a simple example to provide a feel for how this might actually work in practice.

The essence of the Define phase is to make certain from the start that we have a clear understanding of scope and objectives, and that they have been documented in the form of a Project Charter. Further, we gather and distill "Voice of the Customer" or "VoC" (where "customer" is broadly understood to include all relevant stakeholders, sometimes referred to as the "VoX" to include all of them). As a last step in Define we make certain we have agreement on appropriate measures of success and have established priorities as necessary.

Properly executed, project selection and Define go hand in hand to ensure alignment with important business requirements and objectives. One of the methods used to achieve alignment is "Y to x Flow-down" – this example envisions a financial institution in which the Board of Directors has defined "Improving Return on Equity" as a top-level objective. This high level goal is "flowed-down" to lower levels until ultimately it connects to Service Levels provided by IT. In this example, slow case resolution in a call center has been found to have significant impact on collections and is hence a target for improvement.

Example Case - Define

Problem Statement - Analysis found a correlation between customer dissatisfaction and increased case resolution times. This correlation was the primary driver for the project.
Goal Statement - Reduce the 99th percentile case resolution time from 93 days to 10 days, targeting 'the tail'. Reduce the 3rd quartile case resolution time from 12 days to 5 days, while maintaining or improving the current 1st quartile and median values.
Business Case – Business growth has meant an ever-increasing staff effort devoted to case resolution, reducing our capacity to deliver new capabilities. A 5% improvement in case resolution effort is believed to be achievable and will result in avoidance of new hiring equivalent to approximately $500,000 in salary costs.

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During the Measure phase we focus on careful "operational definition" of measures we plan to use (e.g., what exactly is meant by a measure such as "user minutes unavailable"), planning for collection of the measurements, including consideration of sample sizes and methods that prevent unintentional introduction of biases. We may undertake benchmarking or other activities to set or refine improvement targets, evaluate the quality of our data, and make adjustments as necessary.

A range of tools such as Failure Modes and Effects Analysis (FMEA) may be invoked to help us identify potentially "significant x's" that are the controllable factors driving outcomes. Quick hit opportunities may also be identified and addressed to "stop the bleeding" in some instances.

Example Case

Case Resolution Time was operationally defined as: "*the number of days between the time a case is reported and is closed, or the last time the case went on hold prior to closing if it goes from hold status to closed status".*

Case resolution time is a continuous measure that is calculated utilizing fields in the case tracking system (where every customer call is logged and tracked) that are populated automatically, so measurement system reliability was assured. Available case data included approximately 34,000 data points collected over an eight-month period.

An as-is mapping of the current case resolution process was prepared in each of the support regions. The process maps showed that each of the four regions used a different case resolution process, each experiencing different problems and delays.

A segmentation tree and data collection plan was developed, and data was collected on case resolution days by case type, region, and application.

During Analyze, using the data collected during Measure, we focus on examination of the data to identify significant segments and drill down to root causes.

Example Case

The Analyze phase used the segmentation tree and performed several different hypothesis tests to identify segments of data significantly impacting case resolution time. The initial segments focused on were Case Type, Application, and Region.

Hypothesis tests using the data from all regions combined indicated significant variance in resolution time in all of the segmentation factors. Further analysis determined that most of the variance could be attributed to process noise caused by the four different resolution processes.

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When regions were analyzed individually, most of the variance was attributable to region itself – i.e., associated with the process used in each region. When analyzed region by region there was no statistically significant difference attributable to different applications or to issue type – hence, the appropriate focus for improvements was on the work processes used by the regions.

During Improve an improvement team identifies options for solutions to the root cause problems identified during Analyze, and considers alternative deployment strategies.

Example Case

Three possible improvement alternatives were identified.

1. Select the worst performing sub process used by each particular region and ONLY work to improve that sub process (i.e., regionally focused improvement projects done in parallel for each region – concurrent "little bangs").
2. Perform root cause analysis on the 12 different sub processes, identify critical x's in each of the sub processes and try to leverage learning across the sub processes (i.e., focus on a single region and replicate learning to other regions later – a single "little bang").
3. Move to a higher level of standardization with a national support process (i.e., attempt to improve all regions and all sub-processes concurrently – "big bang").

Option 3 was selected as both management and staff felt that the lead-time to significant improvement using either option 1 or 2 would be far too long. Hence, the project sponsor made a decision, with concurrence of the regional managers, to move to a standardized support process across all regions.

The first part of the improvement was to standardize the case resolution process across the country. The existing case resolution processes were analyzed by Technical Services and the East Region Case Resolution Process was selected as the starting point for a consistent case resolution process as that region had the best (lowest) baseline case resolution times.

A "Workout" session was held with participants from each of the regions in order to design and plan implementation of the "to-be" case resolution process. During the two-day workout participants were trained on the proposed "to-be" case resolution process, any concerns about the process were addressed, and regional implementations were planned. The two-day workout allowed progress that would have taken weeks to achieve remotely.

Improvements included:

- A set of in-process control metrics (SPC charts)
- Technical Services to Development Issue Escalation Process
- Technical Services Management Issue Escalation Process

They were implemented in three phases: (1) deploy the new standard process in all regions (2) Develop and deploy the Development Issue Escalation Process and (3) Develop and deploy the Technical Services Escalation Process.

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In-process control metrics were tracked to monitor each phase of the deployment and also are used in the on-going control phase.

The Control phase is concerned with ensuring sustainable results. This is accomplished by establishing a control plan that includes dashboards and metrics for all involved stakeholders and pre-defined exception thresholds that trigger pre-defined response plans.

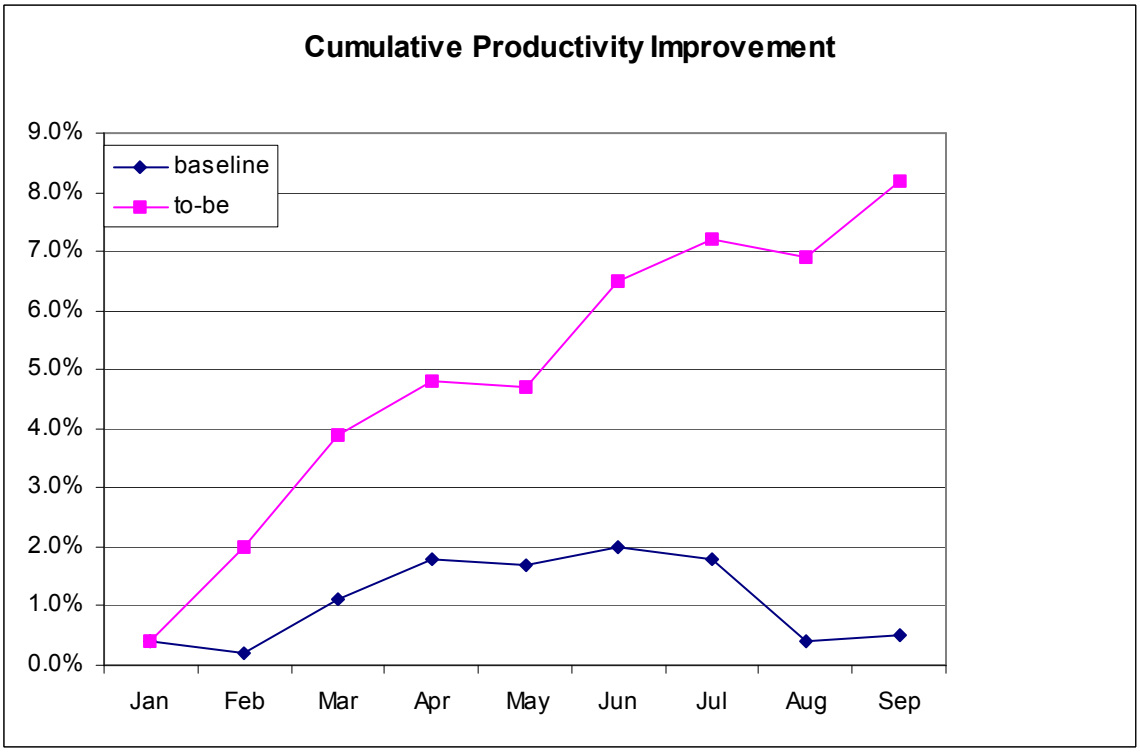
Case Example

Process description documents were created, including Case Resolution Process, Managed Issue Escalation Process and the Development Issue Escalation Process. These documents are used for training and as reference material. Additionally, reference material associated to the case resolution process was prepared, such as the Queue Manager handbook, Regional programming queue assignments and programmer skills matrices. All of the documentation was web accessible.

An additional metric to monitor productivity change (key to the business case) and a process for updating and monitoring all metrics on a weekly basis was established. Weekly monitoring focuses on open case age, which is the leading indicator to case resolution time.

Productivity improvement resulting from the new processes enabled the team to close over 8% more cases with the same level of effort compared to the baseline period.

Case Results



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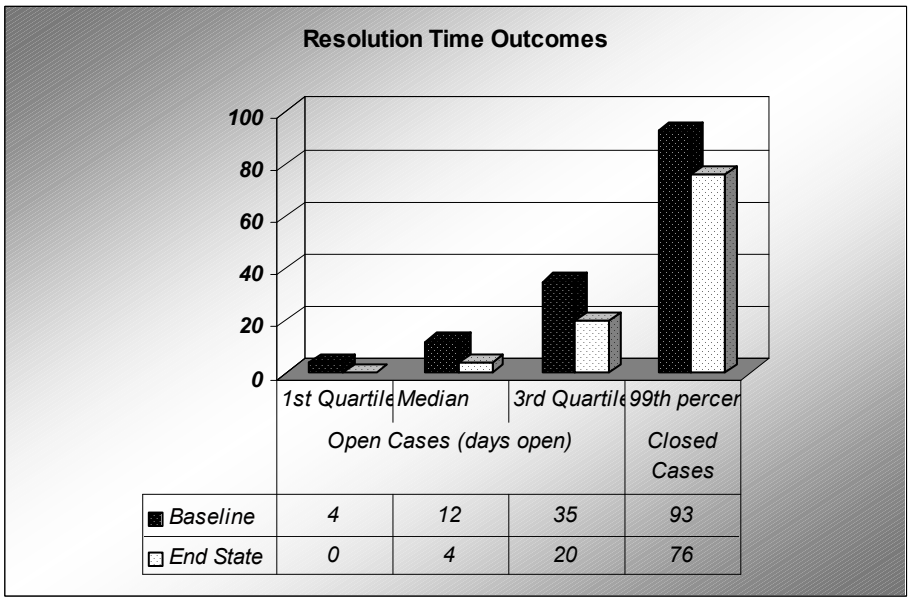
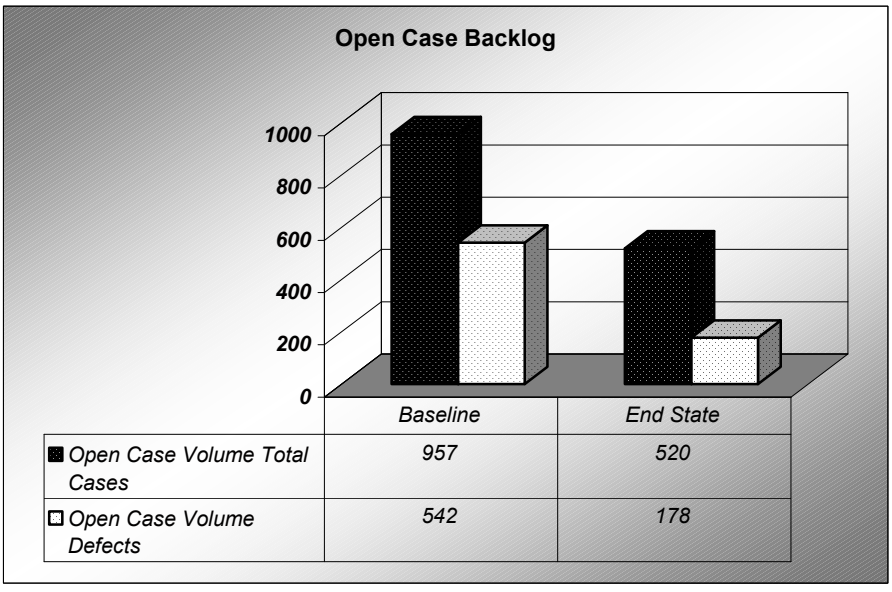


- Project Goals were exceeded for 1st quartile and median. Although the 99th percentile was reduced 18% the project goal was not met.



- Case Backlog is down 43%; Open Defects backlog is down 66%. Defects as a percentage of open cases are down 22%.
- Financial benefit calculated utilizing the 8% productivity gain was $735,000.

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Conclusion

Lean Six Sigma is being used successfully in conjunction with ITIL® in many organizations. Both are powerful in themselves and highly synergistic in combination. Lean Six Sigma and ITIL® are powerful, broad in scope, and multi-faceted. There are many valid ways to understand them and describe their synergy. I invite readers to contact me with comments or questions (ggack@process-fusion.net) and to share perspectives and insights into these and other connections between Six Sigma and software/IT industry best practices and standards.

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