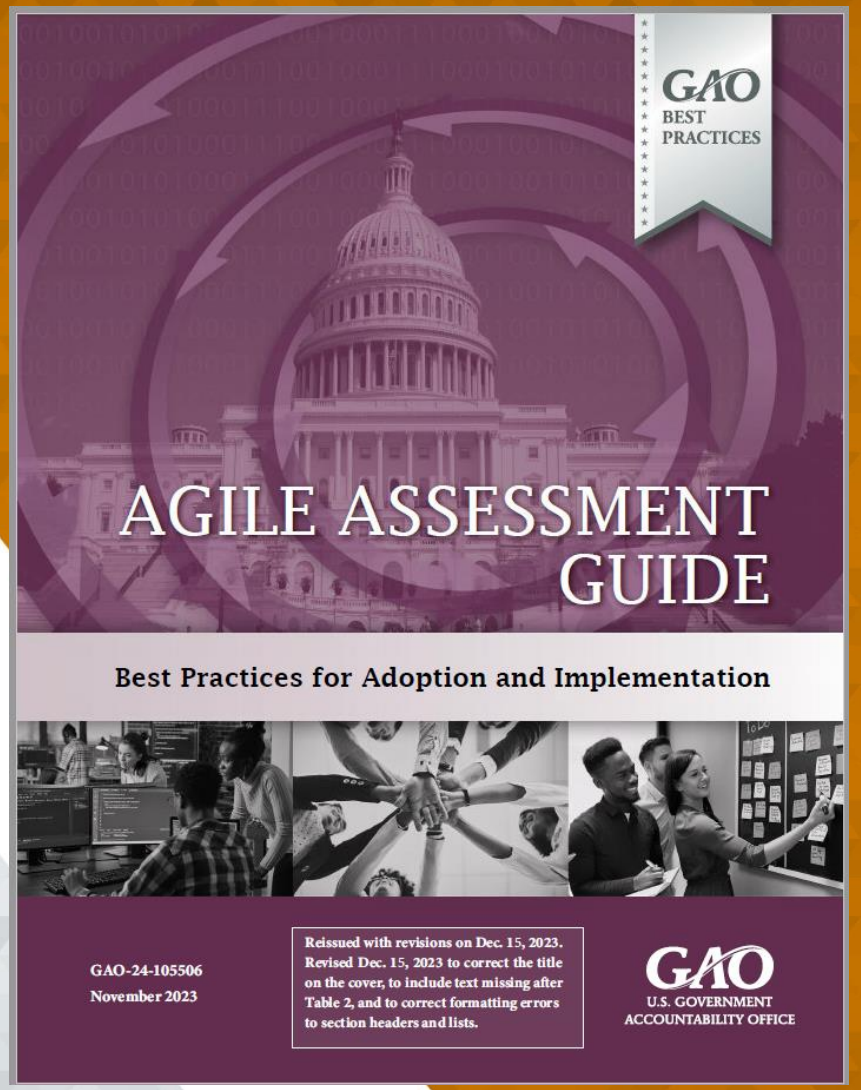
GAO Agile Assessment Guide: Applications for Cost Estimating

Juaná S. Collymore PMP, PSP, CCEA



Outline

- Background (GAO)
- Best Practice Guides
- Agile Guide Overview
- Deeper Dive:
  - Work breakdown structure
  - Cost estimating

Background

Overview: About GAO

- GAO is an independent, nonpartisan agency serving the Congress to help improve the performance and ensure the accountability of the federal government
- Core values are Accountability, Integrity, and Reliability
- To ensure independence, the Comptroller General (CG) is appointed to a 15-year term by the President. Other than the CG, there are no political appointees at GAO

Oversight, Insight, Foresight

Overview: About GAO (Our Work)

- GAO work is primarily done at the request of congressional committees or subcommittees or is mandated by public laws or committee reports. We also undertake research under the authority of the Comptroller General.
- Some examples of our work include:
  - Auditing agency operations to determine whether federal funds are being spent efficiently and effectively
  - Investigating allegations of illegal and improper activities
  - **Reporting on how well government programs and policies are meeting their objectives**
  - **Performing policy analyses and outlining options for congressional consideration**
  - Issuing legal decisions and opinions, such as bid protest rulings and reports on agency rules
- In 2018, Congress directed the formation of the Science, Technology Assessment, and Analytics (STAA) team, recognizing that the accelerating pace of innovation has created a need for more and deeper analysis of science and technology

More information about GAO can be found at www.gao.gov

Best Practice Guides

Overview: Best Practice Guides

Why develop best practice guides?

- Legislators, government officials, and the public want to know whether government programs are achieving their goals and what these programs are expected to cost and when they are expected to be finished.
  - Best practice guides provide clear criteria to establish the quality of program artifacts and whether they provide managers and oversight organizations enough information to make informed decisions.
- Developing reliable program cost and schedule estimates is critical to
  - Effectively using public funds.
  - Meeting OMB's capital programming process.
  - Avoiding cost overruns, missed deadlines, and performance shortfalls.
- The Guides help provide a framework for managing the government's acquisition efforts and ensuring the successful development and integration of cutting-edge technologies and their integration into large and complex systems.

Overview: Best Practice Guides

GAO Criteria

- **Cost Estimating and Assessment Guide**
  - Issued: March 2020, GAO-20-195G
- **Schedule Assessment Guide**
  - Issued: December 2015, GAO-16-89G
- **Technology Readiness Assessment Guide**
  - Issued: January 2020, GAO-20-48G
- **Agile Assessment Guide**
  - Issued: November 2023, GAO-24-105506

Agile Guide Overview

GAO Agile Assessment Guide: Chapters

- Chapter 1: Background
- Chapter 2: Agile Adoption Challenges in the Federal Government and Actions Taken in Response
- Chapter 3: Agile Adoption Best Practices
    - Team activities, Program processes, and Agency environment
- Chapter 4: Overview of Agile Execution and Controls
- Chapter 5: Requirements Development and Management in Agile
- Chapter 6: Agile and the Federal Acquisition Process
- **Chapter 7: Agile Program Monitoring and Control**
    - Work Breakdown Structure (WBS), Cost estimating, Scheduling, and Earned Value Management (EVM)
- Chapter 8: Agile Metrics

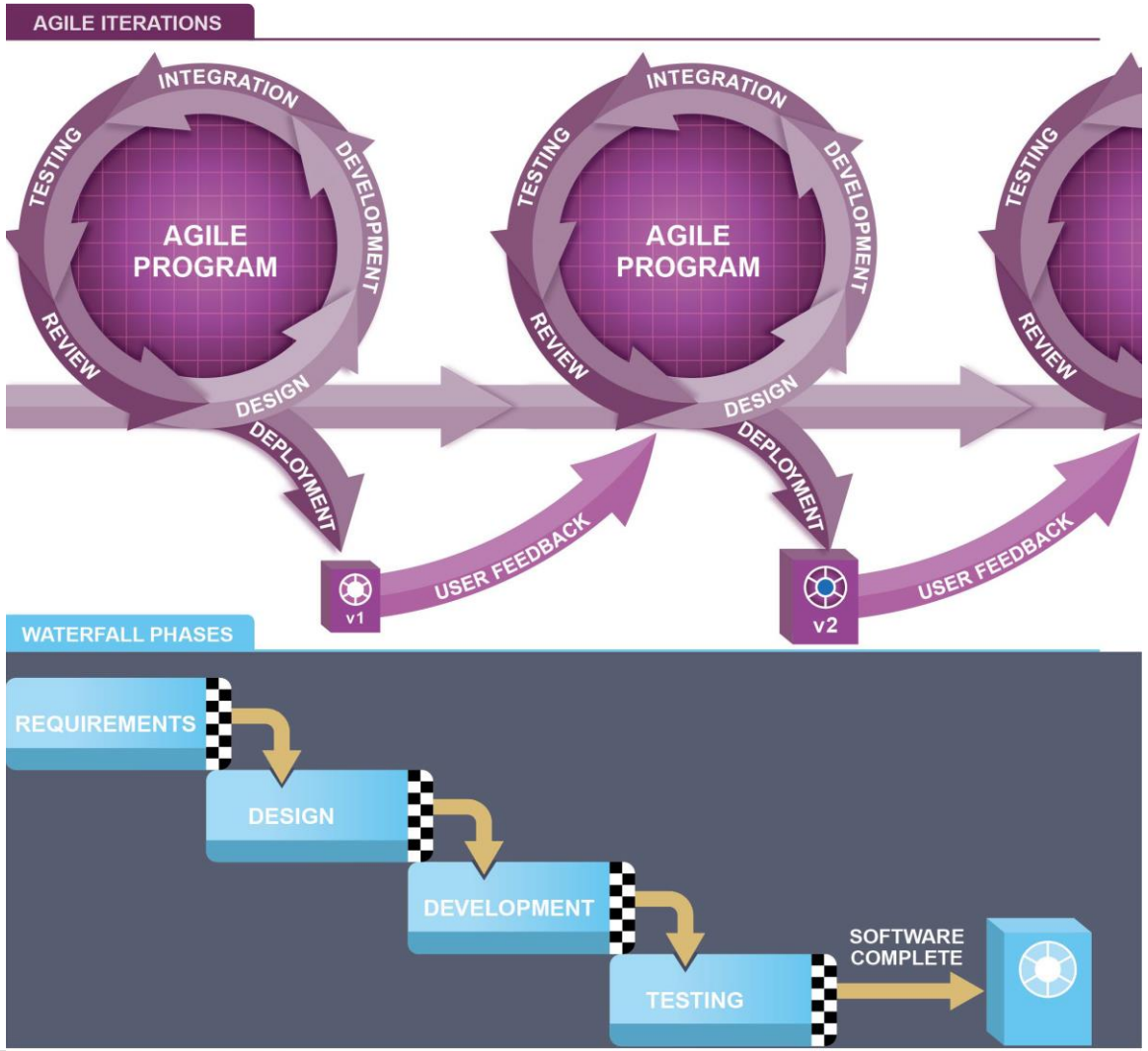
GAO Agile Assessment Guide: Appendixes

- Appendix I: Objective, Scope, and Methodology
- Appendix II: Key Terms
- Appendix III: Related Terms
- Appendix IV: Auditor's Key Questions and Effects
- Appendix V: Common Agile Frameworks
- Appendix VI: Debunking Agile Myths
- Appendix VII: Background for Case Studies and Agile in Action
- Appendix VIII: Specialists Who Helped Develop this Guide
- Appendix IX: GAO Contacts and Staff Acknowledgements

GAO Agile Assessment Guide: What is Agile?

- Agile software development is an approach to developing and delivering software that allows stakeholders to validate requirements, processes, and system functionality in increments, and deliver functionality to users in shorter cycles

- Software development in the government has traditionally followed a “waterfall” approach. This approach typically involves sequential phases, often with delivery of working software years after development begins



Source: GAO analysis of DOD and USCIS Information.t | GAO-24-105506

GAO Agile Assessment Guide: Key Terms

- **Road map**: A high level plan that outlines a set of releases and the associated features. The road map is intended to be continuously revised as the plan evolves.

- **Release**: A planning segment of requirements that deploys needed capabilities. The release is a time boxed event that consists of a set number of iterations that are determined by the program. The **release plan** is where different sets of usable functionality or products are scheduled to be delivered to the customer.

- **Backlog**: The backlog is a list of features, user stories, and tasks to be addressed by the team, program or portfolio and is ordered from the highest priority to the lowest priority. A backlog can occur at varying levels; for example, a product backlog is a high-level backlog that contains all the requirements for the entire program.

For more terms and definitions see the Agile Guide's Appendix II: Key Terms
It is important to define the terms with the program early because terms can vary

Deeper Dive: Program Controls

Work Breakdown Structure

Pre-release/iteration planning

WBS	Title	Release
1.1	Prime mission product	
1.1.1	Epic 1	R1
1.1.2	Epic 2	R1/R2
1.2	Program management	All
1.3	Hardware	R1
1.4	Software licenses	R2

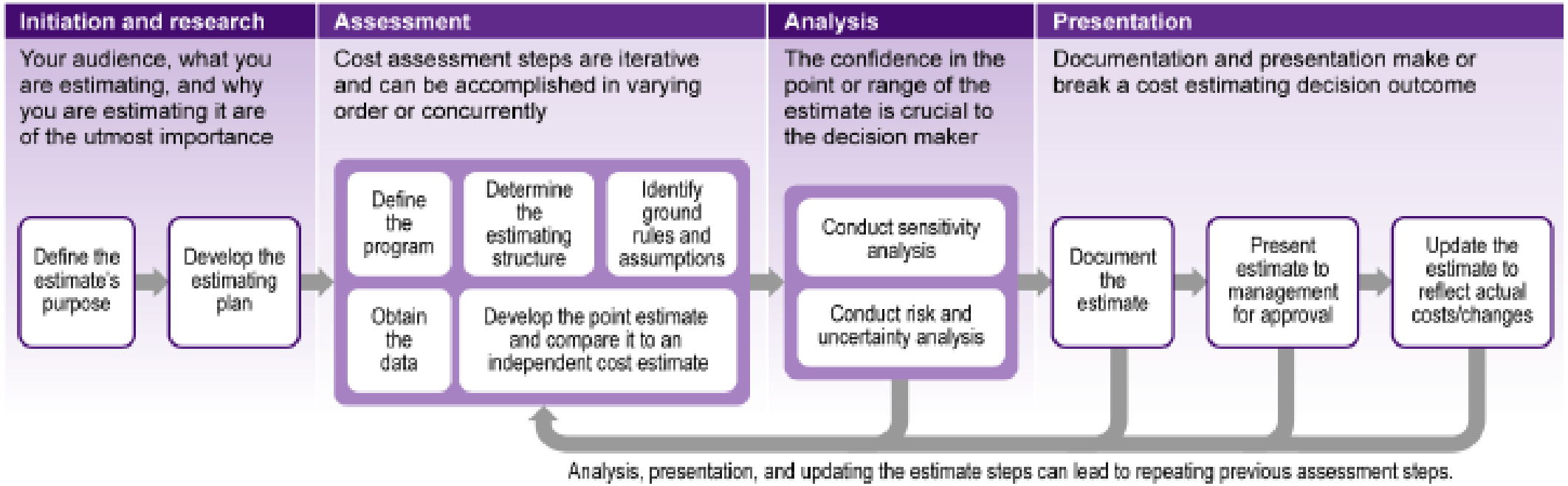
Post-release/iteration planning

WBS	Title	Release
1.1	Prime mission product	
1.1.1	Epic 1	R1
1.1.1.1	Feature 1.1	R1
1.1.1.2	Feature 1.2	R1
1.1.2	Epic 2	R1/R2
1.1.2.1	Feature 2.1	R1
1.1.2.2	Feature 2.2	R2
1.1.2.3	Feature 2.3	R2
1.2	Program management	All
1.3	Hardware	R1
1.4	Software licenses	R2

Source: GAO. | GAO-24-105506

- A work breakdown structure (WBS) can be used by management and Agile teams to provide a clear structure of the total scope of work necessary to meet a program's vision and requirements.
- WBS can also show the relationship between Agile development effort and other parts of the program.

Recall: 12-step Cost Estimating Process



Source: GAO. | GAO-20-195G

- From the GAO Cost Guide (GAO-20-195G), the 12-step cost estimating process

The Agile Guide provides an Agile environment example for each step

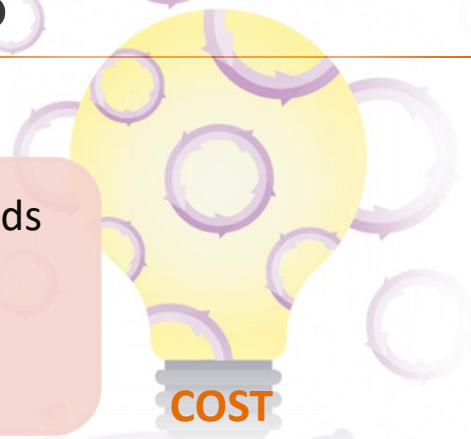
Agile Examples: Cost Estimating Steps (Table 10)

Step	Agile environment example
Step 1:	During release or initial planning, determine how any cost estimates will be used
Step 2:	During initial planning, identify the cost estimating team that will develop the estimate and any technical experts that will be needed to support the estimating effort. The estimate plan should also include details about when the government program office plans to update the estimate with Agile metrics.
Step 3-7:	Steps 3-7 should first occur during initial program planning with the development of a road map or vision and be updated as the estimate is refined at established intervals. Such as after a release, in support of program milestone review, or whenever there are updates to the road map. Agile performance measures and artifacts such as burn up/burn down charts, velocity metrics, and the product backlog can be used to update the estimate accordingly.

Characteristics of a Reliable Cost Estimate

Well-documented	Comprehensive	Accurate	Credible
• Cost estimates can easily be repeated or updated and can be traced to original sources through auditing	• An Agile cost estimate should reflect the effort contained in the product backlog and each item in the product backlog should be directly linked through value-based high-level requirements captured in the program vision and roadmap	• Historical data from other software programs should be used as input to the initial point estimate. • Agile cost estimates should be developed in constant year dollars and appropriately time-phased to account for inflation and updated frequently as more information becomes available	• Agile cost estimates are credible when they have been tested for sensitivity, a confidence level for the point estimate has been determined, they are cross checked using another estimating methodology, and are compared to an independent cost estimate with similar results.

Cost Estimating Considerations



Consistent Sizing

- Relative estimating is typically used by developers, these methods can vary from team to team
- Relative estimating does not provide a consistent measure to develop a cost estimate

Integrate

- Cost estimators should participate in release planning sessions to understand the relationship between the backlog and developers' relative estimating techniques so that they can further reefing the total program's cost estimate

Benefits

- A reliable cost estimate provides many benefits to an Agile program
- For example, the cost estimate can be used to support the government budgeting process and help inform management decisions

Case Study

Personnel Vetting: DOD Needs a Reliable Schedule and Cost Estimate for the National Background Investigation Services Program

(GAO-23-105670)

Background

- The Department of Defense, through its Defense Counterintelligence and Security Agency (DCSA), conducts personnel vetting for the majority of the federal workforce

- Since 2016, DOD has delivered some capabilities through a new information technology system- the National Background Investigation Services (NBIS) program.
  - DOD has spent over half a billion dollars on NBIS

- DOD has deployed some NBIS capabilities; however, NBIS was originally slated to be fully operational in 2019. At the time of this report, the program projects that legacy systems will be decommissioned by the end of 2024.

- In 2021, GAO recommended that DCSA develop a reliable schedule. In this report, we found that they failed to develop a reliable schedule and that their 2022 cost estimate is not reliable.

Findings: Cost

Characteristic	Score/Summary
Accurate	**Minimally Met**: The cost estimate was based on prior budgets rather than programmatic requirements and historic program data. We also found errors in the model (e.g. discrepancies between assumptions and the cost model). Further, it was not clear how data was normalized to ensure valid comparison or that inflation was applied in a consistent way.
Comprehensive	**Minimally Met**: The estimate did not document all the ground rules and assumptions and the work breakdown structure was based on budget categories rather than NBIS products. Further, several items were excluded form the estimate, despite being programmatic requirements.
Credible	**Not Met**: While some cost drivers were examined for sensitivity, the estimate did not include a risk and uncertainty analysis, did not employ cross-checks, and was not compared to an independent cost estimate.
Well-Documented	**Minimally Met**: The estimate provided some documentation to support the methodology used to develop the estimate and inflation indexes; however, not all supporting data were adequate since they did not document data reliability. Further, there was no technical baseline and it was unclear from the documentation that management approved/reviewed the estimate.

Conclusion

- The findings in this report resulted in a Matter for Congress:
  - Congress should consider requiring the Secretary of Defense to direct the NBIS Program Management Office to develop a reliable program schedule and cost estimate for NBIS as defined in GAO's *Schedule Assessment Guide*, *Cost Estimating Assessment Guide*, and *Agile Assessment Guide*.

Thank you

Guides Available Online and Downloadable in PDF:

GAO Cost Estimating and Assessment Guide:
https://www.gao.gov/products/gao-20-195g

GAO Schedule Assessment Guide:
https://www.gao.gov/products/gao-16-89g

GAO Technical Readiness Assessment Guide:
https://www.gao.gov/products/gao-20-48g

GAO Agile Assessment Guide:
https://www.gao.gov/products/gao-24-105506

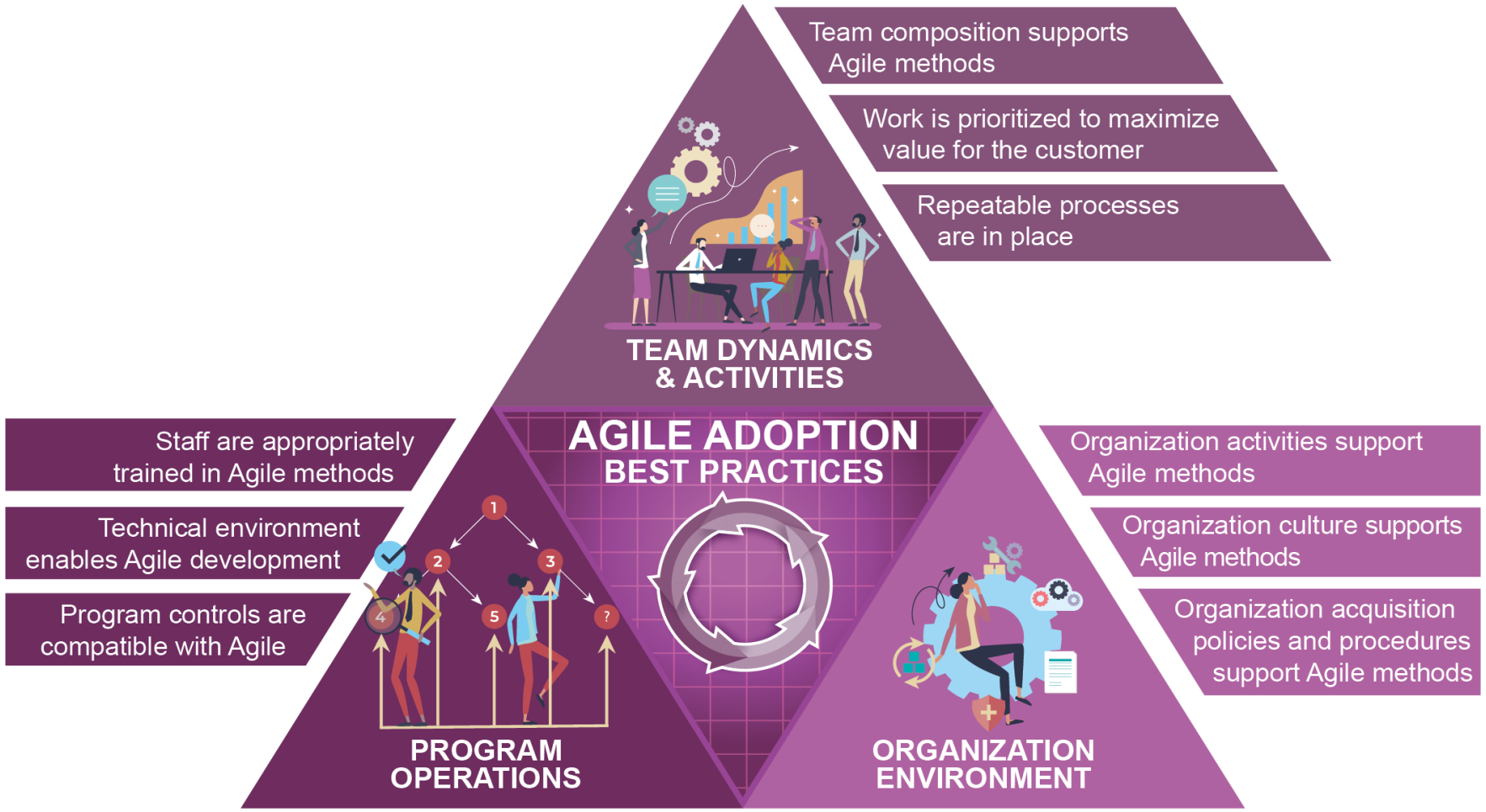
GAO on the Web

Web site: http://www.gao.gov/
Facebook: https://www.facebook.com/usgao
Twitter: https://twitter.com/usgao
YouTube: https://youtube.com/user/usgao
Podcasts: http://www.gao.gov/podcast/watchdog.html

Copyright

Back Up

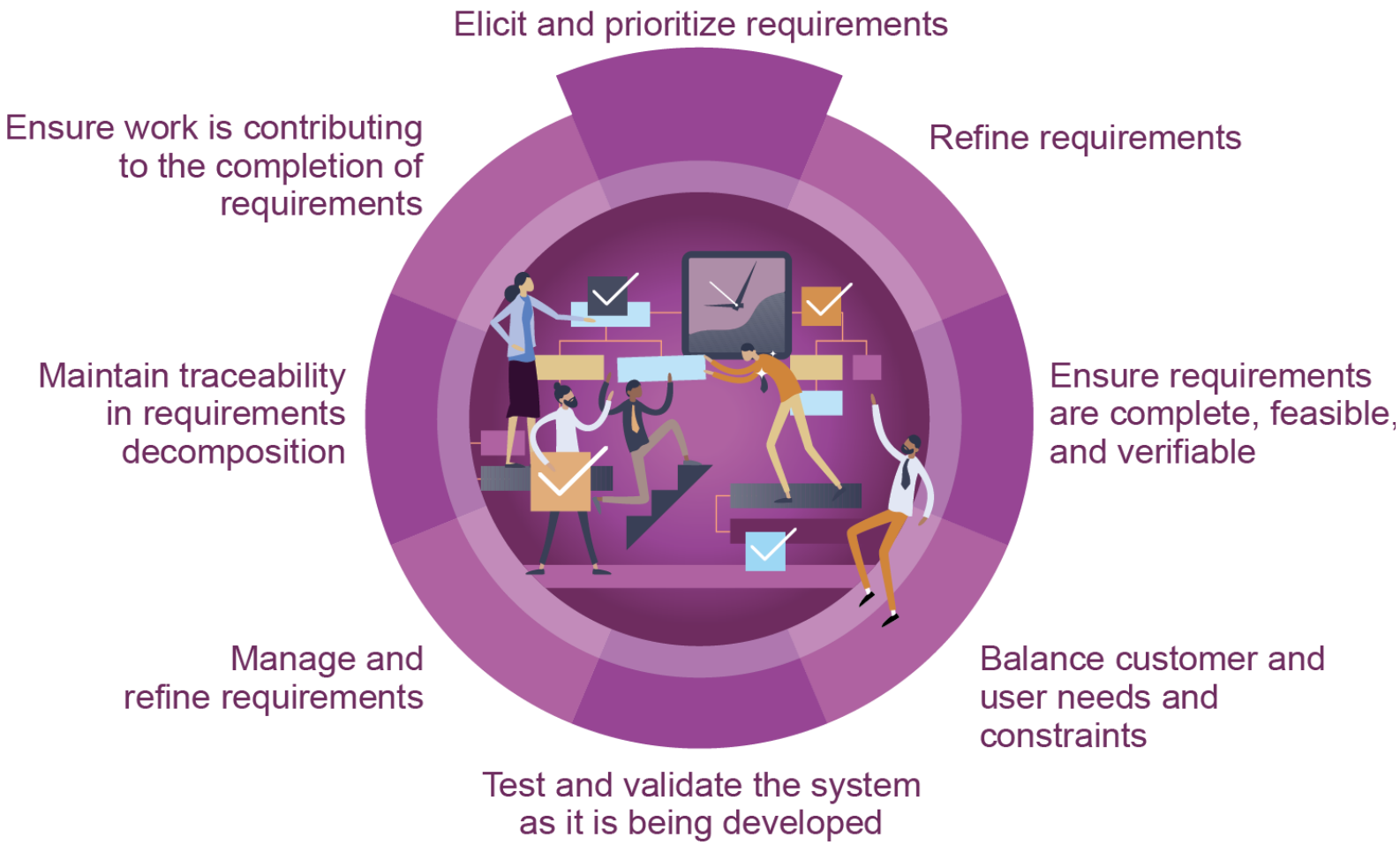
Best Practices: Agile Adoption



Source: GAO analysis of agency and private sector information (data); Vectormine/stock.adobe.com (images). | GAO-24-105506

Best Practices: Requirements Management

Back

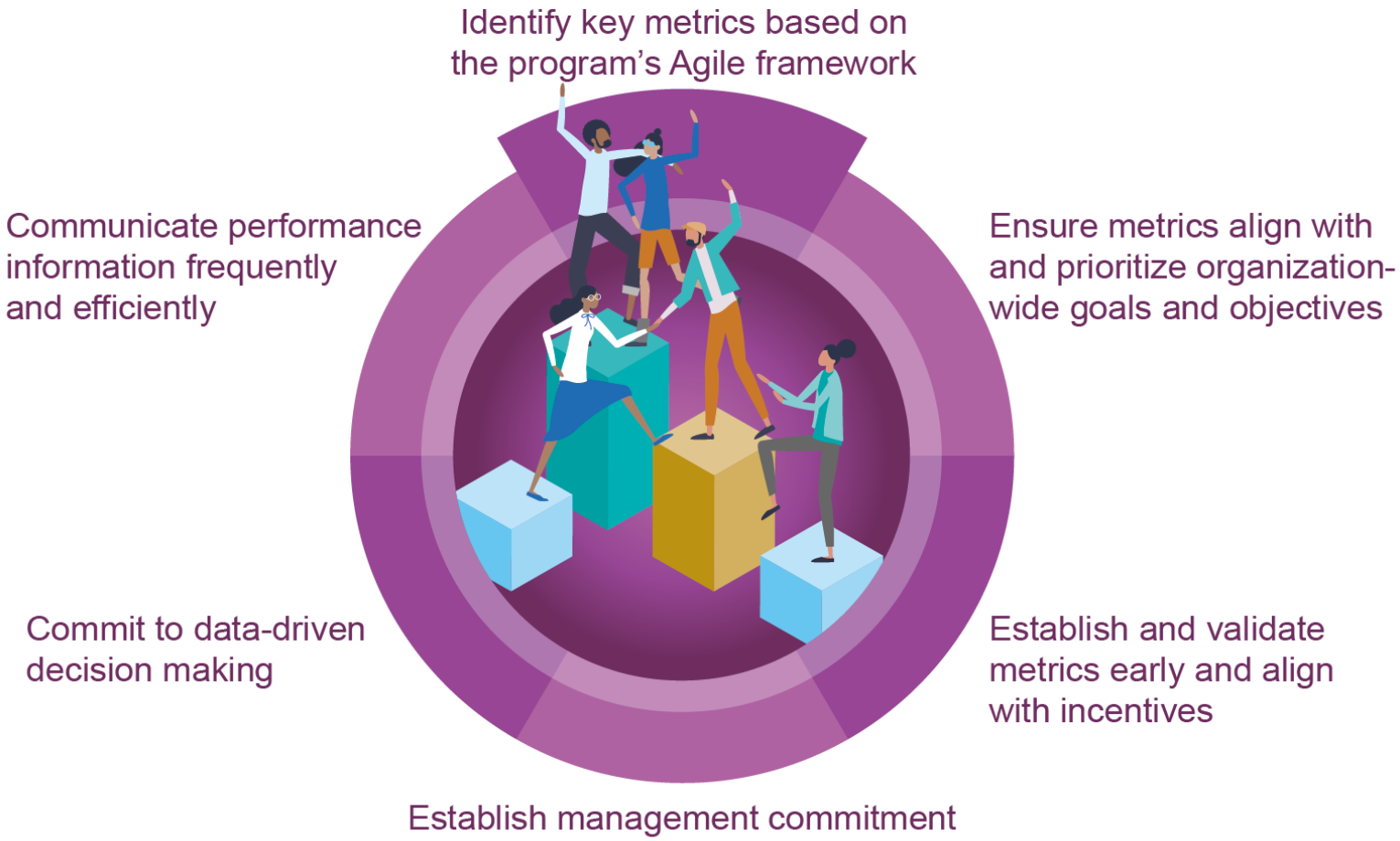


Source: GAO analysis of CMMI v. 1.3, PMI and SEI documentation (data); Vectormine/stock.adobe.com (images). | GAO-24-105506

Best Practices: Contracting

Source: GAO analysis of agency and private sector information (data); Vectormine/stock.adobe.com (images). | GAO-24-105506

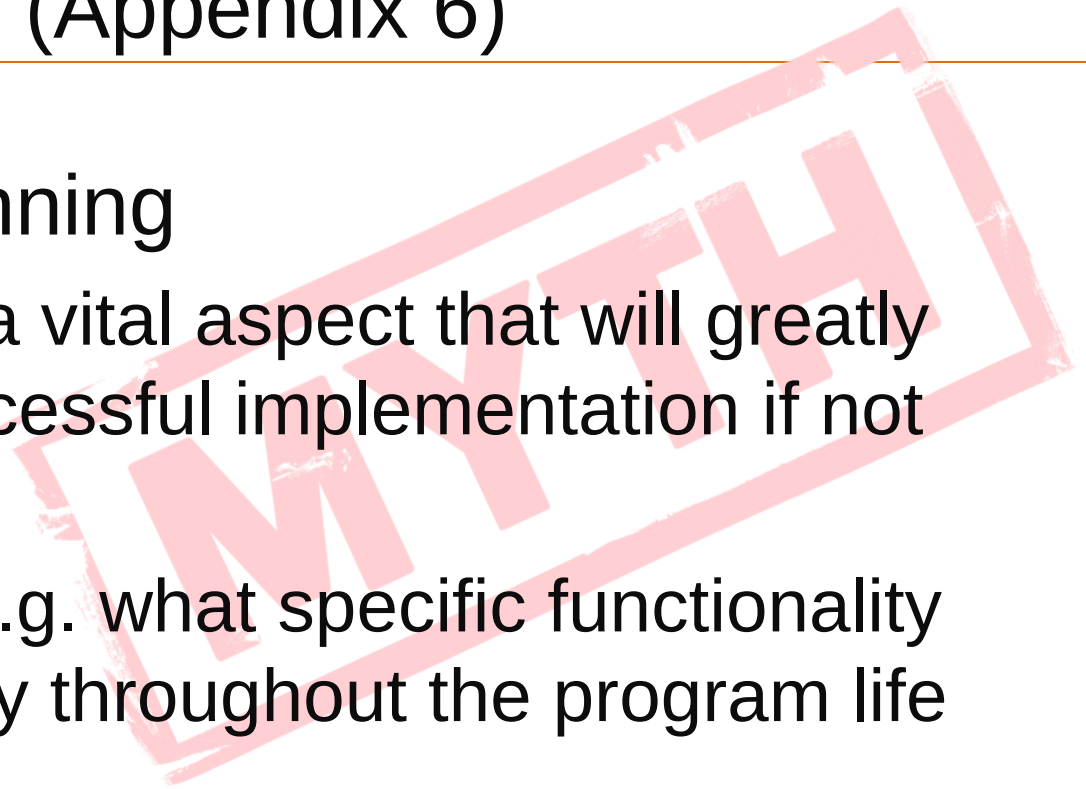
Best Practices: Metrics



Source: GAO analysis of agency and private sector information (data); Vectormine/stock.adobe.com (images). | GAO-24-105506

Debunking Agile Myths (Appendix 6)

- **Myth**: Agile does not require planning
  - As with any approach, planning is a vital aspect that will greatly diminish the effectiveness of a successful implementation if not done appropriately.
  - Agile spreads planning activities (e.g. what specific functionality will be delivered when) more evenly throughout the program life cycle.
  - High-level planning is completed at the beginning of an Agile program and is continuously elaborated on throughout the program as new information becomes available.



Debunking Agile Myths (Appendix 6)

- **Myth**: A schedule baseline cannot be reliably developed or used for an Agile software development effort
  - A central tenet of Agile is to welcome change. As part of this, teams practice rolling wave planning. This helps to minimize the cost of changing plans, but frequent changes can appear to be in conflict with the concept of adhering to a baseline.
  - However, welcoming change does not mean that software is developed and delivered in an undisciplined or ad hoc manner.
  - A baseline should be created and approved in concert with the rolling wave planning process and it should contain enough detail to enable a collaborative agreement between product owners and developers without making schedule updates overly frequent or cumbersome.

Debunking Agile Myths (Appendix 6)

- **Myth**: Earned value management is not compatible with Agile programs
  - EVM is an important management tool that provides performance measurement information for a program.
  - While EVM tracks program performance to a fixed point in time, using an Agile approach does not preclude the need for a disciplined approach for performance measurement processes. This is especially true for government Agile programs. While scope is flexible for an iteration, often scope is not flexible for the overall program.
  - The team must differentiate requirements to identify flexibility in the scope; a tailored EVM approach can leverage EVM's benefits for Agile programs.