

Building Agile Maturity in a CMMI Culture

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Overview

[Bleum](#)'s Global Headquarters in Shanghai, China, has been appraised^{iv} [Capability Maturity Model Integrated](#)[®]^v (CMMI) Level 5 for at least the last 10 years. Being CMMI Level 5 was an internal requirement set to qualify for international customers' software development and outsourcing work. Their other customers, less demanding, have benefitted too. Bleum takes the ISO standards that apply to security and quality seriously, and consider their CMMI-DEV Level 5 appraisal results and the capabilities it encompasses an important part of their identity over the years. Co-author Malcom Patrick observed their work in using processes as a CMMI Lead Appraiser over several years, in two cycles of appraisals.

As their customers and their own teams began to use [Agile](#)^{vi} techniques more and more in recent years, Bleum's Quality and Process organization wrote and incorporated Agile processes into their set of organizational processes, and modified their workflow management platform and tools to support Agile techniques in their different groups.

The Offshore Development Centers (ODC) in Bleum use dashboards designed to show project and service quality and progress. They developed these based on CMMI precepts, to use data they collect to forecast productivity and quality and to manage progress and daily operations for their customers' development project work.

When Agile teams became more numerous, the Quality and Process team brought experienced Agile team members and scrum masters together to define and agree about a Bleum Agile Maturity Model as a means to understand how to properly support and perform Agile, how to set and achieve quality and performance goals for Agile teams, and how to convert Agile results into a form that was compatible with the management practices and the dashboard. In this partnership, their most experienced people helped the Quality people improve their descriptions of the Agile techniques and their understanding about how it works, enabling them to judge if the Agile techniques were being properly used or not, and to provide better quality coaching. Difficulties reporting Agile results amongst project- style results were ironed out.

Defining their Bleum Agile Maturity Model to describe their Agile practices enabled quality evaluation of Agile teams' work in a way that is compatible and consistent with practices in non-Agile groups, led to increasing maturity for Agile teams, improved skills for scrum masters and team members, eliminated arguing about differing perceptions of light weight Agile and heavy weight CMMI, and improved Agile teams' results.

Bleum's been able to make Agile work just fine within a high-maturity CMMI organization.

¹ CMMI is registered in the U.S. Patent and Trademark Office by **Carnegie Mellon University**

Maturity Model

A brief review, the CMMI's three constellations or domains (Development, Services, and Acquisition) contain best practices grouped by process areas that achieve important goals. For example, an important measurement goal is:

- Measurement objectives and activities are aligned with identified information needs and objectives.

To achieve this goal the models describe four practices that would ordinarily be necessary. These practices and their supporting descriptions are valuable advice to managers and developers, service providers, or procurement people. The goals and their related practices describe how processes can work in process areas in the applicable CMMI model, e.g., the Measurement and Analysis area. There are some particular process areas for each “constellation” and a core of 16 process areas common to all three models. The process areas are staged into four “levels” of maturity, ranging from 2 to 5

2. project work is repeatable
3. processes are described; and project work is repeatable...
4. processes are managed using objective data and quantitative techniques; and processes are described...
5. processes are optimized to take advantage of new technology, or to better satisfy customers, to reduce cost, or to meet other business needs; and processes are managed...

Organizations that are at the 5th level, the optimizing level, are good to work with. They care about quality and can actually affect it, making promises they can keep. Actually, any of these levels of maturity may be appropriate for different business circumstances. Only the missing Level 1, where processes aren't even repeatable from time to time, is a bad business election for sustainable businesses.

To have a superior, living system of management and development (e.g., regularly meeting all of the goals described in the CMMI-DEV model through level 5) a lot of things have to be in place. Organizations that really have this live it day to day as part of clear and purposeful development and management work. Some organizations tried to implement the CMMI model as written, but this approach didn't result in a living system, instead becoming a burden of templates and formalities that made getting the work done more difficult for engineers and their managers. Whoops. In those cases, often after a time they abandoned the heavy processes they had installed. Level 5 bragging rights in many cases came with quality stumbles. Bleum is one of the companies that got it right and has invested in keeping it going.

The Problem

In recent years, many of Bleum's customers switched to using Agile for running their teams, and Bleum's team members had to learn and become “agile”, too.

Agile and CMMI have been traded off against each other ever since the [publication](#) of the “Agile Manifesto”^{vii} in 2001. CMMI became perceived as a heavy-weight approach when implemented as a process system instead of used as a reference model for best practices, while Agile is, well, agile, “light weight” processes; more about that later.

Bleum's boss, Eric Rongley, committed himself and his company at the start, more than a decade ago, to compete on business excellence, and used CMMI along with other tools to calibrate performance and progress. He'd seen how CMMI worked in India, creating a common language for companies to discuss problems, solutions, and future plans, as a way of learning how to be better, and for communicating to the market a company's commitment to using best management practices. He wanted his startup in China to get even more from CMMI and other ways of improving than he'd seen in India.

If you're serious about sustainably managing software development and development centers then your processes will include the best practices described in CMMI anyway. If you're faced with customers or projects that have to use Agile, then you will need to integrate Agile into your management processes. It's best to do that in a lightweight manner that respects the Agile techniques, but connects to and supports key operational goals, e.g. managing costs, quality, or customer satisfaction.

Many organizations set up different and less controlled systems for their Agile work, outside of their closely managed project work; others have drawn their Agile practices into their organization's set of practices (OSP) as processes that may be used in appropriate circumstances, as Bleum has done. However, it's difficult to enable teams to really apply Agile techniques true to the principles of Agile and still collect and use historical data for management, control and improvement, and set and achieve measured goals, e.g., for customer satisfaction or product quality. These activities are usually considered "heavy" and antithetical to Agile.

Bleum had long and successful experience monitoring ODC work for quality; however checking Agile teams' implementation of processes for compliance to the Agile parts of the OSP required different tools and approaches from those used for non-Agile teams.

The quality and process group at Bleum, managed by co-authors Soufe Li, AVP, People and Engineering Process Excellence, and by Michelle Lin, Software Quality Assurance Manager, struggled with this for some time.

As more customers wanted to use Agile, there were differences of opinion among the new, untested scrum masters about what practices to use and how to apply them. Some of them mixed in project techniques from the CMMI style OSP with their Agile practices; others applied Agile in a very directive, heavyweight way, with the scrum master as the driver for the team; while some teams seemed to get things right. Managers and the quality team saw that Agile teams had to learn to apply appropriate Agile techniques in the proper agile spirit to get benefit from them, and scrum masters needed to become less directive to encourage teams to grow to become self-managing. Also, it was a puzzle how SQA could support scrum masters' and teams' learning, to move from heavier "training wheels" Agile to more effective, lighter implementations. And, SQA still had to be able to evaluate and characterize the quality of teams' Agile maturity and integrate measures of their results into other groups' results to show "apples and apples" dashboard results needed by the managers who had both Agile and project style groups to oversee.

Michelle came across the article about the Agile Maturity Model (AMM), published in the [International Journal for Software Engineering](#)^{viii} in December, 2009. The authors proposed a maturity model for Agile, sorting many of the popular Agile practices into Explored, Defined, Improved, and Sustained organizational maturity levels.

For example, in their model several agile project planning techniques are in the Explored level (2); pair programming and continuous integration are fully in use in Defined Level (3) teams; self organizing teams operate in the Improved level (4); and teams control team performance at the Sustained level (5). As in CMMI, more measurement data is available and is used by team members as they employ more techniques and use more sophisticated Agile techniques at higher maturity levels.

Like CMMI, this AMM proposed sets of progressively more related techniques for teams to use as the teams “mature”; and like CMMI, the “higher level” techniques could be applied early by teams, but teams would encounter additional risks when they did that. For example, pair programming, a Defined Level (3) technique, is more difficult and less effective if story boarding, an Exploring Level (2) technique, isn’t already fully in use in the Agile project.

Soufe and Michelle saw possibilities in using an Agile Maturity Model with their Agile teams to assess the quality of implementation of related Agile techniques and as a way to encourage teams to use appropriate sets of techniques based on their experience level and on the needs of their customers.

Solution

Patel and Ramachandran’s Agile Maturity Model describes each “maturity level” in terms of “Key Process Areas” that are then related to a set of Agile practices. An example from Level 2:

2.1 Project Planning (Release Planning)

- 2.1.1 The planning game is used to create project plans
- 2.2.2 Estimate the scope of the project
- 2.2.3 Release planning is used to create schedules
- 2.2.4 The project velocity is measured
- 2.2.5 The project is divided in to iterations
- 2.2.6 Estimation is done by developers
- 2.2.7 Past estimation and functional point techniques used for estimation
- 2.2.8 Planning is based on the business value
- 2.2.9 Customer or business representative present or at least invited to all team estimation sessions
- 2.2.10 Iteration factor is based on project factors like size and complexity and organizational factors

Most of these are recommended Agile techniques. The AMM links the techniques together into a “Key Process Area”, and puts them at an organizational maturity level, in this case Level 2.

Here are practices related to the Level 4 Key Process Area, Project Management:

4.1 Project Management

- 4.1.1 Obtain plan commitments
- 4.1.2 Is the primary reporting metric for tracking progress feature based, such as stories complete versus stories remaining, burn up graphs or cumulative flow diagrams
- 4.1.3 Use the projects defined process
- 4.1.4 Integrate plans

4.1.5 Co-ordinate and collaborate with stakeholders or on-site customer

4.1.6 Use the project shared vision

Here, their AMM seems to have brought in some CMMI ideas, e.g, *4.1.3, Use the project's defined process*. Anyway, we can see that Level 4 project management builds upon practices described in Level 2's practices.

At Bleum, the process and quality group noticed inconsistencies among the practices in Patel and Ramachandran's AMM and their assignment of practices to the different maturity levels. They felt that some of the practice descriptions were rough; some Agile techniques weren't included; the model didn't fit off shore style development very well; and some valuable non-Agile technical ideas weren't included, e.g., particular attention to high-level requirements and low level (detailed) requirements.

However, they saw that they could use this maturity model approach to support improvement of their Agile projects by characterize projects' "Agile-ness". An Agile maturity model would give them a framework and roadmap to show teams what Agile practices they might more easily learn and undertake next and to assess the quality of projects' use of the Agile techniques they'd decided to use.

Working with their Agile/Scrum/XP experts they developed their own Agile maturity model like Patel and Ramachandran's AMM, but structured differently, including techniques recommended and described by their resident experts. The Bleum AMM defines 18 supporting practices related to 11 process groups, with 121 check items providing details about each practice in its process groups.

The 11 Agile process groups in the Bleum AMM are-

- High level requirements
- Low level requirements
- High level plan
- Sprint plan
- Sprint tracking
- Retrospective
- Sprint review
- Code quality
- XP practice
- Sustainable Pace
- Mutual interaction

The process groups in the Bleum AMM provide context for understanding what the Agile practices are about and to remind team members where the practices fit. Some of the Agile practices may fall into more than one process group. Each practice has one or more check items that describe specifically what is expected if the practice is performed in a process group.

For example, the Grooming Meeting is an Agile practice that falls into three process groups:

- High Level Requirements,
- Low Level Requirements,
- Mutual Interaction.

One check item for this practice, related to the process group Mutual Interaction is: "See that the user story is written by a collaboration of the product owner and the development team as part of the

grooming meeting.” The user story, a normal Agile output, is the artifact for that particular check item. Note that a QA person must actually be there to see the interaction described in the check item. No special artifacts that could be audited later but aren’t “native” to Agile are required. There are other check items for the Grooming Meeting practice in other process groups, e.g. the Grooming Meeting practice in the High Level Requirements process group has a checklist item, “Are Product Owner, Scrum master, and the development team invited into the Refinement Meeting?” Again, this has to be observed by SQA; there aren’t documents that can be audited to confirm this happened

ID	AMM Lev	Process Group	Practice	Check-Item	Artifact	Severity	Pass?	Remark
5	3	Low Level Requirement	Grooming Meeting	Is a business analyst identified in offshore team and take partial PO's work considering the communication constraint of time zone in offshore model?		High		
6	3	Low Level Requirement	Grooming Meeting	Does BA refine the product backlog with PO before the refinement meeting?		High		BA responsibilities in offshore
7	3	Low Level Requirement	Grooming Meeting	Does BA communicate with PO frequently about the requirement issues or concerns from development team?		High		BA responsibilities in offshore
8	3	Low Level Requirement	Grooming Meeting	Does BA work with development team to define the acceptance criteria?		High		BA responsibilities in offshore
9	4	Mutual Interaction	Grooming Meeting	User Story is written by the collaboration of product owner and development team	User Story	High		
10	3	High Level Requirement	Grooming Meeting	Are product owner, scrum master and the development team invited into the refinement meeting?		High		Team should involve in
11	3	Sprint Plan	Sprint Planning Meeting	Does team explain the reason for different estimation results and re-estimate again till getting agreement on the same size?		High		

Figure 1: Agile checklist relating specific Agile techniques to process areas

Developing a detailed list of applicable things to check for each practice, for each process enables the process and quality group to assess the level of maturity of their Agile teams, and recommend to teams improvements for future sprints or iterations, or to identify and recommend fixes for Agile practices that aren’t being fully or properly performed. Techniques described in checklist items were assigned to maturity levels based on how difficult they are to use and how they support the agreed team maturity at each level.

Bleum’s AMM defines these levels of Agile maturity:

Level 2 is the Explored level. The team is able to manage a sprint with good results. This means that they are capable of sprint planning and tracking, clarifying requirements with the user (user story driven), and of managing problems.

Level 3 is the Defined level. The team is able to manage their products with good results. The team has the big picture of requirements and plans and has a deeper understanding of requirements. Code is managed using tools and automation. Effective sprint reviews create frequent feedback loops.

Level 4, the Improved level. Besides good quality, the team is able to improve their working efficiency. Requirements are well managed, have a clear vision and goal; XP practices are adopted to better manage technical debt. Team increases use of Test Driven Development, Behavior Driven Development, Continuous Integration, refactoring, etc.

Level 5, the Sustained level. Self-organized teams are achieved. Team members are empowered to improve their processes through quantitative feedback and to identify and adopt innovations.

An important Agile principle is that teams determine the practices they need based on the work, the customer, and their own comfort level in applying different techniques. The Process and Quality

group encourages teams to select from Level 2 checklist things before Level 3, 4 or 5 things when they are planning what techniques they are going to use in a project.

Each teams' SQA person evaluates team performance for the practices that teams said they were going to use and notes problems or superior performances in performing any of these techniques. Usually, each sprint the team gets a report from SQA (longer sprints may have extra reports) showing what percent of practices they are applying at each of the Bleum AMM levels (2 through 5), and notes from SQA about their success, or issues to follow up on and fix.

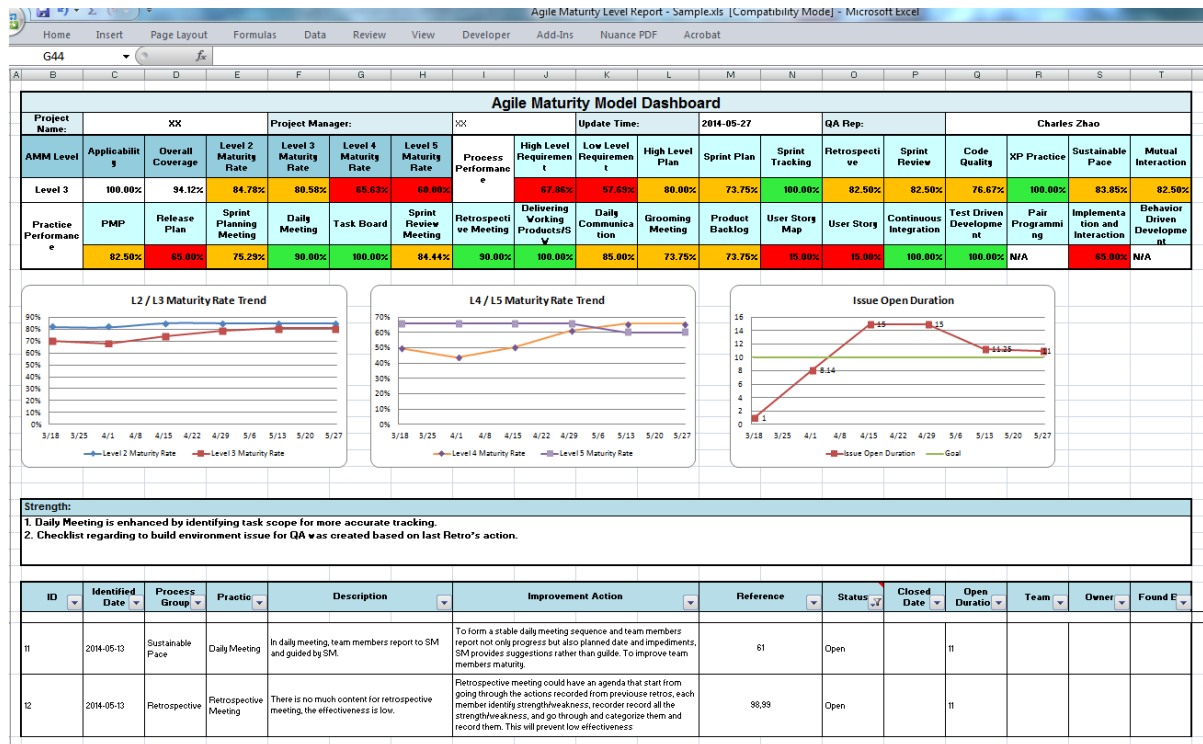


Figure 2: The team's AMM Dashboard report is built from data entered by a team's SQA person.

During their observations the SQA people collect any measurement data needed for dashboard reports, in some cases enumerating and recording data, in other cases collecting and recording data from team members. Data about things important to the project, e.g., tickets cleared, backlog, effort, errors, are combined with grades on the practices the team uses; these are reported to the team biweekly, in person in a team retrospective as part of the team status discussion and improvement planning.

From: Charles Zhao
 To: [redacted]
 Cc: [redacted]
 Subject: Team Agile Maturity Level Report 05272014
 Message: Agile Maturity Level Checklist List V0.5_05272014.xls (999 KB)

Dear All,

Here is the AMM report for the last sprint. I will discuss with you the solutions and follow up action items.

AMM Level	Level 2 Maturity Rate	Level 3 Maturity Rate	Level 4 Maturity Rate	Level 5 Maturity Rate
Level 3	84.78%	80.58%	65.63%	60.00%

Highlights:

Checklist regarding to build environment issue for QA was created based on last Retro's action.
 Daily Meeting is enhanced by identifying task scope for more accurate tracking.

Weakness:

1. Stories are not specific and without acceptance criteria, relying on team's design.
2. Team's clarification on requirement/design with PO is not on time.
3. Build environment is not stable which blocks QA testing progress.
4. PBI priorities is separated from release plan, PBIs with higher priority were not released.
5. Team members are not mature enough to track progress and identify risks/issues/pick tasks by themselves.

Open Issue List:

ID	Identified Date	Process Group	Practice	Description	Improvement Action	Status	Open Duration
8	5/13/2014	Sustainable Pace	Daily Meeting	In daily meeting, team members report to SM and guided by SM.	To form a stable daily meeting sequence and team members report not only progress but also planned date and impediments, SM provides suggestions rather than guide. To improve team members maturity.	Open	11
9	5/13/2014	Retrospective	Retrospective Meeting	There is no much content for retrospective meeting, the effectiveness is low.	Retrospective meeting could have an agenda that start from going through the actions recorded from previous retros, each member identify strength/weakness, recorder record all the strength/weakness, and go through and categorize them and record them. This will prevent low effectiveness	Open	11

Thanks & Best regards,

Figure3: Report to team, for discussion in the team retrospective

The data from the Agile teams and the characterizations of their Agile practice are worked into periodic ODC reports so that managers understand achievements and challenges for the Agile projects, progress information, and escalated issues. Agile teams' measurements of organization's critical, controlled processes are integrated into the organization's performance baselines, some of which apply only to Agile work.

Also, any superior practice performances observed by SQA are discussed and may be shared with the Agile community. For example, SQA made a video of a mature team's daily meeting and shared it with other teams, for discussion about improvements. Public recognition and sharing of these better performances is an important part of their Agile community improvement work.

Quarterly, the senior management team meets and reviews in detail the results of all projects, including the Agile projects, using the measurements and action reports that originate in the work and are gathered from teams in weekly team meetings in both Agile and project groups.

Results

Teams plan their use of Agile techniques based on their skills and the needs of the customer for the project, then see clearly each sprint whether they're doing what they expected to do, and learn about any problems that they need to solve sprint to sprint. They also get to learn how highly successful teams perform practices. This gives Agile teams tools to understand and manage their performance and improvement that have been available to project style groups in Bleum for a long time.

Scrum masters and teams get more feedback about what is working and where they may need help. It also provides scrum masters with a path for their development, so that they start out with teams that are mostly using Level 2 Agile practices, and move on to learn, apply, and coach more complicated or demanding practices described in higher levels of the Bleum AMM as they build their experience.

Scrum master's or team members' training or needs, or experience levels enable the team to adjust their sprint plans and use of Agile techniques accordingly. The additional feedback from SQA on the job and from the reports covered in the team meetings empowers teams to be confident about their work, in the spirit of Agile. Scrum masters become more confident and less controlling as teams become more self managing and their Agile processes actually become "lighter".

Managers get quality, productivity, process compliance, and skill level information about Agile teams that they need, so they know how things are going and can manage to meet or improve customer satisfaction and meet other business goals.

While developing Agile capability, considering the resources spent on defining the Bleum AMM, training, and support, SQA has spent more time with Agile teams than with project-style teams; however, as these methods and reports have been in use and improved measurably less time has been required from SQA to support their Agile teams. This approach has paid off in better Agile team results.

Future

Goals for support for Agile include helping more teams become comfortable using techniques from the higher maturity levels, using more automation, and becoming more confident and truly self-managing teams and team members.

For those Bleum customers who want their ODC partners to use Agile, Bleum's teams can calibrate how to fit into extended teams and help provide superior results. When Bleum's teams do development using Agile they have an improving set of suitable practices they know how to use to meet the needs of their customers.

None of this conflicts with CMMI; the organization's reports focus on quality results from all projects, not just project-style projects or Agile technique projects. The partnership of experts within Bleum to understand and get the most benefit from Agile makes sure that management infrastructure, management practice, or over-design of processes don't warp the techniques and make them lose their "light weight" character and benefit. Measured improvement shown in team results so far show this approach is working. It engages scrum masters, team members, quality and process support people to work together to get better results with Agile in a CMMI L5 organization.

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^{iv} Standard CMMI® Appraisal Method for Process Improvement (SCAMPISM) A, Version 1.3: Method Definition Document, SCAMPI Upgrade Team, March 2011, HANDBOOK, CMU/SEI-2011-HB-001

^v CMMI® for Development, Version 1.3, CMMI-DEV, V1.3, CMMI Product Team, Improving processes for developing better products and services, November 2010, TECHNICAL REPORT, CMU/SEI-2010-TR-033, ESC-TR-2010-033

^{vi} See Wikipedia article, http://en.wikipedia.org/wiki/Agile_software_development for a summary of Agile techniques

^{vii} Copyright 2001, 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, Dave Thomas,

^{viii} Agile Maturity Model (AMM): A Software Process Improvement framework for Agile Software Development Practices. Chetankumar Patel and Muthu Ramachandran