

Appraisal Requirements for CMMI[®] Version 1.3 (ARC, V1.3)

SCAMPI Upgrade Team

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Acknowledgments

Many talented people were involved in the V1.3 upgrade of the CMMI appraisal method. Four primary groups were involved: the SCAMPISM upgrade team (SUT), the configuration control board, the CMMI steering group, and organizational sponsors. Members of the groups involved in upgrading the CMMI appraisal method are listed in Appendix C.

The SUT reviewed and discussed change requests submitted by CMMI users to change the CMMI appraisal method. The SUT then wrote, reviewed, and revised proposed changes to the appraisal method.

The configuration control board for the CMMI Product Suite reviewed and approved proposed changes to the appraisal method.

The steering group guided plans for the appraisal method upgrade, provided feedback on significant appraisal issues, and ensured involvement from a variety of stakeholders for the CMMI appraisal method.

The contributions of these individuals are gratefully acknowledged. So, too, are those of others from the CMMI product team and the process improvement and appraisal communities who provided change requests, ideas, and best practices leading to the improvements reflected in the current set of appraisal documentation.

Abstract

This report, the Appraisal Requirements for CMMI, Version 1.3 (ARC, V1.3), defines the requirements for appraisal methods intended for use with Capability Maturity Model Integration (CMMI®) and with the People CMM. The ARC may also be useful when defining appraisals with other reference models. The ARC defines three appraisal classes distinguished by the degree of rigor associated with the application of the method. These classes are intended primarily for people who develop appraisal methods to use with reference models such as those in the CMMI product suite.

1 Introduction

The Appraisal Requirements for CMMI (ARC), V1.3 defines the requirements for appraisal methods intended for use with Capability Maturity Model Integration (CMMI[®]) and with the People CMM. The ARC may also be useful when defining appraisals with other reference models. The ARC consists of a set of high-level design criteria for developing, defining, and using appraisal methods based on CMMI models.

In addition, a set of appraisal classes is defined based on typical applications of appraisal methods. These classes are intended primarily for developers of appraisal methods to use with reference models such as those in the CMMI Product Suite. Appraisal methods may be applied for different purposes, including assessments for internal process improvement and capability evaluations for supplier selection and process monitoring. This document defines the requirements for such methods, but not the conditions or constraints under which they might be applied.

The approach employed to provide guidance to appraisal method developers is to define a class of typical applications of appraisal methods (which are based on years of experience in the process improvement community) called appraisal method classes. Requirements are then allocated to each class as appropriate based on the attributes associated with that class. Thus, a particular appraisal method may be declared to be an ARC Class A, B, or C appraisal method. This designation implies the sets of ARC requirements that the method developer has addressed when designing the method.

Appraisal teams use reference models as the basis for identifying the strengths and weaknesses of the processes examined during an appraisal. Appraisal results can be used in a number of ways:

- planning an improvement strategy for the organization
- generating maturity level or capability level ratings
- supporting acquisition or business partnering decisions
- mitigating risks for product acquisition, development, and monitoring

General appraisal principles include the following:

- Start with an appraisal reference model.
- Use a formalized appraisal process.
- Involve senior management as the appraisal sponsor.
- Focus the appraisal on the sponsor's business objectives.
- Observe strict confidentiality and non-attribution of data.
- Approach the appraisal collaboratively.
- Focus on follow-on activities and decision making based on the appraisal results.

Where to Find Additional Information

You can find additional information, such as the intended audience, background, and benefits of using SEI reference models at the following web pages:

- <http://www.sei.cmu.edu/cmmi/>
- <http://www.sei.cmu.edu/cmmi/tools/peoplecmm/index.cfm>
- <http://www.cert.org/resilience/rmm.html>

Feedback

We are very interested in hearing your ideas so we can continually improve our products.

Please share your ideas using a change request form available on the SEI website:

<http://www.sei.cmu.edu/downloads/cmmi/forms/cr-appraisal.doc>

If you have other questions, send an email to the following email address:

cmmi-comments@sei.cmu.edu

2 Benefits and Features of CMMI Appraisal Methods

ARC requirements are designed to help improve appraisal consistency across multiple constellations, models, and appraisal methods. ARC requirements will help appraisal method developers, sponsors, and users understand the tradeoffs associated with various methods.

For organizations that intend to appraise against multiple CMMI constellations (e.g., CMMI-DEV, CMMI-SVC, CMMI-ACQ), or against other reference models (e.g., People CMM and potentially the CERT Resiliency Management Model), a unified appraisal approach permits some economy of scale in model and appraisal training. One appraisal method can provide results for one or more constellations and other reference models.

3 Requirements for CMMI Appraisal Method Class Structure

The CMMI appraisal method class structure (specified in Appendix A) identifies the requirements appropriate to appraisal methods designed specifically for three typical applications, shown in Table 1. There is no requirement for any given appraisal method to fall exactly into one class; however, this structure is intended to provide value and utility to users of the CMMI Product Suite, and its use is encouraged.

Table 1: Requirements of CMMI Appraisal Method Classes

| Requirements | Class A | Class B | Class C |
|---|----------------------------|--------------------------------|--------------------------------|
| Types of Objective Evidence Gathered | Artifacts and affirmations | Artifacts and affirmations | Artifacts and/or affirmations |
| Ratings Generated | Goal ratings required | Not allowed | Not allowed |
| Organizational Unit Coverage | Required | Not required | Not required |
| Appraisal Team Leader Requirements | Certified lead appraiser | Person trained and experienced | Person trained and experienced |

Key differentiating attributes for appraisal classes include the following:

- the degree of confidence in the appraisal outcomes
- the generation of ratings
- appraisal cost and duration

Class A methods must satisfy all ARC requirements and are the only methods considered suitable for providing ratings for benchmarking. The SEI will only record ratings generated by SCAMPI A appraisals, although other ARC class A methods may be created.

Class B appraisal methods must comply with a subset of ARC requirements. As indicated in Appendix A, several requirements of Class A methods are optional for Class B methods. Two types of objective evidence are required for both Class A and B methods. Class B methods do not produce ratings. These types of appraisals are recommended for initial assessments in organizations that are just beginning to use CMMI models for process improvement activities. They also provide a cost-effective means for performing interim assessments and/or capability evaluations between Class A appraisals.

Class C appraisal methods must comply with a subset of ARC requirements for Class B methods. Only one of the two types of objective evidence required for Class A and Class B methods is required for Class C methods. Class C Methods do not produce ratings. Validation and corroboration are also optional for Class C methods. These types of appraisals would most likely be used when the need for a “quick look” arises or for periodic self-assessments by projects and organizational support groups.

ARC requirements are based on widely used appraisal methods that have yielded accurate, consistent, and useful results. As other appraisal methods are identified and are shown to have similar quality characteristics, the requirements may be modified to reflect their features.

4 Requirements for CMMI Appraisal Methods

The following sections define the suite of requirements for CMMI appraisal methods. Each requirement statement is preceded by an indicator of applicability to one or more of the three CMMI appraisal method classes (i.e., A, B, C). If the indicator for an appraisal class is not listed for a requirement, then that requirement is either optional or not applicable for that appraisal class, as shown in Appendix A.

4.1 Appraisal Method Documentation

4.1.1 (ABC) The method shall be documented and, at a minimum, include the following:

- a. identification of the CMMI models (version, discipline, and representation [staged or continuous]) with which the method can be used
- b. identification of the ARC version upon which the appraisal method is based
- c. a list of which CMMI appraisal requirements are satisfied by the method, along with the CMMI appraisal method class it belongs to (if applicable)
- d. activity descriptions, artifacts, and guidance that implement each of the appraisal requirements

4.1.2 (ABC) The method documentation shall provide requirements and/or guidance for determining the suitability of the appraisal method relative to the appraisal's purpose, objectives, and constraints.

4.1.3 (ABC) The method documentation shall provide requirements and/or guidance for identifying the scope of the model(s) to be investigated in the appraisal, including the process areas and capability levels, as appropriate for the model representation.

4.1.4 (ABC) The method documentation shall provide requirements and/or guidance for identifying the organizational unit to be appraised, including the sponsor's relationship to the organizational unit and the basic units (e.g., projects or work groups) and support functions that will participate.

- 4.1.5 (ABC) The method documentation shall provide requirements and/or guidance for selecting appraisal team members and criteria for qualification.
- 4.1.6 (ABC) The method documentation shall provide requirements and/or guidance for an appraisal team leader's qualification criteria.
- 4.1.7 (ABC) The method documentation shall provide requirements and/or guidance for determining the appropriate size of the appraisal team.
- 4.1.8 (ABC) The method documentation shall provide requirements and/or guidance on the roles and responsibilities of the sponsor, the appraisal team leader, and the appraisal team members.
- 4.1.9 (ABC) The method documentation shall provide requirements and/or guidance for estimating the resources required to conduct the appraisal (including the amount of time required to conduct an appraisal).
- 4.1.10 (ABC) The method documentation shall provide requirements and/or guidance for appraisal logistics.
- 4.1.11 (ABC) The method documentation shall provide requirements and/or guidance for collecting relevant data on the organizational unit and associating the data to the reference model.
- 4.1.12 (ABC) The method documentation shall provide requirements and/or guidance for creating findings, relative to the reference model.
- 4.1.13 (ABC) The method documentation shall provide requirements and/or guidance for protecting the confidentiality of appraisal data and ensuring non-attribution of data contributed by appraisal participants.
- 4.1.14 The method documentation shall provide requirements and/or guidance for (1) recording traceability between the data collected during the appraisal and the findings and/or ratings, (2) the retention and safekeeping of appraisal records, and (3) compiling and maintaining an appraisal record that supports the appraisal team's findings and/or ratings and that contains the following minimum content:
 - a. (ABC) dates of appraisal
 - b. (ABC) appraisal plan

- c. (A) objective evidence, or identification thereof, sufficient to substantiate goal rating judgments
- d. (ABC) the appraisal method (and version) used, along with any tailoring options
- e. (ABC) findings
- f. (A) characterizations
- g. (A) any ratings rendered during the appraisal (goals, process areas, and maturity or capability levels)

4.2 Planning and Preparing for the Appraisal

4.2.1 (ABC) The method shall provide for the preparation of appraisal participants.

4.2.2 (ABC) The method shall provide for the development of the appraisal plan.

At a minimum, the appraisal plan shall specify the following:

- a. the identity of the sponsor of the appraisal, and the sponsor's relationship to the organizational unit being appraised
- b. the appraisal purpose, including alignment with business objectives
- c. the appraisal reference model scope, including
 - 1. the process areas to be investigated within the organizational unit
 - 2. the highest maturity level and/or capability level to be investigated for each process area within the appraisal model scope
- d. the organizational unit that is the subject of the appraisal
- e. the process context, which, at a minimum, shall include the following:
 - 1. size of the organizational unit
 - 2. demographics of the organizational unit
 - 3. application domain of the products or services of the organizational unit
 - 4. size, criticality, and complexity of the products or services
- f. the identity of the CMMI and other reference models used, including the version, and representation (staged or continuous)
- g. the experience, knowledge, and skills of the appraisal team leader who is responsible for the appraisal in accordance with the method requirements
- h. the identity and affiliation of the appraisal team members, including the appraisal team leader, with their specific appraisal responsibilities
- i. the identity (name and organizational affiliation) of appraisal participants and support staff, with specific responsibilities for the appraisal
- j. any additional information to be collected during the appraisal to support achievement of the appraisal objectives
- k. a description of the planned appraisal outputs, including ratings to be generated (process areas, maturity level)
- l. anticipated follow-on activities (e.g., reports, appraisal action plans, re-appraisal)

- m. planned tailoring of the appraisal method and associated tradeoffs, including the sample size or coverage of the organizational unit
- n. the activities to be performed in conducting the appraisal
- o. resources and schedule assigned to appraisal activities
- p. appraisal logistics
- q. appraisal risks and associated mitigation plans
- r. potential conflicts of interests and associated mitigation plans

4.2.3 (ABC) The method shall require that the appraisal plan, and any changes to the appraisal plan, shall be agreed to by the sponsor (or the delegated authority) and documented in the appraisal record.

4.3 Appraisal Data Collection, Consolidation, and Validation

Appraisal teams base their findings on review of one or more types of objective evidence. The requirements in this section identify the types of objective evidence recognized by ARC-compliant appraisal methods. As indicated in Appendix A, both of the two types of objective evidence identified below are required for Class A and Class B appraisal methods. At least one type of objective evidence is required for Class C methods.

4.3.1 (AB) The method shall collect affirmation data (e.g. by conducting interviews with project or work group leaders, managers, and practitioners).

4.3.2 (AB) The method shall collect data by reviewing artifacts (e.g., organizational policies, project or work group procedures, slides from past presentations, and implementation-level work products).

4.3.3 (ABC) The method shall require appraisal team consensus when teams are involved in decisions related to determining the validity of findings and establishing ratings.

4.3.4 (ABC) The method shall require a mechanism for consolidating the data collected during an appraisal into accurate findings according to the following criteria:

- a. The finding was derived from objective evidence seen or heard during data collection sessions.
- b. The finding is clearly worded, phrased without attribution, and expressed in terminology used by the staff working in the organizational unit.
- c. Objective evidence supporting the finding is traceable to the project, work group or organizational unit.

- d. The finding is relevant to the appraisal reference model and can be associated with a specific model component.

4.3.5 (AB) The method shall require a mechanism for verifying findings according to the following criteria:

- a. The finding is based on corroborated objective evidence.
- b. The finding is consistent with other verified findings. (Verified findings cannot be both true and mutually inconsistent; in aggregate, they constitute a set of truths about the organizational unit that must be consistent.)

4.3.6 (AB) The method shall require the following minimum set of criteria to be satisfied in order for objective evidence to be considered “corroborated”:

- a. The objective evidence is obtained from at least two different sources.
- b. At least one of the two sources must reflect the work that is actually being done (e.g., process area implementation).

4.3.7 (ABC) The method shall require a mechanism for determining that sufficient data has been collected to cover the scope of the appraisal.

4.3.8 (A) The method shall require a mechanism for consolidating objective evidence into preliminary findings relative to the appraisal reference model.

4.3.9 (A) The method shall require that preliminary findings be validated with appraisal participants in order to solicit their responses for validation of the findings’ accuracy and clarity.

4.4 Rating

4.4.1 (A) The method shall define a rating process that satisfies, at a minimum, the following:

- a. An appraisal team can rate a specific or generic goal when corroborated objective evidence for each practice related to the goal meets the method’s defined data coverage criteria.
- b. An appraisal team can rate a process area when it has rated each of the process area’s specific goals and generic goals within the appraisal scope.
- c. An appraisal team can determine a maturity level rating once it has rated all of the process areas within that level and each level below.¹
- d. An appraisal team can determine the capability level of a process area when it has rated each of the generic goals at or below the target capability level.

¹ See 4.4.5b for how a maturity level rating can be determined when using the continuous representation.

4.4.2 (A) The method shall require that maturity level ratings and/or capability level ratings be based on the definitions of capability levels and maturity levels such as those found in the CMMI models.

4.4.3 (A) The method shall rate each specific and generic goal (provided the prerequisites of rating have been met) within the appraisal scope in accordance with the following rules:

- a. Rate the goal “satisfied” when the associated generic or specific practices (or acceptable alternative practices) are judged to be implemented and the aggregate of weaknesses does not have a significant negative impact on goal achievement.
- b. Rate the goal “not rated” if the goals cannot be rated in accordance with the method’s defined criteria for data sufficiency,
- c. Rate the goal “unsatisfied” otherwise.

4.4.4 (A) The method shall rate each process area within the appraisal scope, if requested by the appraisal sponsor, in accordance with the following rules:

- a. When a process area is determined to be outside of the organizational unit’s scope of work, the process area is designated as “not applicable” and is not rated.
- b. When an applicable process area is outside of the scope of the model used for the appraisal, the process area is designated as “out of scope” and is not rated.
- c. When one or more goals cannot be rated in accordance with the method’s defined criteria for data sufficiency, the process area is designated as “not rated” and is not rated.
- d. Otherwise, when a process area is to be rated for a staged representation, the process area is “satisfied” if and only if all of its specific goals and all of its generic goals at the maturity level of interest and below are rated “satisfied.” Else, it is “unsatisfied.”
- e. Otherwise, when a process area is to be rated for a continuous representation, the process area is given a capability level rating based on the highest level for which all of its specific goals and generic goals have been satisfied.

4.4.5 (A) The method shall rate the maturity level, if requested by the appraisal sponsor, in accordance with the following rules:

- a. A maturity level for a staged representation is achieved if all process areas within the level and within each lower level are either “satisfied” or “not applicable.”
- b. A maturity level for a continuous representation is achieved if the capability level profile is at or above the target profile for all process areas for that maturity level and all lower maturity levels in the equivalent staging, excepting those process areas that are designated as “not applicable.”

4.5 Reporting Results

4.5.1 (ABC) The method shall require documenting and reporting the appraisal findings and/or ratings to the appraisal sponsor and to the appraised organization.

4.5.2 (ABC) The method shall require that the appraisal record be provided to the appraisal sponsor for retention.

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Appendix A CMMI Appraisal Method Class Specification

The following table shows the applicability of the ARC requirements to the three classes of appraisal methods. In the cases where a requirement is applicable to a particular appraisal method class, “yes” is denoted. In some cases, a requirement has been specified as “not applicable” or “optional” for one or more appraisal methods. Requirements identified as not applicable are not relevant to the indicated method class; optional requirements, however, may still be performed. In the cases where “partial” is denoted, one or more sub-elements of the associated requirement are not applicable or are optional for the specified appraisal method class, while the rest of the sub-elements of that requirement are applicable to the class, as indicated.

Table 2: Applicability of ARC Requirements to Appraisal Method Classes

| Requirements | Class A | Class B | Class C |
|--|---------|---------------------------|---------------------------|
| Method Documentation | | | |
| 4.1.1 – Documentation of method | yes | yes | yes |
| 4.1.2 – Identifying appraisal purpose and objectives | yes | yes | yes |
| 4.1.3 – Model scope | yes | yes | yes |
| 4.1.4 – Identifying organizational unit | yes | yes | yes |
| 4.1.5 – Team member selection | yes | yes | yes |
| 4.1.6 – Team leader qualification criteria | yes | yes | yes |
| 4.1.7 – Size of team | yes | yes | yes |
| 4.1.8 – Sponsor, team leader, and team member roles and responsibilities | yes | yes | yes |
| 4.1.9 – Estimating appraisal resources | yes | yes | yes |
| 4.1.10 – Logistics | yes | yes | yes |
| 4.1.11 – Collecting and mapping data to appraisal reference model | yes | yes | yes |
| 4.1.12 – Creation of findings | yes | yes | yes |
| 4.1.13 – Assuring confidentiality and non-attribution | yes | yes | yes |
| 4.1.14 – Appraisal record | yes | partial (a,b,d,e only) | partial (a,b,d,e only) |

| Requirements | Class A | Class B | Class C |
|--|----------------|----------------|---|
| Planning and Preparing | | | |
| 4.2.1 – Preparation of participants | yes | yes | yes |
| 4.2.2 – Development of appraisal plan | yes | yes | yes |
| 4.2.3 – Sponsor approval of appraisal plan | yes | yes | yes |
| Data Collection, Consolidation, and Validation | | | |
| 4.3.1 – Data from interviews | yes | yes | At least one type of objective evidence |
| 4.3.2 – Data from documents | yes | yes | |
| 4.3.3 – Consensus of team members | yes | yes | yes |
| 4.3.4 – Accuracy of findings | yes | yes | yes |
| 4.3.5 – Verification of findings | yes | yes | optional |
| 4.3.6 – Corroboration of objective evidence | yes | yes | optional |
| 4.3.7 – Sufficiency of data | yes | yes | yes |
| 4.3.8 – Preliminary findings preparation | yes | optional | optional |
| 4.3.9 – Preliminary findings validation | yes | optional | optional |
| Rating | | | |
| 4.4.1 – Define a rating process | yes | N/A | N/A |
| 4.4.2 – Basis for maturity level and capability level rating | yes | N/A | N/A |
| 4.4.3 – Rules for goal rating | yes | N/A | N/A |
| 4.4.4 – Rules for process area rating | yes | N/A | N/A |
| 4.4.5 – Rules for maturity level rating | yes | N/A | N/A |
| Reporting Results | | | |
| 4.5.1 – Report results to sponsor and appraised organization | yes | yes | yes |
| 4.5.2 – Retention of appraisal record | yes | yes | yes |

Appendix B CMMI Appraisal Upgrade Participants

Many talented people have been part of the effort to upgrade the CMMI appraisal method to Version 1.3. This appendix recognizes the people involved in this upgrade. Primary groups involved included the SCAMPI upgrade team, the configuration control board, and the CMMI steering group. (If you wish to see a more complete listing of participants involved in the larger V1.3 effort, see Appendix C of CMMI for Development V1.3.)

SCAMPI Upgrade Team

The SCAMPI upgrade team (SUT) reviewed change requests submitted by CMMI users to change the CMMI appraisal method. Upgrade activities were then based on change requests, V1.3 guidelines provided by the CMMI steering group, and additional input from the configuration control board.

- Busby, Mary (Lockheed Martin)
- Buttles-Valdez, Palma (Software Engineering Institute)
- Byrnes, Paul (Integrated System Diagnostics)
- Hayes, Will (Software Engineering Institute)
- Khetan, Ravi (Northrop Grumman)
- Kirkham, Denise (The Boeing Company)
- Ming, Lisa (BAE Systems)
- Ryan, Charlie (Software Engineering Institute)
- Schaaff, Kevin (Booz Allen Hamilton)
- Stall, Alex (Software Engineering Institute)
- Svolou, Agapi (Alexanna LLC.)
- Ulrich, Ron (Northrop Grumman)

Configuration Control Board

The configuration control board for the CMMI Product Suite reviewed and approved changes for the appraisal method, including these Appraisal Requirements for CMMI (ARC).

- Campo, Mike (Raytheon)
- Carleton, Anita (Software Engineering Institute)
- Chrissis, Mary Beth (Software Engineering Institute)
- Dauplaise, Kirsten (NAVAIR)
- Evanoo, Mike (SSCI)
- Frost, Rich (General Motors)
- Gallagher, Brian (Northrop Grumman)
- Gristock, Steve (JP Morgan Chase)
- Godfrey, Sally (NASA)
- Jacobsen, Nils (Motorola)
- Konrad, Mike (Software Engineering Institute)
- Moore, Chris (WR ALC)
- Mullison, Wendell (General Dynamics)
- Phillips, David M. (Software Engineering Institute)
- Schwomeyer, Warren (Lockheed Martin)
- Scibilia, John (US Army)
- Swidorsky, Dave (Bank of America)
- Tyson, Barbara (Software Engineering Institute)
- Rassa, Robert C. (Raytheon Space and Airborne Systems)
- Richter, Karen (OSD/IDA)
- Young, Rusty (Software Engineering Institute)

CMMI Steering Group

The steering group guided plans for V1.3, provided consultation on significant appraisal issues, and ensured involvement from a variety of interested stakeholders for the CMMI appraisal method.

- Beamish, Alan (USAF)
- Carleton, Anita (Software Engineering Institute)
- Chittister, Clyde (Software Engineering Institute)
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