

IMPLEMENTING SCRUM (AGILE) AND CMMI® TOGETHER

By Neil Potter and Mary Sakry

Introduction

If you are a software engineer or IT professional, your group has very likely shown a strong interest in reducing costs, improving quality and productivity. Your group might also have looked at various pre-packaged frameworks, such as Agile (e.g., Scrum and Extreme Programming), CMMI¹, and Six Sigma.

At first glance, each of these frameworks might look at odds with each other, making it difficult to use two or more. This typically occurs because much of the information shared regarding these frameworks is from success and failure stories, rather than understanding the specifics of each framework. Each framework can be implemented successfully depending on how much care is placed on its implementation.

In this article we compare CMMI and Scrum since they are two commonly used frameworks, and ones we have seen groups struggle with when using them together.

First, let us define each briefly.

Scrum

Scrum is a pre-defined development lifecycle based on Agile principles. Agile methodologies promote a project-management process that encourages frequent inspection and adaptation, and a leadership philosophy using teamwork, self-organization and accountability. [See sidebar on page 2.]

¹ CMMI information in this article is based on copyrighted material from SEI / CMU. *CMMI: Guidelines for Process Integration and Product Improvement*. Boston: Addison-Wesley, 2003



CMMI for Development

CMMI is a collection of practices that organizations (software, hardware and IT) can adopt to improve their performance. The CMMI comes with two main views (representations), Staged and Continuous. *Staged* shows all the Process Areas (groups of related practices) in the form of a road map, allowing organizations to focus on basic improvements before attempting advanced topics. The *Continuous* representation has the same content but allows for any topic (Process Area) to be selected in an a la carte style. [See www.sei.cmu.edu/cmmi/models]

The Level 2 Process Areas focus on change and project management. Level 3 focuses on engineering skills, advanced project management and organizational learning. Levels 4 and 5 focus on the use of statistics to improve the organization's performance by statistically controlling selected processes and reducing variation.

So the question is, how do these two frameworks relate, and how can an organization use both?

Scrum is an example implementation of some of the Maturity Level 2 practices. Below we have listed the main practices of CMMI that map cleanly to Scrum process steps. This doesn't mean that an organization could not eventually add additional CMMI practices to its projects; it just means that in Scrum, there is no clear equivalent called out.

Although the practices of Scrum provide good implementation examples of many Level 2 CMMI practices, one catch is the level of artifacts needed to appraise at CMMI Level 2. If a Scrum team either discards or loses its project artifacts, then being appraised Level 2 will not be possible since there will be little evidence showing what happened. If however, a project team stores these data, an appraisal team can then use them for verification. Ideally, Scrum team members would naturally want to store their work so that they could refer to past iterations during lessons-learned sessions.

CMMI and Scrum mapping

In the tables below we show several CMMI practices (using CMMI text taken from the model definition) and how Scrum can implement each practice. To appraise Level 2, it is assumed that the Scrum implementation is robust and shows evidence of the CMMI practice being performed.

REQUIREMENTS MANAGEMENT:

The purpose of Requirements Management (REQM) is to manage the requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.

[Continued on page 3.]



Summary of Scrum

Scrum is a process that teams can adopt quickly to plan and manage their work. Each Scrum step has just enough detail to plan, design, build and test code, while tracking team progress. Its strength is that it is straightforward to use. The risk is that it can be used to focus on building components with less regard for the complete system. This risk can be managed.

Scrum has three primary roles: Product Owner, Scrum Master, and team member.

The Product Owner communicates the vision of the product to the development team. This includes representing the customer's interests through requirements and prioritization.

The Scrum Master acts as a liaison between the Product Owner and the team. The Scrum Master does not manage the team but instead works to help the team achieve its Sprint goals by removing obstacles. The Scrum Master verifies that the Scrum process is used.

The team members do the project work. The team typically consists of software engineers, architects, analysts and testers.

The intent of Scrum is to build working components in small iterations, each iteration lasting between two and four weeks. A *typical* Scrum lifecycle has the following steps:

- Write the requirements (and store in the Backlog)
- Plan the release (which could span more than one 2-4 week Sprint)
- Plan the Sprint
- Conduct the Sprint
 - Analysis
 - Design
 - Coding
 - Testing
- Conduct Sprint retrospective

Daily stand-up meetings are held to track team progress and identify barriers.

[See www.scrumalliance.org]

REQM	CMMI Practice	Scrum Practice
SP 1.1	Develop an understanding with the requirements providers on the meaning of the requirements.	<ul style="list-style-type: none"> Review of Product Backlog (requirements) with Product owner and team.
SP 1.2	Obtain commitment to the requirements from the project participants.	<ul style="list-style-type: none"> Release planning and Sprint planning sessions that seek team member commitment.
SP 1.3	Manage changes to the requirements as they evolve during the project.	<ul style="list-style-type: none"> Add requirements changes to the Product Backlog. Manage changes in the next Sprint planning meeting.
SP 1.5	Identify inconsistencies between the project plans and work products and the requirements.	<ul style="list-style-type: none"> Daily standup meeting to identify issues. Release planning and Sprint planning sessions to address inconsistencies. Sprint burndown chart that tracks effort remaining. Release burndown chart that tracks story points that have been completed. This shows how much of the product functionality is left to complete.

PROJECT PLANNING

The purpose of Project Planning (PP) is to establish and maintain plans that define project activities.

PP	CMMI Practice	Scrum Practice
SP 1.1	Establish a top-level work breakdown structure (WBS) to estimate the scope of the project.	<ul style="list-style-type: none"> The standard tasks used in a Scrum process combined with specific project tasks (Scrum Backlog).
SP 1.2	Establish and maintain estimates of the attributes of the work products and tasks.	<ul style="list-style-type: none"> Story points, used to estimate the difficulty (or relative size) of a Story (requirement).
SP 1.3	Define the project life-cycle phases upon which to scope the planning effort.	<ul style="list-style-type: none"> The Scrum process.
SP 1.4	Estimate the project effort and cost for the work products and tasks based on estimation rationale.	<ul style="list-style-type: none"> Scrum Ideal Time estimate (similar to billable hours or Full-time Equivalents).
SP 2.1	Establish and maintain the project's budget and schedule.	<ul style="list-style-type: none"> Scrum estimates (in Ideal Time). Estimates of what work will be in each release. Sprint Backlog. Project Taskboard.
SP 2.4	Plan for necessary resources to perform the project.	<ul style="list-style-type: none"> Scrum estimates in Ideal Time Release plan, Sprint Backlog and assignments.
SP 2.6	Plan the involvement of identified stakeholders.	<ul style="list-style-type: none"> Scrum process roles (including team, Scrum Master, Product Owner). [Note: The stakeholders listed in Scrum might not be the complete list of stakeholders for the project, e.g., customers, other impacted teams.]
SP 2.7	Establish and maintain the overall project plan content.	<ul style="list-style-type: none"> Scrum release plan. Sprint Backlog. Project Taskboard. [Note: The term "plan" in CMMI refers to additional plan components (such as risks and data management) that are not called out specifically in Scrum.]
SP 3.1	Review all plans that affect the project to understand project commitments.	<ul style="list-style-type: none"> Sprint planning meeting. Daily Scrum meeting.
SP 3.2	Reconcile the project plan to reflect	<ul style="list-style-type: none"> Sprint planning meeting.

	available and estimated resources.	<ul style="list-style-type: none"> • Daily Scrum meeting.
SP 3.3	Obtain commitment from relevant stakeholders responsible for performing and supporting plan execution.	<ul style="list-style-type: none"> • Sprint planning meeting. • Daily Scrum meeting. • [Note: The stakeholders listed in Scrum might not be the complete list of stakeholders for the project.]

PROJECT MONITORING AND CONTROL

The purpose of Project Monitoring and Control (PMC) is to provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan.

PMC	CMMI Practice	Scrum Practice
SP 1.1	Monitor the actual values of the project planning parameters against the project plan.	<ul style="list-style-type: none"> • Sprint burndown chart that tracks effort remaining. • Release burndown chart that tracks completed story points. This shows how much of the product functionality is left to complete. • Project Task Board used to track stories (requirements) that are done, in progress, or ones that need verification.
SP 1.2	Monitor commitments against those identified in the project plan.	<ul style="list-style-type: none"> • Discussions on team commitments at the: <ul style="list-style-type: none"> – Daily Scrum meeting. – Sprint review meeting. • Sprint burndown chart that tracks effort remaining. • Release burndown chart that tracks story points that have been completed. This shows how much of the product functionality is left to complete.
SP 1.5	Monitor stakeholder involvement against the project plan.	<ul style="list-style-type: none"> • Discussions at the: <ul style="list-style-type: none"> – Daily Scrum meeting. – Sprint review meeting. • [Note: The stakeholders listed in Scrum might not be the complete list of stakeholders for the project, e.g., customers, other impacted teams.]
SP 1.6	Periodically review the project's progress, performance, and issues.	<ul style="list-style-type: none"> • Daily Scrum meeting. • Sprint review meeting. • Retrospectives.
SP 1.7	Review the accomplishments and results of the project at selected project milestones.	<ul style="list-style-type: none"> • Sprint review meeting.
SP 2.1	Collect and analyze the issues and determine the corrective actions necessary to address the issues.	<ul style="list-style-type: none"> • Notes from the: <ul style="list-style-type: none"> – Daily Scrum meeting. – Sprint review meeting. <p>[Note: Some teams track their outstanding actions on the Product Backlog. It doesn't matter where or how the items are tracked, as long as they are.]</p>
SP 2.2	Take corrective action on identified issues.	<ul style="list-style-type: none"> • Actions from the: <ul style="list-style-type: none"> – Daily Scrum meeting. – Sprint review meeting.
SP 2.3	Manage corrective actions to closure.	<ul style="list-style-type: none"> • Tracking of actions from: <ul style="list-style-type: none"> – Daily Scrum meeting. – Sprint review meeting. • [Note: This assumes that teams will track (and not lose) actions.]

How about the other components of Level 2?

Configuration Management (CM)

CM is not specifically called out in Scrum. However, in an Agile environment it is pretty easy to add a layer of CM to protect your work. Even for groups that like to use white boards, you can be creative and at least establish some basic protection by labeling items (e.g. “V1.1,” or “Story dated 1/2/YY”) and taking a photo. The CM Process Area does require more than just versioning, but versioning is an easy start.

Product and Process Quality Assurance (PPQA)

Some basic PPQA activities are being done naturally when the Scrum Master checks that the Scrum process is being followed. Other PPQA activities are completed when a team performs code reviews, document reviews and testing. The Scrum Master also plays a role of removing process barriers and inefficiencies. However, Scrum does not specifically call out a level of *objective* process and product check, nor does it state that particular standards or processes should be defined and used. Therefore Scrum does not automatically implement PPQA. However, refinements can be made such that it does.

Supplier Agreement Management

There are no practices in Scrum that deal with the selection and management of suppliers.

Generic Practices

Approximately half of the Level 2 Generic Practices of Requirements Management, Project Planning and Project Monitoring and Control are implemented by Scrum. A mapping of these is at www.processgroup.com/scrum-cmmi-mapping-ma-gp-v1.pdf.

Measurement and Analysis

The purpose of Measurement and Analysis (MA) is to develop and sustain a measurement capability that is used to support management information needs. There are no practices in Scrum that establish a measurement program similar to the expectations of MA. However, the measures in Scrum can be used to implement MA. A mapping showing the relationship between CMMI and Scrum measurements is at www.processgroup.com/scrum-cmmi-mapping-ma-gp-v1.pdf.



How about Level 3?

There are two main areas where Scrum has gaps compared to Level 3. One is in the CMMI expectation that project data and lessons are shared among projects via a common process asset library (or repository). Second, the expectation that the engineering phases of requirements, design, implementation, verification, integration and validation are well defined and implement the Level 3 engineering practices. These CMMI concepts can be done in an Agile/Scrum environment, but they don't come with the common Scrum definition.

Scrum does suggest implementing *Communities of Practice*, to reach across teams to share lessons learned, and *Retrospectives* within a team. These ideas could certainly be used to populate an asset library and thereby codify best practices and tailoring guidelines. The following Level 3 components therefore are not readily implemented by Scrum without additional work:

- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Integrated Project Management
- Risk Management
- Decision Analysis and Resolution
- Some engineering Specific Practices (e.g., requirements validation and verification data analysis)
- Generic Goal 3 (i.e., using an organization-wide and tailored process with measurements)

Summary

Scrum is a good implementation for some of the practices in Level 2. Therefore, a group can use Scrum and CMMI together. All the remaining practices in Levels 2 and 3 can be implemented while using Scrum.

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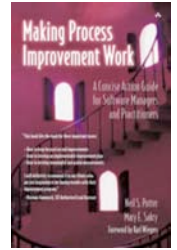
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Foreword by
Karl Wieggers

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References

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