How Agile practices can employ CMMI to meet the US GAO requirements

How to answer the requirements of the Government Accountability Office's requirements for Agile techniques and answer the challenges the GAO identified using these Agile techniques with the best practices in the Capability Maturity Model Integration (CMMI).

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How to answer to US GAOs' requirement to use Agile methods

The GAO was asked to identify:

1) effective practices in applying Agile for software development solutions and

2) federal challenges in implementing Agile development techniques.

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GAO-identified practices and approaches for applying Agile

- The GAO identified 32 practices and approaches as effective for applying Agile software development methods to IT projects.
- The practices generally align with five key software development project management activities:
  - (1) strategic planning, (2) organizational commitment and collaboration, (3) preparation, (4) execution, and (5) evaluation.
- Officials who have used Agile methods on federal projects generally agreed that these practices are effective.

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The 10 GAO-identified practices for applying Agile

Specifically, each practice was used and found effective by officials from at least one agency, and ten practices were used and found effective by officials from all five agencies. The ten practices are:

1) Start with Agile guidance and an Agile adoption strategy.
2) Enhance migration to Agile concepts using Agile terms, such as user stories (used to convey requirements), and Agile examples, such as demonstrating how to write a user story.
3) Continuously improve Agile adoption at both the project level and organization level.
4) Seek to identify and address impediments at the organization and project levels.

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The 10 GAO-identified practices for applying Agile (continued)

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5) Obtain stakeholder/customer feedback frequently.
6) Empower small, cross-functional teams.
7) Include requirements related to security and progress monitoring in your queue of unfinished work (the backlog).
8) Gain trust by demonstrating value at the end of each iteration.
9) Track progress using tools and metrics.
10) Track progress daily and visibly.

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The 14 GAO-identified challenges

- The GAO identified 14 challenges with adapting to and applying Agile in the federal environment based on an analysis of experiences collected from five federal agencies that had applied Agile to a development effort.
- The 14 challenges are:
    1) Teams had difficulty collaborating closely.
    2) Procurement practices may not support Agile projects.
    3) Teams had difficulty transitioning to self-directed work.
    4) Customers did not trust iterative solutions.
    5) Staff had difficulty committing to more timely and frequent input.

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The 14 GAO-identified challenges

(continued from previous) …

6) Teams had difficulty managing iterative requirements.

7) Agencies had trouble committing staff.

8) Compliance reviews were difficult to execute within an iteration time frame.

9) Timely adoption of new tools was difficult.

10) Federal reporting practices do not align with Agile.

11) Technical environments were difficult to establish and maintain.

12) Traditional artifact reviews do not align with Agile.

13) Agile guidance was not clear.

14) Traditional status tracking does not align with Agile.

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Using CMMI to meet the 14 challenges for applying Agile

- Although the GAO identified 10 effective practices for applying Agile, they also identified 14 challenges with applying it. What can be done to overcome these challenges?
- The Capability Maturity Model Integration (CMMI) can answer and satisfy these challenges.

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What is the CMMI?

- The Capability Maturity Model Integration (CMMI®) is a world-class performance improvement framework for competitive organizations that want to achieve high-performance operations.
  - Building upon an organization's business performance objectives, CMMI provides a set of practices for improving processes, resulting in a performance improvement system that paves the way for better operations and performance.
- CMMI helps an organization develop their organizational capabilities by learning new behaviors that can help improve performance, speed, quality and profitability.

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What is the CMMI?

- The CMMI is divided into Process Areas (PA) named for their area of coverage in any software development effort, examples are Configuration Management (CM), Process and Product Quality Assurance (PPQA), Measurement and Analysis (MA), etc.
  - There are 22 total PA s in CMMI for Development (CMMI-DEV).
  - With each PA, there are a series of Specific Practices (SP) identified for that PA. Each PA explains what needs to be done, but the user of the model chooses “how” to do it. CMMI is lifecycle-agnostic.

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How the Capability Maturity Model Integration (CMMI) can answer these 14 challenges

- Recently, the CMMI Institute's has updated some of the process areas in the Capability Maturity Model® Integration to help those using Agile to interpret its practices.
- The CMMI does not tell you 'how' to perform a technique or practice, it tell you the practices you 'should' employ for best results.
  - CMMI does not provide a single process. Rather, the CMMI framework models what to do to improve your processes, not define your processes.
  - Therefore the CMMI can and is used with any and all software development lifecycles from Agile to Waterfall, to Spiral, etc.

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Using Agile with CMMI

- Many Agile techniques and ceremonies are used to implement CMMI practices since these best practices can be proven by implementing Agile techniques.

- Experience has proven that Agile and CMMI when used together can prove the methods, techniques and practices can coexist and prove more powerful in developing an organization's capability to build quality software products that satisfy the customers requirements and answer to changing needs.

- As a CMMI Lead Appraiser and Agile Coach (SPC and CSM) Margaret Glover has been coaching, mentoring and appraising CMMI organizations who employ Agile software development lifecycles with complete success. Margaret is a CMMI Lead Appraiser, as well as a certified Introduction to CMMI instructor.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #1: Teams had difficulty collaborating closely.
  - The Project Planning (PP) Process Area (PA) in CMMI asks that the organization establish and maintain plans that define the project/work activities (PP Specific Goal (SG) 2). These plans can be represented in a tool as User Stories, hence this Agile activity can also serve as a project plan when defined in a Sprint Backlog or a Project/Program Backlog. Using a tool enables the organization to not have to build large and onerous Requirement Specifications. Management should be supportive of teams who may not be in the same work space, but who can collaborate within a virtual tool for writing and tracking requirements (Requirements Management (RM) SP 1.4.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #2: Procurement practices may not support Agile projects.
  - The Supplier Agreement Management (SAM) PA supports subcontractor arrangements with contracts and vendors who supply products that are delivered to clients as part of the overall software solution. This process area asks that you evaluate vendors based on requirements and established criteria. These requirements and criteria can be represented as user stories used in Agile and Epic for Business and Support that are used in SAFe (SAM SG 2).

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #3: Teams had difficulty transitioning to self-directed work.
  - The teams could look at Project Planning (PP) and Project Monitoring and Control (PMC). These two process areas in the CMMI invite the teams to collaborate and come up with their own working estimates, not be dictated to for dates. This works extremely well with CMMI asking that all commitments to the project/work plan be reviewed by everyone affected (SP3.1). CMMI encourages group and team collaboration and understanding of the estimates of the work in a project (PP SP 3.2).

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #4: Customers did not trust iterative solutions.
  - Let customers know that through the Agile defined position of Product Owner, they have full visibility into the requirements and what they need in the next iteration. The Product Owner can track the requirements with the customer through the Sprint Backlog and using the Requirements Management (REQM) PA SP 1.5 and Requirements Development (RD) SP 2.1 where product requirements are based on customer requirements. Have the Product Owner through Sprint Demos, ensure the customer requirements that are documented are in fact implemented.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #5: Staff had difficulty committing to more timely and frequent input.
  - Staff should understand the Minimum Viable Product (MVP) objective. This allows for the development team to build the smallest piece of incremental software that will stand on its own. This allows the customer to perform product component Verification (VER) to ensure that the product that is being developed is verified against the requirements in the Sprint Backlog for that particular Sprint. This allows for defects to be found much earlier than if they were using waterfall. In process verification is supported by the VER PA and also the Agile ceremony of Sprint Demo (VER SG 3).

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #6: Teams had difficulty managing iterative requirements.
  - Software requirements constantly change in definition and in scope. In Agile, they can be maintained in a collaborative tool that everyone can and should have visibility into. No more large documents, but instead user stories which can be built with benefits to the customer. This way the iterative requirements (REQM PA) can be seen by everyone and managed effectively.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #7: Agencies had trouble committing staff.
  - The Project Planning (PP) and Project Monitoring and Control (PMC) PAs can help the Agile team understand their commitments and what is contained in each Sprint Backlog for the requirements that must be met. Staff are considered resources and are covered under the CMMI Generic Practices in GP 2.3 requiring each project to ”provide adequate resources for performing the process and developing the work products”.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #8: Compliance reviews were difficult to execute within an iteration time frame.
  - The Verification (VER) PA can be performed at the Sprint reviews where the software is delivered to the customer as the Mean Viable Product for the customer to review. The VER PA supports this activity for reviews. Having a preset time frame means that is no more waiting for a product component. The Agile principle of writing the test first then the code also support reviews of working code. Having a definition of “done” (an Agile definition) for working code also supports this activity that is described in the VER PA.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #9: Timely adoption of new tools was difficult.
  - Tools should be determined when the Vision (an Agile form of a Charter) is written for the Agile product and product components in support of the development of the product. The adoption of tools is covered with the best practices in the Technical Solution (TS) PA, under SP 1.1, and under all PA with the Generic Practice 2.3 “provide adequate resources for performing the process, developing the work products, and providing the services”. Tools should be selected well in advance and the Supplier Agreement Management (SAM) PA gives guidance on how to pick the best vendor, subcontractor or tool for the job.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #10: Federal reporting practices do not align with Agile.
  - If the Government is use to the Waterfall Lifecycle they do have to align to the reporting in Agile. This means a Sprint Demo of the MVP at the end of each Sprint. This would be a welcome change for waiting for the large SRS to be written or the High Level Design Doc and Detailed Design Doc to be written where in the past one waited two years for these documents to be written. Here in Agile, again Requirements Management (REQM) can help explain the tracking and traceability of requirements to the User Stories and their estimates (using Measurement and Analysis from that PA) can help customers understand when product components are to be delivered and the

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #11: Technical environments were difficult to establish and maintain.
  - The Technical Solution (TS) PA covers how the design of products and product components are to be implemented, along with the environment needed for their development for Validation defined in the VAL PA in SP 1.2 and the environment for Verification defined using the VER PA SP 1.2. These best practices can help define the needed environment.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #12: Traditional artifact reviews do not align with Agile.
  - Traditional artifacts and large documents are not part of the Agile process. This is not to say that requirements, design and code is not documented. They are now available for virtual access in tools that perform the Configuration Management (CM) PA to ensure that these assets are controlled for change management processes. See CM SG 1 for guidance on established baselines of all the necessary work products. CM SG 2 also requires that changes to these items are tracked and audited.

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #13: Agile guidance was not clear.
  - Guidance on processes is covered in Organizational Process Definition (OPD) of the CMMI. This PA describes how an Organizational Standard Software Process (OSSP) must be developed to describe how exactly the software is to be built and what lifecycle and work products will be generated to support the organization. It expects the organization to be training on these processes and to work with in the constraints but to allow tailoring when necessary and controlled (See the PA of Integrated Project Management (IPM) and Risk Management (RSKM)).

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Meeting the 14 GAO-identified challenges with CMMI

- Challenge #14: Traditional status tracking does not align with Agile.
  - Status becomes more commonplace with Agile as the daily Scrum meetings ask, “What did you do yesterday, what will you do today, and what do you need help with?”. Also the Burndown Velocity of the User Story estimates do a much better job of a daily Metric of project status (see the Measurement and Analysis (MA) PA and the requirements in CMMI).

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Learn more about how Agile and CMMI work together

These answers to the 14 challenges identified by the US GAO were generated by Margaret A. Tanner Glover, a certified CMMI Lead Appraiser, CMMI Introduction instructor, CSM and SPC.

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