



An Integrated Framework for Performance Excellence

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After 10 years of utilizing and consulting customers in CMMI®, the author uses his experiences to outline three “driving principles” of performance improvement (focus on business issues /performance goals, involved leadership/process ownership, and rapid improvements); compare four improvement approaches (CMMI, Lean, Six Sigma, and the Information Technology Infrastructure Library [ITIL]); and show how an integrated CMMI-based framework has become a highly successful approach for improvement.

My company’s journey with CMMI began as a member of the Version 1.0 Product Team. Since supporting that effort in 1999 and 2000, we have consulted with customers who have adopted CMMI, have adopted it ourselves on several occasions, and have become a partner with the SEI for Appraisal Services and Training. We have also found ourselves part of a growing community that continues to discover the emerging power and value of the CMMI model suite. The driving principles that have emerged from this body of work are:

- An improvement effort must be focused on achieving real business goals and helping the organization execute its business strategy.
- If real results are needed in a meaningful time frame, leadership must be involved in a direct and real way, and process doers should own their own processes.
- To be of significant value, improvements must be accomplished at the *speed of business*: often in weeks or months, rarely in years.

We were driven by customer needs to attempt integration of the CMMI framework with other improvement approaches. We have now, along with our customers, integrated Lean Thinking, the ITIL framework, and Six Sigma mechanisms into the CMMI framework. Surprisingly, we found that CMMI models consistently provided a synergistic integrating framework for these other approaches, resulting in CMMI-based performance improvement capabilities that far outreached any one of these approaches alone.

It is worth mentioning that all of our initial efforts were in support of customer and internal software development organizations. The lessons learned in this article are all directly applicable to small-to-large software organizations. Our first integration

of Lean Thinking was accomplished by integrating the Lean software development constructs [1] into the CMMI for Development (CMMI-DEV) framework. The surprising results (discussed in this article) encouraged us to approach the integration of other improvement approaches with a more positive and hopeful view. These ideas were initially briefed by the author (in an acquisition context) to the DoD-sponsored Software Acquisition Fall Workshop (2007).

In this article, I will first discuss the three *driving principles* of performance improvement. A brief comparative discussion of the four improvement approaches follows, and I will conclude with a discussion of the integrated CMMI-based framework.

The Driving Principles

Principle #1: Focus on Business Issues and Performance Goals

An improvement effort without focus on performance goals or the resolution of business issues resembles a missile without a guidance system: You’re pretty sure it will land, but you’re just not quite sure where.

The performance and/or quality goals should be of real business importance to the organization’s or project’s leadership, and completely in line with its business strategy. Too often, improvements become overly oriented on the process, as though the process were an end-goal. Focus on compliance with a model (like the CMMI) without improving performance and/or work product quality can have a devastating effect on an organization.

All improvement models and approaches (including CMMI, Lean Thinking, Six Sigma, and ITIL) can be implemented badly—that is, for their own sake. There is no *holy grail* of CMMI achievement (including Maturity Level 5) that will guarantee that an organization will perform better unless it consciously sets out to do so from the beginning. Level 3 organizations may not perform any better than Level 1 organiza-

tions—and some actually perform worse!

Figure 1 reflects 10 years of anecdotal evidence of the relationship between focus (the independent variable) and cost or value (dependent variables) in various improvement efforts.

The solid line indicates how business value increases dramatically as focus on real business performance goals is increased. The reasons for this improvement in value are many, but perhaps most important is that when the organization is focused on specific performance/quality goals, CMMI practices and informative components can easily be implemented in the context of the organization’s business case. Practices can be implemented as is, or alternatives written that respond better to the business case. Informative components can more readily be sifted for implementation, which turns out to be incredibly helpful.

Notice that *very* unfocused efforts (near the zero abscissa value) can and have actually resulted in improvement efforts that have negative value to an organization.

At the same time, cost can be expected to decrease (as indicated by the dashed line) to an optimum least cost. The primary reason for this is that a sharper focus on business context drastically reduces the rework associated with model implementations that are not helpful to achieving the performance/quality goals of the organization. In one of our most recent improvement efforts, costs were reduced to one-fourth of that for previous, similarly scoped efforts.

Principle #2: Involved Leadership and Process Ownership by Process “Doers”

Process improvement literature discusses the role of management as an enabler—a function that provides resources, allows the process group to do its business, and sponsors the process improvement activity. This approach is fine if slow progress, inefficient and ineffective processes, and reluctant buy-in are the goals.

Leadership focused on performance

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improvement is much more engaged, providing the business goals and strategy and the realization that performance improvement efforts are exactly about making the business succeed. Leadership is directly and proactively involved in the improvement effort, playing an important role on a weekly or even daily basis. Leadership ensures everyone in the organization knows, by example, that performance improvement is part of the job, not separate from it.

Perhaps the most common mistake organizations can make is to assign the development of processes to a *process group* that is not made up of the process doers. Even if the group is extraordinarily good at eliciting the *process requirements* from the actual users of the processes, its products (the organization's processes) will be resisted or even thwarted. The literature is full of cautions, analyses, and workarounds for the push back or resistance from process doers when the process group deploys a new or changed process. There are discussions of what to do with *heroes* when they cause trouble (!), and advice on how to deal with resistance—even advice on how to *mandate compliance!*

Principle #3: Improvements Should Be Made at the Speed of Business

The speed of business today is driven by rapid changes in markets and in technologies. Few organizations have the luxury of two or three years to make meaningful improvements to their performance. Time frames of a month or a year are more realistic and, most importantly, more responsive to the needs of the organization.

As an academic exercise, it is recognized that improvement velocity has both speed and direction. Direction can be thought of as focus, as discussed earlier. Speed, of course, has to do with how fast the improvement effort produces artifacts and changes in performance or work product quality.

Velocity = Speed of improvement in a focused direction.

We studied the factors associated with the institutionalization of a process in an organization, and came to the conclusion that time was not a significant attribute. Of course, there exists a lower bound on the time to implement and institutionalize processes in an organization, but we believe there is no *standard* time (e.g., two years to Maturity Level 2, four years to Maturity Level 3, etc.). If the organization is focused on achieving important performance/quality goals, and on simultaneously interpreting and assuring model compliance, success is

more a matter of achieving the organizational goals while working through the details rather than of the passage of time.

For example, in the case where the cost of an improvement effort was reduced to one-fourth that of similar efforts, time was reduced by 77 percent (11 months versus four years).

I now will provide a comparative discussion of the four improvement approaches we have used most. For each approach, I will provide a value proposition, a look at the downsides, and end with a brief discussion of how well the approach integrates with other frameworks for improvement.

Improvement Approaches

CMMI

CMMI is basically a set of three models—Development, Services, and Acquisition—and SCAMPISM. The models and appraisal methods were developed by integrated teams composed of people from the SEI, industry, and government (I was an industry member of the CMMI V1.0 product team). CMMI models provide best practices in the three domains of Development (software, hardware, and systems), Services (any kind, including IT), and Acquisition. The models are called CMMI-DEV [2], CMMI for Services (CMMI-SVC) [3], and CMMI for Acquisition.

CMMI's value lies primarily in three areas:

1. The three sets of domain-specific best practices.
2. Practices that enable an improvement infrastructure, allowing process and performance improvements across five different levels.
3. A robust, extensible appraisal method that is recognized for its reliability and credibility.

The specific practices contained in the CMMI-DEV model support mature sys-

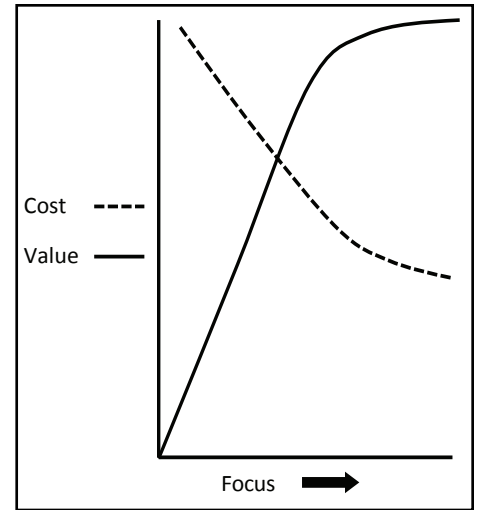


Figure 1: Dependence of Cost and Value on the Focus of an Improved Effort

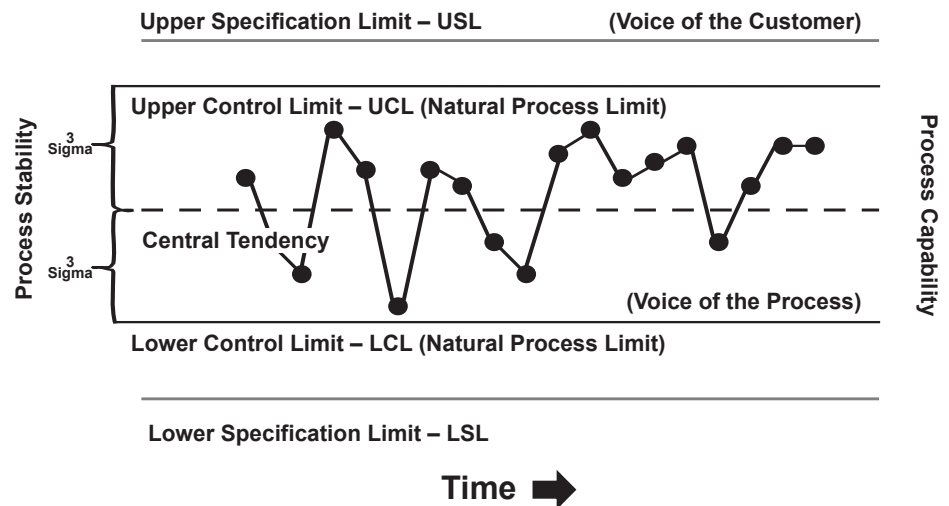
tems, software or hardware development, and have been migrated to enable both Lean and Agile approaches.

The infrastructure practices provide guidance for developing the *organization for improvement*, as well as necessary supporting functions, such as configuration management, quality assurance, and metrics.

SCAMPI allows for responsive, cost-efficient assessments of ongoing improvement efforts, and is extensible to include things such as performance goal evaluation and ITIL. SCAMPI allows for rapid course corrections in improvement efforts as well as rapid and essential learning by the organization, and provides internationally recognized benchmarking.

There are some downsides as well. CMMI does not contain practices or guidance for setting meaningful business or performance objectives, or for formulating improvement strategies to achieve such objectives (with the exception of the Strategic Planning process area within the CMMI-SVC model). It is fair to note, how-

Figure 2: Sample Process Control Chart



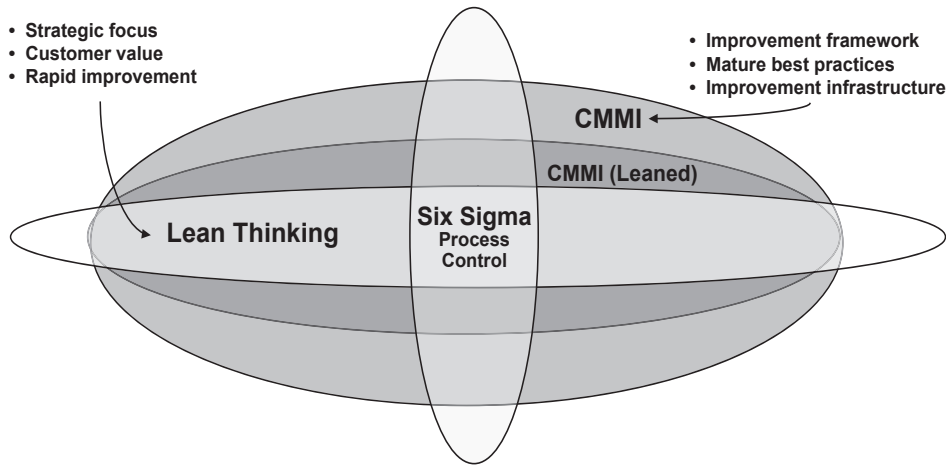


Figure 3: *Overlapping Attributes of Improvement Approaches*

ever, that most models or improvement approaches omit such guidance.

CMMI models are *integrable* with each other in what is called multi-model implementations. Examples are implementations of the CMMI-DEV with CMMI-SVC for engineering development and services organizations. Our experience integrating Lean Thinking, Six Sigma, and ITIL into CMMI-DEV and CMMI-SVC models has revealed that there are no *anti-patterns* or other intractable problems.

Lean Thinking

Lean is much more than building efficient, streamlined processes and the potential reduction of resources needed to perform a process or service. In fact, these things are secondary to the point of Lean.

Because our customers were beginning to migrate from CMMI to a Lean improvement approach, Richard McCabe (of the Systems and Software Consortium) and I performed an analysis of potential contradictions between CMMI-DEV and Lean software development, and between CMMI-DEV and Agile software development. We rated each specific practice as *Enabling, Supportive, Acceptable, or Unacceptable* in the manner in which they supported Lean and Agile software development. We fully expected to find a few to dozens of *Unacceptables*—but found none [4].

This result, we realized, was attributable to the wisdom of the CMMI framers, who conceived of *Required (Goals), Expected (Practices), and Informative (everything else)* components. Because the informative com-

ponents can be adopted according to the business context and case, and because practices can be modified to fit the business case, the CMMI-DEV was found to be very supportive of both Lean and Agile approaches.

Lean Thinking is about a fanatical focus on delivering value to the customer, waste elimination, setting and attaining performance goals, cadence and synchronization, Agile project management, and fully integrating processes, technologies, and knowledge into a continuously improving framework that responds quickly to customer demands. In Lean organizations, the processes are owned by the doers of those processes, and they are charged by management to make those processes perform better on a continuous, sometimes daily, basis. Lean software development, in particular, is well-defined [1].

On the downside, simultaneous multiple Lean efforts (Kaizen Events) can become uncoordinated and negatively affect one another. Lean, by itself, leaves the definition of an improvement framework or infrastructure to the organization.

Lean has proven fully integrable with the CMMI, ITIL, and Six Sigma efforts. In most cases, Lean is treated as the *lead* approach since it offers speed, focus on customer value, and responsiveness to customer needs.

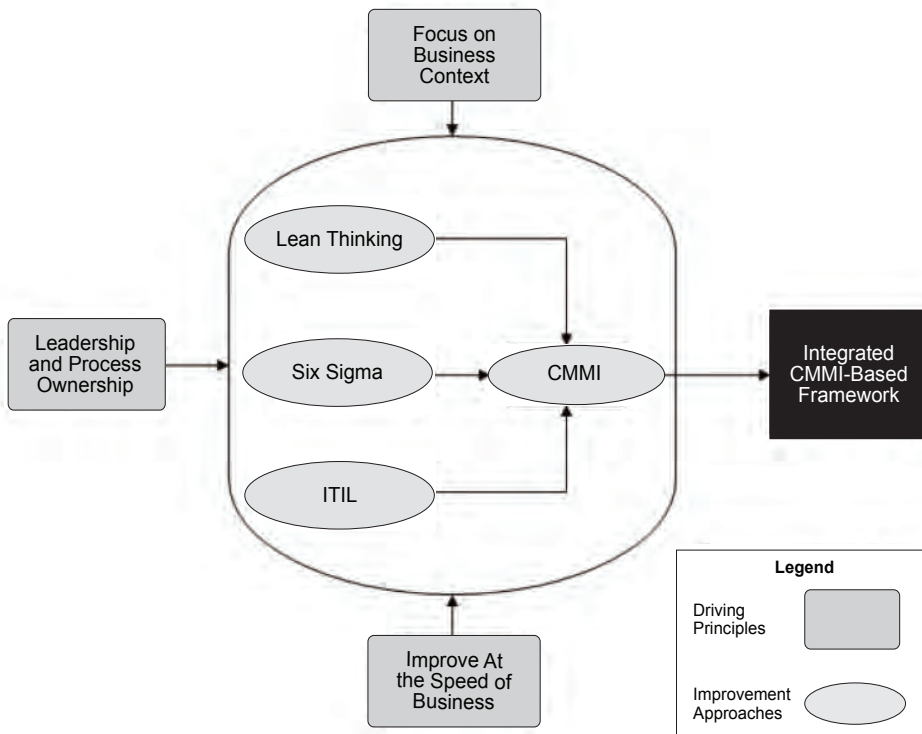
Six Sigma

Six Sigma is the statistical control and performance prediction capability associated with stable processes. A process that is being statistically managed enables the use of project-level leading indicators rather than the lagging indicators most projects typically use. The common analogy is that managing with lagging indicators is like driving while looking into the rear-view mirror.

A Six Sigma process is simply one for which the specification limits are six standard deviations from the central tendency—and the process is statistically stable. Figure 2 (see page 7) illustrates the basics of a process control chart. The central tendency is normally the mean, but, in certain situations, tracking the mode or median may prove beneficial. The specification limits are set to the desired state or performance, and are considered the *voice of the customer*. The natural process limits are typically set to ± 3 Sigma.

After processes are stabilized, they are made to perform better by either changing the central tendency of the process (typically the mean), and/or reducing the variation due to common causes. Six Sigma tools include regression analysis, tests of hypoth-

Figure 4: *The Four Approaches in an Integrated Framework*



esis, process modeling and simulation, process baselining, process control charts, experimental design, and optimization methods.

On the downside, process control is expensive and time-consuming. It depends on process execution data, so longer improvement cycle times (development, service, or acquisition) can be problematic. Organizations wishing to employ Six Sigma process control would do well to ensure that the predicted return on investment warrants the investment.

Six Sigma has been proven to be fully integrable with CMMI model implementations. In fact, it is fair to say that Six Sigma is a preferred approach for implementation of CMMI high maturity (Capability and Maturity Levels 4 and 5). Lean has the advantage of rapid cycle times, which, in addition to its own Lean value, offers the benefit of rapid data collection for Six Sigma studies.

ITIL

Version 3.0 of the ITIL is a knowledge base consisting of a series of five volumes: Service Strategy, Service Design, Service Transition, Service Operation, and Continual Service Improvement. Each volume, in addition to introductory and summary material, is composed of best practices and guidance, including risk analyses.

Certifications associated with ITIL are focused on *individual knowledge development*, from the Foundation to the ITIL Expert and Master levels. For organizations, there is one recognized and one emerging option. Organizations may undergo an audit against ISO 20000, commonly known as the IT Service Management Standard. This standard is somewhat dated, having been founded largely on ITIL 2.0. An emerging and promising option is to adopt CMMI for Services, using ITIL 3.0 best practices and guidance as informative materials in the adoption of the CMMI-SVC model. Several organizations are reportedly targeting on doing SCAMPI Class A benchmark appraisals against CMMI-SVC with integrated ITIL best practices.

On the downside, ITIL 3.0 guidance for the improvement infrastructure is relatively weak. The framework itself does not provide a long-term basis for consistent and continuous performance improvement. The existing *certification* standard is outdated, and does not provide a structure for continuously increasing the level of IT service management.

Several examples of the integration of ITIL 3.0 into an implementation of CMMI-SVC have been a topic of some interest to the CMMI for Services Advisory Group.

Software Defense Application

For more than a decade, the author has used CMMI with private businesses and government defense organizations alike. What comes from these experiences is an integrated CMMI-based framework offering improvements for defense organizations in focus, speed, and cost reductions. The real-world results speak for themselves: a reduction in timelines from Maturity Level 1 to 3 of 25-50 percent; cost reductions from 33-50 percent; and cost avoidance of more than 33 percent for attainment of business performance goals with a corresponding Level 3 process capability.

The marriage appears to be a good one, with CMMI providing practices for the *infrastructure for improvement* and the appraisal method, and ITIL providing IT service best practices. Several SCAMPI Class B and C appraisals have reportedly been done against the CMMI-SVC model, with ITIL best practices. Benchmark (SCAMPI Class A) appraisals are being planned.

The CMMI-Based Integrated Framework

As mentioned throughout this article, each CMMI model provides a high-value framework for integration of other improvement approaches. Figure 3 reveals the most salient attributes of each improvement approach, and how these attributes overlap and support one another. For example, Lean Thinking provides a sharp degree of focus on customer value, and provides mechanisms for rapid improvement.

Figure 3 also indicates that CMMI is, practically speaking, collapsed in its application by applying Lean Thinking to its implementation. Six Sigma is basically orthogonal (independent) of both Lean and CMMI, and works well with both approaches. As described previously, ITIL is treated as an extension of the *informative components* in CMMI-SVC.

Earlier, I discussed the three driving principles of performance improvement; Figure 4 illustrates that these principles form the focus of how the improvement approaches are integrated into the CMMI framework. In all cases in which we have enjoyed measurable success, it provides the basic framework for improvement.

As well, Figure 4 depicts the *mind map* of working through the integration of these improvement approaches for a particular environment or business domain, and reminds us of the importance of *first principles*.

This integrated framework for performance excellence has become the de facto approach for improvement in several of our segments, and, we believe, will offer increasing value and responsiveness as we continue learning how to tune this framework. But we can already appreciate that our efforts, and those of many others, have helped to

get the most out of CMMI.◆

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