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CMU/SEI-96-TR-002
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Software Capability Evaluation
Version 3.0
Method Description

Paul Byrnes
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CMM-Based Appraisal Project

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FOR THE COMMANDER

(signature on file)

Thomas R. Miller, Lt Col, USAF
SEI Joint Program Office

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This document is based largely on the previous work that led to the *SCE Version 1.5 Method Description* and *SCE Version 2.0 Method Description* [CBA Project, 94]. Thanks are again offered to everyone who contributed to developing, writing and reviewing those documents. Many reviewers have contributed to the development and revision of this document; their valuable insights added a great deal to the quality of the finished product.

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Preface

About This Document

This report documents version 3.0 of the Software Capability Evaluation (SCE) Method. This document incorporates Capability Maturity Model[SM1] (CMM[SM]) v1.1 [Paulk 93a] and the key practices of CMM v1.1 [Paulk 93b] into the SCE Method. SCE V3.0 is a CAF-compliant method.[2] The primary focus of this report is on *what* is done; less attention is given to *how* it is done. SCE Evaluator training provides this how-to information.

Some of the objectives for the SCE Method are that it should be reliable, repeatable, trainable, consistent, and closely aligned with the CMM-Based Appraisal for Internal Process Improvement (CBA IPI). This document is part of ongoing efforts to meet those objectives and to improve the method.

Goals of This Document

The method description is aimed at a wide audience. After reading this document, readers should

- understand how SCE fits into the larger context of software acquisition, development, and process improvement
- understand the fundamental concepts of SCE
- know what the activities performed during an SCE are
- understand the objectives of an SCE
- understand the relationship with other CMM-based diagnostic tools

Intended Audience

The report is intended to help managers understand the SCE Method, help sponsors decide on the appropriateness of using SCE to evaluate a target organization, and enable potential recipients of an SCE to determine if an internally administered SCE would point out areas of risk that merit immediate improvement to compete more effectively. The audience also includes all attendees of SCE v3.0 training and anyone who wants to learn about the SCE method.

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1. Capability Maturity Model and CMM are service marks of Carnegie Mellon University.

2. The CMM Appraisal Framework (CAF) documents appraisal requirements for CMM-based appraisal methods. A CAF compliant method must implement all CAF requirements. The CAF was created to help address community concerns for achieving better alignment between SEI CMM-based appraisal methods.

It is assumed that the reader has some knowledge of the SEI Capability Maturity Model (CMM) [Paulk 93a] and the associated document, *Key Practices of the Capability Maturity Model, Version 1.1* [Paulk 93b]. Training in the reference model and in performing an SCE is necessary before joining an SCE team as an evaluator.

Document Structure

Part 1, the Introduction, provides background information about the purpose, goals, objectives, applications, and products supporting the SCE Method. Part 2, the Overview of the SCE Method, provides a high level description of the SCE activities, a conceptual framework for CMM-based data collection, information about various SCE application characteristics, and information about the evolution of the SCE Method. Part 3 includes a more detailed description for users of the method. Tailoring the baseline method for government source selection is documented in the *SCE Version 3.0 Implementation Guide for Supplier Selection*.

Appendices include a SCE V2.0 to V3.0 activity mapping, a CAF requirements traceability matrix, temporal flow and information flow diagrams, a baseline schedule, a version update description, attribute definitions, a glossary, and a bibliography.

Other SCE Documents

In addition to this document, the initial release of the SCE v3.0 document suite includes an implementation guide for supplier selection. These documents are provided as part of team training. Implementation guides for other uses of the method, such as internal evaluation, or with models similar to the software CMM may be added to the suite upon SEI approval. Also approved with initial document release is the training course necessary for SCE teams.

SCE Product Suite		
Method and Guidance	**Education, Training, and Qualification**	**Transition and Installation**
• Method description† • Implementation guide for supplier selection† • Implementation guide for process monitoring • Implementation guide for internal evaluation • Team member reference guide • Quick reference manual	• Evaluator training† • Introduction to SCE • Overview seminar • Senior evaluator training • Refresher training • Qualification program • Reference model training	• Transition strategy • Installation guide • Technology transition workshop • Implementation workshop • Communication package • Automated support aids

† *indicates that an item is part of the initial release of the SCE v3.0 product suite.*

Table P-1: Proposed SCE Product Suite

Software Capability Evaluation Version 3.0 Method Description

Abstract: This report describes Version 3.0 of the Software Capability Evaluation (SCE) Method. SCE is a method for evaluating the software process of an organization to gain insight into its process capability. This version of the SCE Method is based on the Capability Maturity Model (CMM) defined in *Capability Maturity Model for Software, Version 1.1* [Paulk 93a]. It is compliant with the CMM Appraisal Framework (CAF) [Masters 95]. This document is an update to SCE Version 2.0 [CBA Project 94].

Part 1 Introduction

This part of the document contains the following sections:

1.1 Background and Context

The principles of process and quality management, originally proposed by Deming and Juran for manufacturing enterprises, state that the quality of a system is largely governed by the quality of the process used to develop and maintain it [Crosby 79, Deming 86, Humphrey 90, Juran 88]. The validity of these principles has been demonstrated by many successful manufacturers. While software engineering differs significantly from manufacturing enterprises in some respects, the fundamental principles of product quality through process improvement can be effectively transferred across these domains. By application of these principles to the software domain, the SEI has developed tools such as the **Software Capability Evaluation (SCE) Method**.

SCE is a method for evaluating the software process[1] of an organization to gain insight into its **process capability**. Process capability refers to the range of expected results that can be achieved by following a process. The software process capability of an organization

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provides one means of predicting the most likely outcomes of an organization's next software project—for example, whether the software will be produced on time and within budget [Paulk93a]. SCE provides a snapshot of an organization's past process implementation, current process activities, and future process potential. An SCE probes the organization's process implementation to establish a set of findings used to support the business needs of the ➠**sponsor**.

The processes evaluated by SCE include decision-making processes (such as project planning), communication processes (such as intergroup communication), and technical support processes (such as peer reviews and product engineering)—but not technical production processes (i.e., processes required by a particular methodology, such as object oriented design), as shown in Figure 1-1.

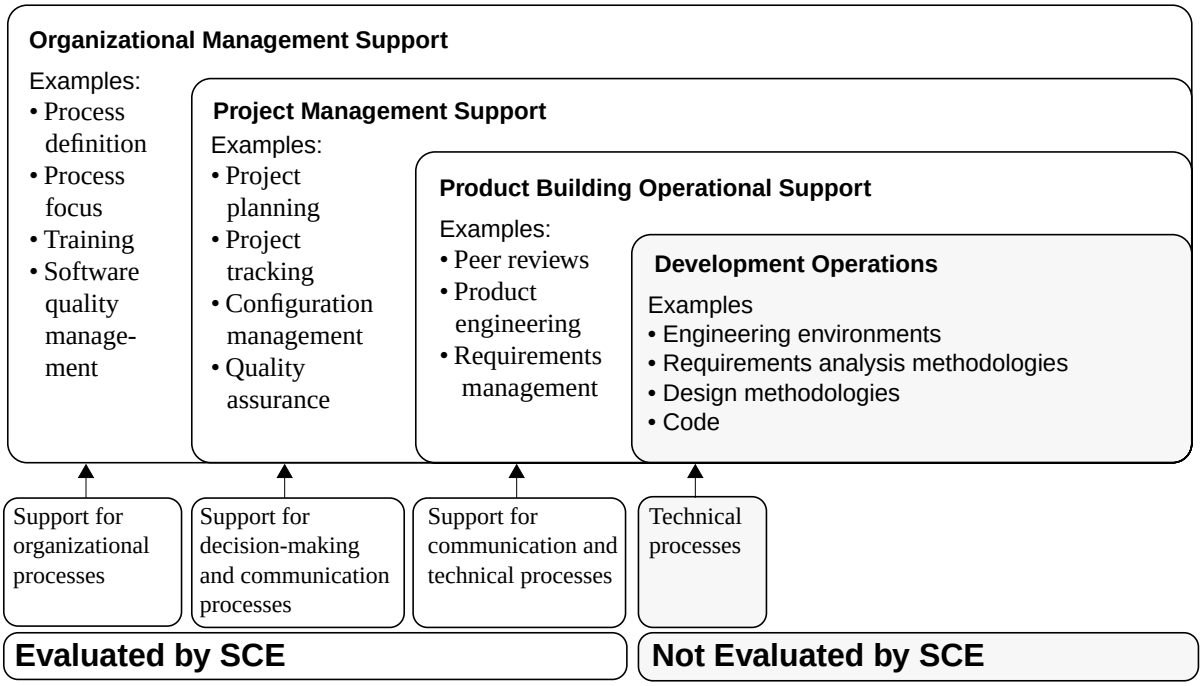

Figure 1-1: Processes Evaluated by SCE

1. Software process is defined to mean the system of all tasks and the supporting tools, standards, methods, and practices involved in the production and evolution of a software product throughout the software life cycle.

SCE (and appraisals generally) are only one aspect of a broader software process improvement effort. Process improvement may be described generically by models such as the SEI-developed IDEAL[SM2] approach to integrated software process improvement. The ➠**IDEAL model** is a systems approach or life cycle framework for implementing process improvement activities. IDEAL stands for the five phases of the approach: Initiating, Diagnosing, Establishing, Acting, and Leveraging. The model is shown in Figure 1-2 on page 3.

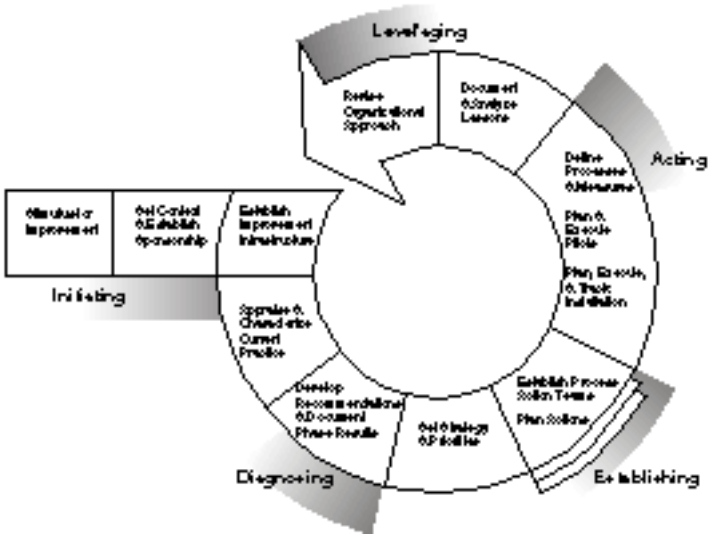

Figure 1-2: IDEAL[SM] Approach to Software Process Improvement

Depending on how SCE is used, it might be found in the initiating and/or diagnosing phases of IDEAL. For example, in Figure 1-2, note that in the Initiating phase, some outside stimulus is needed for process improvement to occur. An external SCE conducted “by” one organization “on” another organization for the purpose of selecting a supplier could provide this stimulus and start an organization on the process improvement path. The actual appraisal, using the SCE method to characterize the current practices of the organization, would occur in the Diagnosing phase. Results of appraisals are used to develop recommendations for furthering process improvement activities.

2. IDEAL[SM] is a service mark of Carnegie Mellon University

The IDEAL approach assumes that the appraisal will be followed by the development of recommendations and a thorough documentation of the appraisal results.

1.2 SCE Goals and Objectives

The overarching goal of all CMM-related activities is disciplined process improvement. This goal is stated explicitly for CMM-Based Appraisals for Internal Process Improvement (CBA IPI), but it is also implicitly part of all SCEs. In addition an SCE meets two specific business goals for its sponsor.

The SCE method is designed to support organizations in appraising business processes. SCE has two primary goals:

1. to provide results that support senior management decision making
2. to obtain accurate results relative to a reference model—the status of the organization's existing process strengths, weaknesses, and improvement activities

Each of these goals has several associated objectives, which are discussed in detail below.

Goal 1: Provide results that support senior management decision making. To provide business value, the prime objective of the SCE is always to provide results that support senior management decision making processes. Some key objectives are the following:

- The sponsor has sufficient, specific data upon which to base trade-offs between cost, schedule, and technical factors for subsequent actions.
- The sponsor has sufficient, specific data to determine, assess, and mitigate risks relative to process capability.
- The sponsor has a baseline with which to link specific business goals to detailed work level processes.
- The sponsor has sufficient process information to incorporate into larger business acquisition and execution decisions.

Goal 2: Obtain accurate results relative to a reference model—the status of the organization's existing process strengths, weaknesses, and improvement activities. The objectives of this goal include the following:

- The evaluation team provides the sponsor with the data needed to "baseline" an understanding of the organization's process capability and to track improvements over time.
- The evaluation team identifies process strengths on which the organization can build to improve their capability.
- The evaluation team identifies process weaknesses which can impact the organization's performance.
- The evaluation team identifies the major non-reference model issues that have an impact on successful use of processes.

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- The findings are sufficiently complete relative to the reference model to allow the sponsor to prioritize efforts and decisions.
- The findings are sufficiently granular that specific process action plans can be developed and efforts tracked.

Organizations also need an accurate picture of the strengths and weaknesses of their current processes in order to develop process action plans. Relating these strengths and weakness to a commonly accepted evolutionary model for process improvement (e.g., CMM) helps organizations to prioritize their plans and focus on those improvements that are most beneficial given their current level of maturity and their business goals. This demonstrates the strong interrelationship of the goals.

The table below shows the relationship between SCE Method goals and its primary application areas. A “high–medium–low” scale has been used to show how the goals are emphasized in a given application. Clearly, this information is conceptual. All SCE uses will be tailored to emphasize these goals differently to meet sponsor needs.

	Method Goal	
Application Type	**Obtain Accurate Results**	**Support Management Decision Making**
Supplier selection	medium	high
Process monitoring	medium	high
Internal evaluation	medium	high

Table 1-1: SCE Goal/ Application Mapping

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1.3 Benefits of SCE

An SCE helps its sponsor make better business decisions. It is a decision-making tool to identify risks inherent in a software development organization's processes that may inhibit achievement of the sponsor's objectives. It also measures the organization's commitment to process improvement.

Process improvements typically lead to

- shorter time to market
- increased quality (fewer errors, less reworking)
- improved customer satisfaction

These factors are important to executives and managers from both buyer and supplier perspectives. *Process improvement programs both in and outside of the software industry have shown returns on investment between 4.5 to 1 and 7.5 to 1* [Herbsleb 94]. The high return on investment shows the potential value of process improvement efforts, and provides motivation for a buyer to focus a supplier's attention on improving processes or for a supplier to initiate and institutionalize continuous process improvement programs.

A CMM-based SCE will be appropriate for a sponsor who

- acquires software and experiences problems with the cost, quality, or schedule (time to market) in those products
- needs to determine risks relative to a product development
- needs to evaluate a supplier's progress in an internal process improvement program
- needs to prioritize efforts for efficient allocation of resources
- wants specific, independent feedback about processes to aid a higher-level business decision-making process

While an SCE must first and foremost meet the sponsor's needs for evaluation, a good appraisal also facilitates subsequent actions within the evaluated organization. It will have maximum impact on an organization if the organization understands customer needs, process improvement principles, has a strategy for improving and meeting these needs, and has established specific goals and objectives.

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1.4 SCE and Other SEI Appraisal Methods

1.4.1 Background

In accordance with the Software Engineering Institute's mission to provide leadership in advancing the state of the practice of software engineering by improving the quality of systems that depend on software, there has been strong emphasis on software development tasks being treated as processes that can be controlled, measured, and improved. In an early software process publication, a software maturity framework was developed to help organizations characterize the current state of their software practice, set goals for process improvement, and set priorities [Humphrey 87].

The SEI assisted a number of organizations in performing assessments based largely on the questionnaire [Humphrey 87]. The early questionnaire provided a scoring mechanism for determining an organization's maturity level. In 1988-91, the SEI provided training to organizations who wished to perform self-assessments of their software processes. In 1990 the SEI commercialized the software process assessment (SPA) to more broadly disseminate the technology. Industry and government licensees were selected to market assessment services. Data from these assessments have been collected by the SEI, and reports are delivered on a regular basis reporting the state of the practice as evidenced by assessment results [Humphrey 89, Kitson 92, Zubrow 94b, Zubrow 94c, Zubrow 95].

The original version of the SCE Method is described in *A Method for Assessing the Software Engineering Capability of Contractors* (CMU/SEI-87-TR-23). It was developed to support source selection in major government software acquisitions. While the major activities have remained the same, other aspects of the SCE Method evolved significantly as a result of feedback from users of the method, observing the effect of SCEs on industry, and the evolution of the CMM and the CAF. This led to public baselining of the SCE Method in the SCE Version 1.5 Method Description, the updating of the method to comply with CMM Version 1.1 in SCE Version 2.0 Method Description, and to the changes contained in this document.

Aligning the SEI Methods with each other has been a principal "common appraisal goal" of the software community for a number of years. Inputs from two user workshops (1992, 1994) and SCE advisory board meetings were key events suggesting this need.

1.4.2 Current SEI Appraisal Methods

To provide a framework for rating against the CMM and to provide a basis for comparing assessment and evaluation results, the SEI established the CAF. The CAF identifies the requirements and desired characteristics of a CMM-based appraisal method in order to improve consistency and reliability of methods and their results [Masters 95]. The term appraisal as used at the SEI includes multiple methods, such as assessments and evaluations, all of which focus on an organization's software development process. Both CBA IPI and SCE 3.0 were created to be CAF-compliant.

CMM-Based Appraisal for Internal Process Improvement (CBA IPI)

The CBA IPI Method was created in response to user needs for a CMM-based assessment method. The SPA Method, which has become so familiar in the software community, pre-dated the CMM. Although many organizations modified the SPA to reflect the CMM, there was a wide range of approaches and results.

The CBA IPI Method was developed and field tested in 1994. After factoring in lessons learned from the community feedback, the SEI released CBA IPI V1.0 in May 1995.The CBA IPI method explicitly uses CMM V1.1 as a reference model. The data collection is based on key process areas of the CMM as well as non-CMM issues. CBA IPI is intended to establish consistency among assessment methods so that results from one assessment can be compared to those of another. The CBA IPI Method complies with the CAF, so results from a CBA IPI should be consistent with other CAF-compliant methods.

Software Capability Evaluation (SCE)

SCEs are used as a discriminator to select suppliers, for contract monitoring, and for evaluation of internal processes. SCE V2.0 was updated to reflect CMM V1.1. SCE V3.0 further improves the method to comply with the CAF and enhance ➠**fidelity** and ➠**reliability** of CBA Methods. Results from a CAF-compliant SCE should be consistent with a CBA IPI if the areas of investigation are the same in relatively the same time frame. SCE is used to gain insight into the software process capability of a supplier organization and is intended to help decision makers make better decisions when choosing from among suppliers, improve subcontractor performance, and provide direction to a purchasing organization.

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Differences Between Assessments and Evaluations

The primary differences between assessments and evaluations are outlined in Table 1-2 below.

Assessments	Evaluations
Development organization uses to improve processes	Acquirers use in selecting and monitoring suppliers; developers use to measure improvement progress
Results are used within the assessed organization	Results are known to sponsor
Assesses process practice	Substantiates current practice
Acts as improvement catalyst	Evaluates commitment to improve
Provides input to action plan	Analyzes performance potential and improvement input
Collaborative—members of organization must be on team	Members of organization may or may not be on team
Applies to organization, not individual projects or contracts	Organizational data applies to specific sponsor needs
Input for improvement action plan to unfreeze organization	*Input for award decision, performance monitoring, risk management, and internal improvement measurement*

Table 1-2: Differences Between Assessments and Evaluations

Interim Profile

The Interim Profile (IP) is a method to rapidly measure the status of an organization's software engineering process improvements between organizational software process assessments [Hayes 95, Whitney 94]. It is based on the CMM V1.1 and is designed to be used only by organizations that have completed an SEI-style assessment, have support for software engineering process improvement in place, and intend to use the results to monitor status and adjust their process improvement plan. A primary motivation for designing the IP method was to provide quantifiable data in an expedient fashion to allow periodic "temperature-checks" of process improvement activities. The IP method is based on the SEI maturity questionnaire [Zubrow 94a] with minimal use of other data sources. The IP method is not intended to comply with the CAF since it focuses on questionnaire responses and does not require other data collection mechanisms as required by the CAF. It is a "quick look" at the organization, not a full assessment, based on the participants' responses to the questionnaire.

1.5 Overview of the SCE Data Collection Model

As mentioned previously, SCE is a method for evaluating the software process of an organization to gain insight into its process capability. To evaluate process capability, sponsors choose teams of trained and experienced people from their organizations, or contractors trained in the SCE methodology. The team uses the SCE Method to sample and analyze information about the organization's process implementation. SCE is a model-based method; this means that the information sampled and analyzed must be within the framework of a particular model. For SCE, this is the CMM v1.1 [Paulk 93a]. In addition to CMM v1.1, the SCE Method uses the associated key practices found in Key Practices of the Capability Maturity Model, Version 1.1 [Paulk 93b]. Key practices are discussed below.

When using SCE with the CMM for Software V1.1 as the reference model, an SCE team may collect data on process capability based on all components of the model, including maturity level, Key Process Areas (KPA), goals, common features, and key practices (these terms are discussed in detail below). By using a reference model, information about process can be systematically organized and elaborated in a way that facilitates comparison to the state of practice within the industry. Non-reference model issues that may have a major impact on an organization's ability to implement process improvements must be considered along with the reference model related issues.

The CMM provides a robust structure for collecting information; this structure is diagrammed at a high level in Figure 1-3. Note that the structure is not strictly hierarchical; topics include features and practices associated with goals, while features and practices may be associated with more than one topic area (this perspective can work equally well with related reference models that employ the same architecture as the CMM for Software, such as the Trusted Software CMM).

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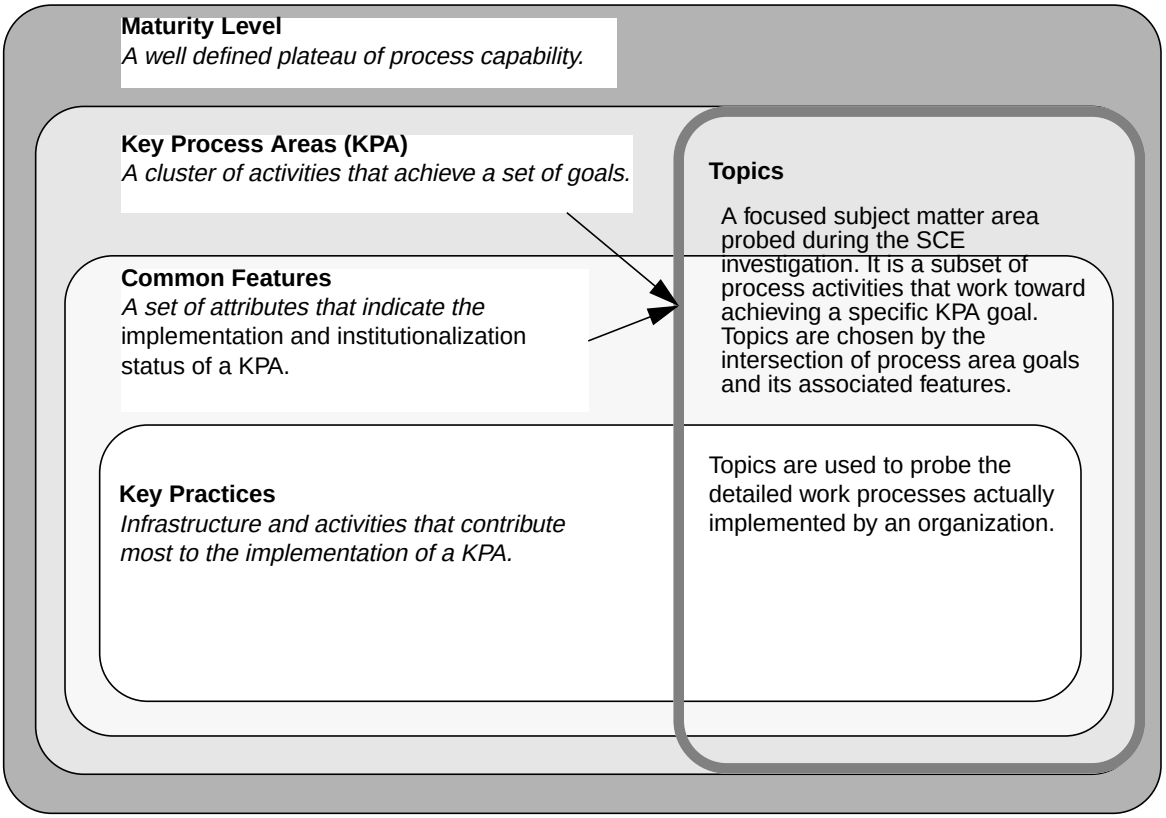

Figure 1-3: The SCE CMM-Based Data Collection Model

Maturity Levels. As noted in the CMM v1.1, “continuous process improvement is based on many small, evolutionary steps rather than revolutionary innovations. The CMM provides a framework for organizing these steps into five maturity levels.” A ➠**maturity level** is a “well-defined evolutionary plateau” toward achieving a mature software process. Each maturity level provides a layer in the foundation for continuous process improvement [Paulk 93a]. The five maturity levels of the CMM are Initial, Repeatable, Defined, Managed, and Optimizing.

Key Process Areas (KPAs). Except for the Initial level, each maturity level is decomposed into several KPAs. Key process areas identify the issues that must be addressed to achieve a maturity level. Examples of KPAs include requirements management, software project planning, and software configuration management. Each KPA identifies a cluster of related activities that, when performed collectively, achieve a set of goals considered important for enhancing process capability [Paulk 93a].

Each KPA contains a set of goals. A goal describes in a general way what should be achieved by implementing a KPA. For example, the goals for the requirements management KPA are the following:

- System requirements allocated to software are controlled to establish a baseline for software engineering and management use.
- Software plans, products, and activities are kept consistent with the system requirements allocated to software.

The goals can be used to determine whether an organization or project has effectively implemented the KPA. The goals signify the scope, boundaries, and intent of each KPA. When evaluating a specific implementation of a KPA, the goals can be used to determine if the implementation satisfies the intent of the KPA.

The path to achieving the goals of a KPA may differ across projects based on differences in application domains or environments. Nevertheless, all of the goals of a KPA must be achieved for the organization to satisfy that KPA. When the goals of a KPA are accomplished on a continuing basis across projects, the organization can be said to have institutionalized the process capability characterized by the KPA.

Common Features. KPAs are organized by a set of common features. A common feature is "an attribute that indicates whether the implementation and institutionalization of a key practice is effective, repeatable, and lasting" [Paulk 93b]. The common features represent the necessary attributes of any process.

The CMM common features are used in the SCE Method. The SCE *features* are directly from the definitions of the common features in the CMM. A feature is one of a set of attributes that provides a view of "whether the implementation and institutionalization of a key practice are effective, repeatable, and lasting" [Paulk 93b]. The features are more appropriate for defining a topic of investigation than the common feature as a whole.

➠ **Key practices** are the infrastructure and activities that contribute most to the effective implementation and institutionalization of a key process area [Paulk 93b]. The key practices are described in *Key Practices of the Capability Maturity Model, Version 1.1* [Paulk 93b]. The key practices serve as examples of "what" is to be done; they should not be interpreted as mandating "how" the goals should be achieved. Alternative practices may accomplish the goals of the KPA. The key practices should be interpreted to judge whether the goals of the KPA are achieved.

The key practices serve as examples of things that an SCE team might see. They are helpful in the data collection and consolidation processes. There are more key practices in the CMM than a typical team can investigate thoroughly in a typical site visit (5 people in 3 days). That is where sampling techniques such as topic selection are extremely helpful.

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SCE is a model-based method that provides a structure for collecting information at varying levels of detail. The choice of information to be sampled in an SCE is determined by the ➠**CMM scope** of the investigation. Often the high level scope is described as the ➠**target process capability**—that is, the process capability, in terms of CMM KPAs, that is most appropriate for the meeting the sponsor's business objectives. The target process capability consists of a set of KPAs that will be evaluated, and establishes the boundaries of the evaluation.

Although the boundaries of the SCE are determined by the KPAs defined in the target process capability, the evaluation is done at a more detailed level. A process area is a set of activities in an implemented process that, acting together, helps an organization to achieve goals. There are two or more goals for each process area; each goal describes something that should be achieved by implementing the process area. However, in order to conduct an SCE investigation—that is, in order to determine what documents to review, whom to interview, and what kinds of questions to ask—teams need a further level of detail.

The level of detail at which an SCE is conducted is the ➠ **topic**. A topic defines a subject matter area that will be probed by the team during an SCE. A topic can be transformed into open-ended questions that can be readily answered by a person in an interview or that can be validated by the team in a review of documentation. For example, within the *CMM Software Project Planning KPA*, there is a goal related to *developing estimates*. The team might want to investigate what procedures are in place to help ensure practitioners derive estimates in a similar manner (the *activities performed* common feature). Thus, they could ask the question, "What are the procedures used to develop software size estimates?" The topic investigated is estimation procedures.

Topics are not a part of the CMM structure, but rather are an SCE method-specific technique for maintaining consistency with the CMM while allowing the team to best meet appraisal requirements. Topics are generated by looking at the intersection of a KPA goal with a common feature. This intersection creates a subject matter area upon which the team can develop appropriate data collection strategies. Topics help to solve the team's dilemma of "looking for" implementation details of actual process use, yet needing to judge that detailed data against very high level goals. Topics help bridge this "judgment gap" inherent in the model structure.

Example. The following example uses the *Software Project Planning KPA* to illustrate the relationships among the concepts described above.

When it has implemented the *Software Project Planning KPA*, an organization will be able to establish reasonable plans for performing software engineering and for managing the software project.

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Within this KPA, one of the things the organization hopes to accomplish is to make sure that *affected groups and individuals agree to their commitments related to the software project* (a goal). The SCE Method uses the shorthand term *make commitments* to describe the activities performed to achieve this goal.

An example of one of these activities is ensuring that *software project commitments made to individuals and groups external to the organization are reviewed with senior management according to a documented procedure* (a key practice). This key practice is categorized as one of the *Activities Performed* within the *Software Project Planning KPA*.

A topic for investigation by the team might then be, “What policies and procedures (commitment to perform common feature) are implemented to help institutionalize this activity?”

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Part 2 Overview of the SCE Process

This part of the document contains the following sections:

This part of the document provides an overview of the activities executed in the SCE Method, taking a high level perspective of the three phases: Plan and Prepare For Evaluation, Conduct Evaluation, and Report Evaluation Results. A figure highlighting key points in the process is provided, followed by a description of activities in each phase. A brief description of the baseline SCE Method and its application is provided to close out this section.

To perform an appraisal using SCE, sponsors choose teams of trained and experienced people from their organizations, or contractors trained in the SCE Methodology. The team uses the SCE Method to sample and analyze information about the organization's process implementation.

There are four major ways information is collected: ➠ **interviewing**, ➠**document review,** ➠ **presentations,** and ➠ **instruments**. These are discussed in detail below.

The analysis and summary of the information collected on an SCE becomes the ➠ **findings** of the team. Findings document the process strengths, weaknesses, and improvement activities in the process areas evaluated by the team. An ➠ **improvement activity** is a process improvement that is not yet institutionalized—for example, a pilot of a new process put in place to address a weakness identified by the organization. Findings are the ➠ **results** of the evaluation. Findings are used by the evaluation sponsor to determine risk from the implemented processes relative to specific business goals (such as a planned development, a new product line, business competitiveness, progress against an improvement plan, etc.). How the findings (results) are used by the sponsor represents the ➠**outcome** of the evaluation.

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The SCE Method consists of three major activity phases: Plan and Prepare for Evaluation, Conduct Evaluation, and Report Evaluation Results (Figure 2-1).

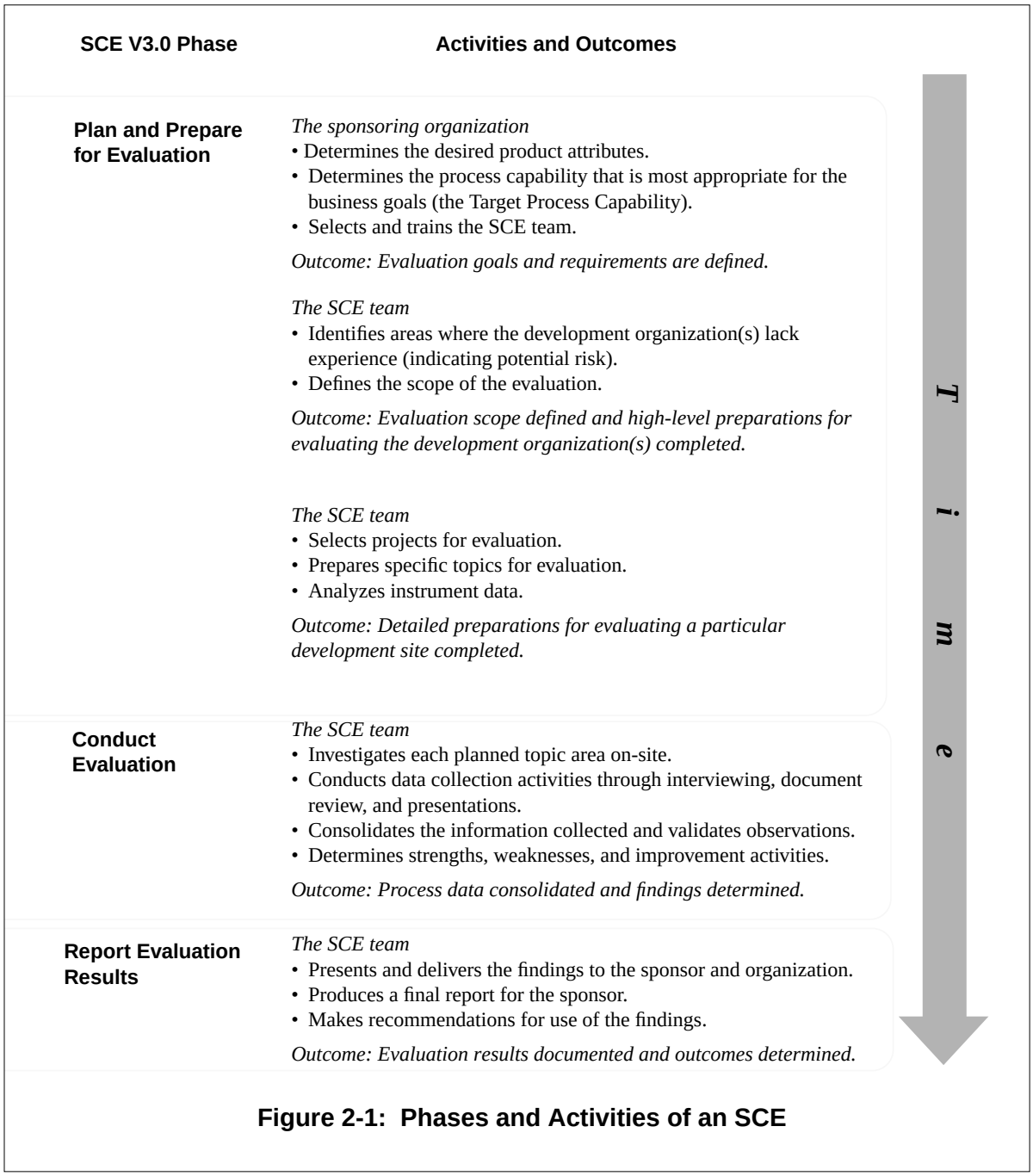

Figure 2-1: Phases and Activities of an SCE

2.1 Plan and Prepare For Evaluation Phase

In this phase, the sponsoring organization decides to use the SCE Method, and prepares for the evaluation. This phase is jointly performed by the sponsor and the SCE team.

During this phase, the sponsor determines the role of SCE, determines the ➠ **attributes** of the desired product and the project required to produce it, determines the process capability that is most appropriate to meet the business goals, and selects the SCE team. These activities link the SCE process and the system level process that uses the SCE findings (such as a supplier selection process).

The focus of the SCE is on risks associated with process capability. The sponsoring organization considers how SCE can be used in conjunction with other technical and managerial activities to identify and mitigate risks associated with the target processes -- those processes that must be executed well to deliver a quality product of interest on time, within budget. Risks not associated with process capability may also be captured as a by-product of conducing an SCE (such as non-CMM findings) and delivered to the sponsor.

With this in mind, the sponsoring organization should define how SCE results will be used and should determine the resources required to perform the SCEs. At some point early in this phase, the sponsoring organization makes a formal decision to use the SCE Method.

During this phase, planning for the SCE should consider

- funding for personnel, training, and travel
- coordinating SCE ➠ **site visits** and requests for information with the development organization(s)
- scheduling time for the SCE activities within the context of the use of the method (e.g., supplier selection, process monitoring, or internal evaluation)

As a result of this planning, the sponsoring organization commits resources to conduct the SCE. Determining the role of SCE and planning for the use of the method may not be done by the SCE team, but these activities are critical to the successful use of the SCE Method.

Once the decision to use SCE is made, the sponsoring organization determines the process capabilities needed to meet business objectives. This is accomplished by analyzing the attributes of the desired product and then determining the process capability that is most appropriate for building the desired product. The processes examined by an SCE always fall within the bounds of the CMM reference model, although non-model related findings may also be noted and reported. The Target Process Capability establishes the boundaries of the SCE investigation—a process area is evaluated if and only if it is part of the Target Process Capability.

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The sponsoring organization also selects the SCE team.[1] A team consists of experienced people who have completed SCE Evaluator training. They may come from the sponsoring organization or a contractor specializing in evaluation services selected by the sponsor. Senior management should select the SCE team and assign the personnel resources, and should assess the potential impact on schedule. Staff with the appropriate engineering experience should establish the Target Process Capability for the SCE.

During the Plan and Prepare for Evaluation phase, the team defines the scope of the investigation for all development organizations to be evaluated. This set of activities is particularly important for successful supplier selection applications of the SCE Method. The CMM scope of the SCE consists of those CMM components chosen to be investigated within the Target Process Capability.

The SCE team identifies those processes that contribute most to the potential development risk throughout the development organization community. It then examines information from each development organization about their view of the product to be built and information about the projects they are submitting as candidates for evaluation. The attributes of the product to be built are compared to the attributes of products developed by the projects that have been submitted as candidates for evaluation. These comparisons identify areas in which the development organization may lack experience, indicating potential risk.

Potential risk areas identified by examining the experience of individual development organizations are then consolidated for all of the organizations to be evaluated. Based on the experience shortfalls in the development organization community the SCE team selects components for evaluation from within each process area in the Target Process Capability. These areas will be investigated at all development organization sites. Collectively, the specific process areas chosen for investigation define the CMM scope of the SCE.

The areas selected define the scope of the SCE. The attributes defined by the sponsor in the product profile was previously used to establish the boundaries of the investigation in terms of process areas; the collective experience of the development organization community is used to help the team focus their investigation within those boundaries and prioritize their time. This tailoring is necessary because of site visit time limitations. During a site visit, sampling techniques are used to investigate the areas within the Target Process Capability. The scope determination is a way of limiting the sample space in order to meet other important evaluation objectives, such as time on site and cost of the evaluation.

1. The sponsoring organization always has the responsibility for team selection. The sponsor may choose to delegate team selection to a third party. An example is when the objective is to obtain an independent evaluation for the purpose of preparing for an upcoming customer led SCE.

The activities described here apply primarily to use of the SCE Method in supplier selection, where multiple development organizations are evaluated. This preparation sets a level playing field. In all cases, the determination of CMM scope is made during the Plan and Prepare For Evaluation phase.

In process monitoring, the same activities are followed for the initial evaluation, assuming no contract has been awarded yet, or has just been awarded. This initial evaluation creates the initial process baseline. Subsequent evaluations of the same organization, from a process monitoring perspective, would be tailored to reflect the special needs of the contract and the weaknesses observed during the initial baseline evaluation. Since there is only one contract, a process monitoring SCE does not execute activities related to an entire community of development organizations. Similarly, since there is a contract, the process monitoring SCE may focus entirely on the project at hand, rather than on evaluating mismatches of multiple projects.

The activities described here that are related to an entire community of development organizations are typically not executed in an internal evaluation SCE application, because only one organization is being evaluated. Mismatches in experience would reflect just one organization.

The SCE team then prepares for a specific site visit. The SCE team selects projects to evaluate, people to interview, and topics for investigation. These activities also are key sampling measures that can be tailored for an evaluation. To do this, the team selects topic areas from within the CMM scope. Topics address observable work practices and are used to probe the process implementation that corresponds to the process areas identified for investigation. A ➠ **topic** defines a specific subject matter area that will be probed during the investigation. For example, a topic might be, “investigate whether the organization has standard procedures for the software configuration management change control process.” Topics are developed by considering ➠ **features**; features are implementation characteristics that are common to every mature process. The features used in the SCE Method are directly from the ➠**common features** of CMM v1.1 [Paulk 93a] and are described in the glossary. For example, every process should have corresponding training and should also have documented plans and procedures; “training” and “plans and procedures” are two of the features that can be used to develop topics for investigation. They directly relate to the commitment to perform and ability to perform common features of the CMM for Software. The intersection of a matrix mapping the goals (and activities) selected (implementation) with the common features (➠ **institutionalization**) generates a topic area.

After selecting evaluation topics, the team creates a strategy for conducting interviews and reviewing documents. The team then works closely with the organization’s site technical coordinator to schedule interviews, request documentation for review, and to make facility arrangements.

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When the Plan and Prepare For Evaluation phase is finished, the SCE team will be ready to perform the site visit. The team will have determined what topics will be investigated (and to what level), whom they need to talk to, what initial questions they need to ask during interviews, and which documents they will review first. The development organization will have prepared the facility for the team, will have the requested documentation on hand, and will have ensured that the interviewees are available. Thorough preparation is essential, because the amount of information to be considered during the site visit will overwhelm the SCE team members if they are not sufficiently prepared.

2.2 Conduct Evaluation Phase

The purpose of the Conduct Evaluation phase is to investigate the topics associated with each key process area selected in enough depth to determine the strengths, weaknesses and improvement activities of those areas. Although the purpose is simple, this is the most complicated activity during an SCE.

To successfully complete the investigation, the team needs to have a good working relationship with the development organization's site visit coordinator. This relationship builds on the previous contacts with the site visit coordinator made during the preparation activities. The team should also maintain high standards of professional conduct (e.g., maintain schedule, remain attentive, practice active listening, etc.). This helps to establish their credibility and to increase the level of cooperation they receive from development organization personnel.

After setting expectations for the site visit with an entry briefing, the team starts the data collection activities. Site data collection has two basic components: investigation of the topics and decision making about the information collected. These components are applied iteratively until a decision has been made about each topic under investigation; this is summarized in Figure 2-2.

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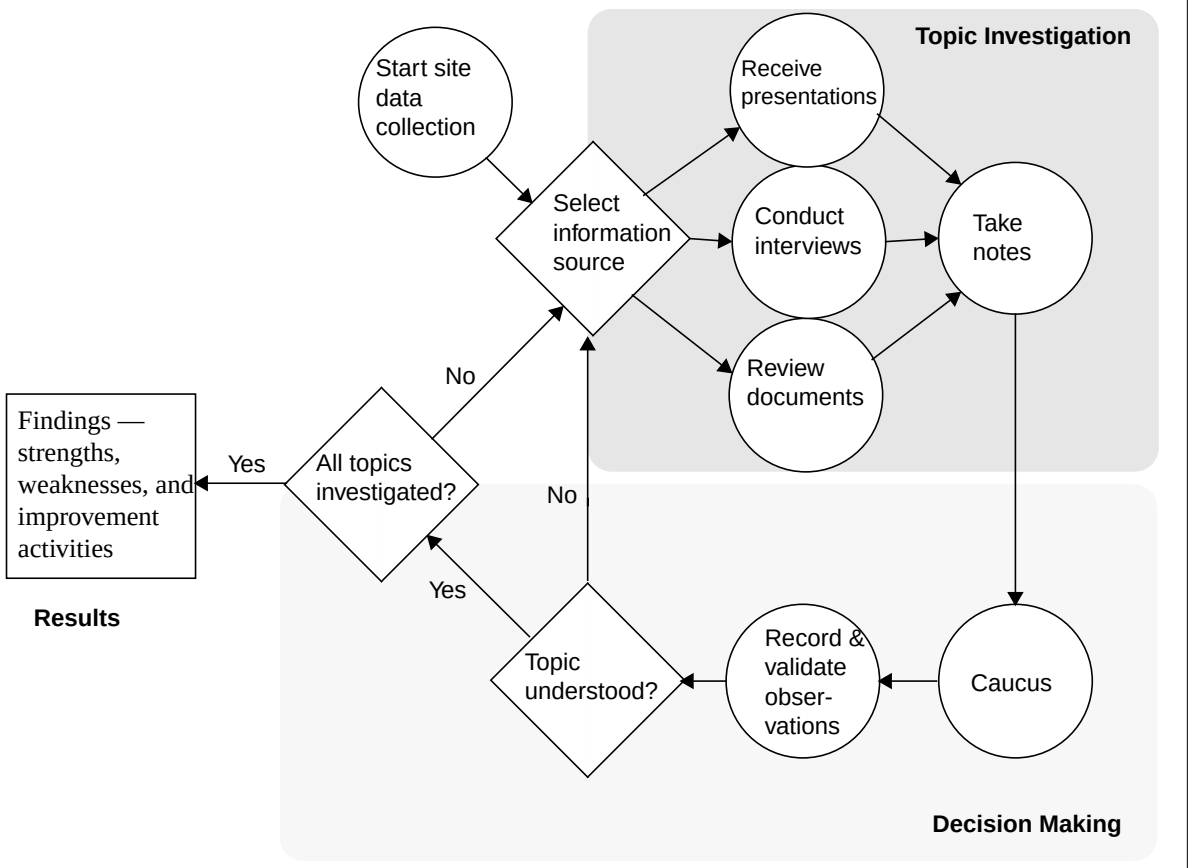

Figure 2-2: A Simplified Flow Chart of the Site Data Collection Activities

The SCE team uses complementary mechanisms to investigate a topic during the on-site period: document review, interviews, and presentations. Instruments (such as the maturity questionnaire), are used as information sources during the plan and prepare phase.

Documents can be used to define and standardize processes, indicate commitment to use the processes, provide an audit trail of processes that were used, and collect data about process performance. Reviewing documents can provide objective evidence of the processes used. A fundamental assumption of the SCE Method is that an executed process will produce artifacts, both intermediate products and end products. These artifacts can be investigated to determine the extent of implementation across a site.

Interviews give insight into how the processes are implemented in practice and show the extent that processes are internalized and understood by the development organization staff. There are two types of interviews used during an SCE: *exploratory interviews* and

consolidation interviews. During exploratory interviews the questions and answers reveal the actual processes practiced and guide the team to the supporting documentation. Consolidation interviews focus on corroboration and clarification of evidence.

Presentations provide both additional data (when the organization presents to the team, and when participants react to team presentations) and validation of data (when participants react to preliminary observations).

By using multiple data gathering mechanisms, the quality of the data is improved. For example, questionnaires are used to gather initial information in a consistent and economical manner. The information is used to guide the interviewing process, which can be quickly re-focused on areas of interest. Document review is used to supplement the interviewing process; this eliminates most of the recall error inherent in interviewing. Later, the draft findings presentation is used to feed back what the team observed to the organization, allowing the organization a chance to correct errors. The quality resulting from using multiple data collection mechanisms in combination is much better than the team could achieve using any single method.

Interviews are a flexible way of eliciting a lot of information quickly. However, interviewing has potential errors due to human recall and to failures in the communications process. Recall errors are minimized by asking the interviewees to provide work products and documentation relevant to their job. Providing the documentation reduces errors by focusing the interviewees on items that can be substantiated. To mitigate potential errors from the communication process, the team interviews as a group, takes extensive notes, and compares their observations during the consolidation process.

The team members record the data collected first as notes. The data is transformed into observations relative to the reference model used. These observations are consolidated through a team consensus process in an ongoing team ➠ **caucus**. In a caucus, the individual team members, “mini-teams,” and often the entire team ask the question, “Do we have enough information about this topic to make a judgment?” Consensus is an ongoing process at various level of detail within the data consolidation activities. The team must agree that there are at least two validated observations in order to make a judgment about that process component. If the evidence is not sufficient or conclusive, a new round of interviewing and/or document review is planned and initiated.

Validated observations become candidates for findings of strengths, weaknesses, or improvement activities associated with one or more of the topics under investigation. The team rates the satisfaction of specific reference model components that were decided to be rated during planning, and are fully covered (corroborated, validated) during the site visit. Rating judgments are always made by the whole team in a consensus process. The determination of findings and determination of ratings are integrally linked but are separate decision processes in the evaluation.

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When the Conduct Evaluation phase is finished, the SCE team members are ready to produce reports for delivery to the sponsor and the recipient organization.

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2.3 Report Evaluation Results Phase

The Report Evaluation Results phase completes the SCE. During this phase, the SCE team documents the results of the investigation and delivers it to the sponsor and the appraised organization. Subsequent to the delivery of the evaluation reports and the proper disposition of the data, the team (or individuals from the team) supports the sponsor in follow on activities which incorporate use of the findings into the larger system for which the sponsor chartered the SCE.

Because of the importance of the SCE findings to process improvement, efforts should be made to provide feedback in a complete and timely manner. Ideally, the SCE team presents the findings to the appraised organization(s) at the conclusion of each site visit.[2] The findings briefing will include all of the findings determined by the team, any ratings that were generated, and will describe what will happen with the results.

A final report is usually completed by the team members after the site visit, and it becomes the actual baseline of all evaluation activities and results for future use by the sponsor. The final report may include recommendations, if desired by the sponsor. Often, the recommendations are done in a follow-up activity and documented separately. Reports are also generated for the SEI process database and for the method developer for future improvement of the evaluation process.

Delivery of the findings and other reports is the distinct transfer of evaluation team activities back into the domain of the sponsor activities (the follow-on activities). When the Report Evaluation Results phase is complete, a formal final report will be generated for the sponsoring organization to use. How the findings report is used depends on the particular application of the method.

SCE team members, and certainly the team leader, can expect to participate in follow-on activities. The knowledge they have gained during the SCE is very valuable to the sponsor in deciding what actions to take based on the SCE results. In supplier selection, this support to the sponsor is usually assisting the team in identifying the risks related to the specific findings. In a process monitoring SCE, this support might include assisting the sponsor in jointly producing an improvement plan with the supplier organization, or in focusing an award fee plan. In an internal evaluation, the follow-on support might be in forming recommendations, participating in actions teams, consulting with the sponsor, or other forms of improvement planning and implementation.

2. In some cases, the government source selection authority may not allow the findings to be presented to the development organization, or may specify that findings be presented after contract award such that the immediate findings briefing presented by the team is little more than an exit briefing.

2.4 Baseline SCE V3.0 Method

The SCE Method can be described in terms of attributes that are tailored or modified to meet various needs. SCE V3.0 is designed to support a variety of needs, and is expected to be tailored, modified, and/or extended to help achieve business goals. Throughout this document, examples from various SCE applications are used which reflect tailoring of appraisal attributes.

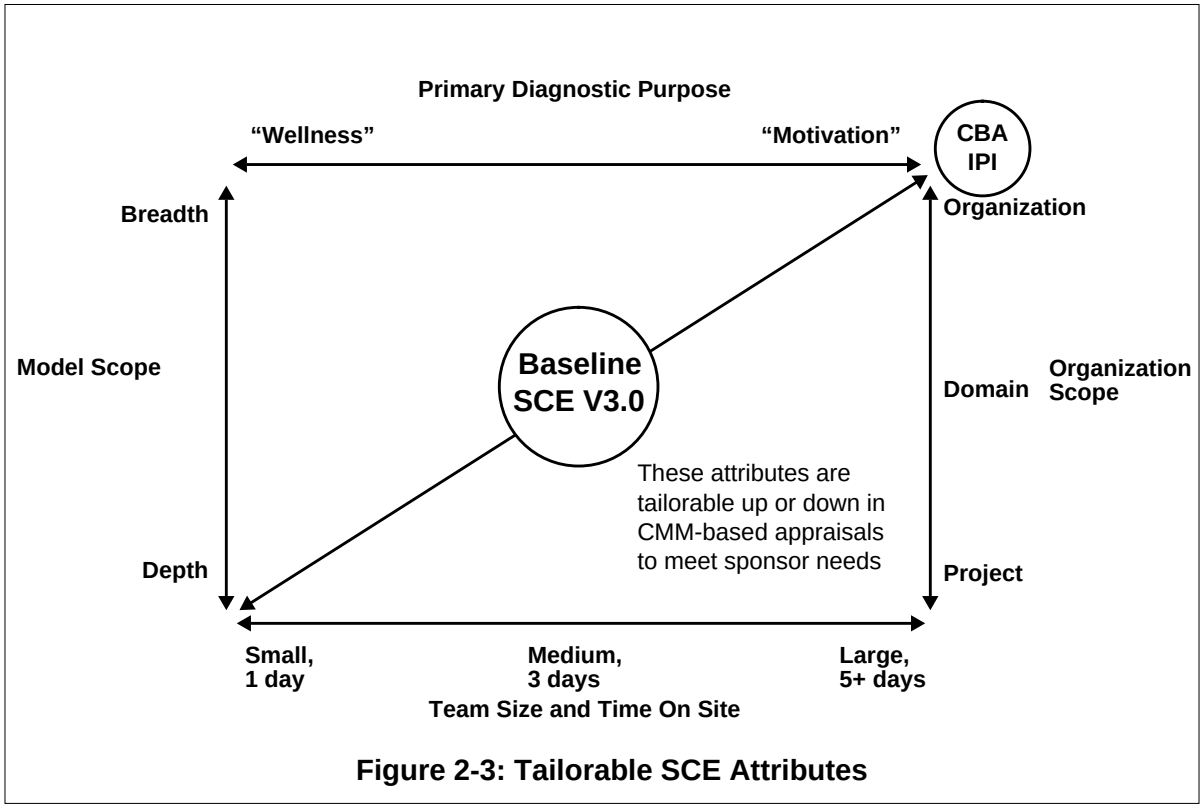

Figure 2-3: Tailorable SCE Attributes

Figure 2-3 provides a graphic summary of the major attributes which can be tailored. The major items include: primary diagnostic purpose, organizational scope, team size/time on site, and model scope. SCE V3.0 is a specific instance resulting from tailoring these items. As can be seen from the figure, the baseline SCE V3.0 Method is intended to be a "mid-point" diagnostic. This is consistent with the SCE V2.0 Method. The CBA IPI would be in the upper right hand corner as it is a motivational breadth-oriented appraisal that generally has an organizational scope.

The baseline SCE V3.0 Method is a specific tailoring of these concepts to achieve method goals described in Part 1 of this document. The principal assumptions built into the "baseline" method (when used for supplier selection) are listed below.

Diagnostic Purpose

- a “mid-point” diagnostic— combines both “wellness” (status check) and “motivation” -oriented characteristics

Organizational Scope

- one appraised entity— single location (per site visit)
- investigation is application domain or product line oriented
- three current projects with similar characteristics
- proposed project is evaluated

CMM Scope

Either

- entire specified model component is investigated (complete coverage) (e.g., if a particular KPA goal is investigated, all activities performed key practices mapped to that goal are investigated),

or

- subset of reference model components is selected (partial scope) (e.g., four of seven level three KPAs in the CMM for Software, V1.1)
- investigation is “depth oriented” — a subset of model items is covered in detail
- rating baseline option is “depth oriented — partial scope, complete coverage”
- scope specifies investigation of practices
- ratings are determined (and provided to the sponsor)
- maturity level rating is not done (lack of complete KPA coverage)
- KPAs, goals, and key practices may be rated (if selected for rating during planning, and sufficient coverage attained)

Team Traits

- five team members
- all are external to the evaluated entity
- all are trained in the reference model and method
- all meet individual and aggregate SCE and CAF experience requirements

Time on Site, Intervention Techniques, and Artifacts Used

- three to three and one half days on site (actual “disruption” period to the appraised entity)

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- both manager and practitioner interviews are conducted
- draft findings are presented to participants for feedback if allowed by sponsor
- evaluation results — findings and ratings — are provided on-site if allowed by sponsor
- automatable forms and instruments used

See Section 4.2, Develop Evaluation Plan, for further discussion on method tailoring decisions. Alternate applications of the SCE Method are defined by making tailoring decisions from this baseline approach. The attributes can be thought of as sliding scales. The team tailors the attributes to achieve sponsor goals.

2.5 Application Characteristics

SCE can be tailored based on specific business and evaluation goals such that the results are focused on the information most pertinent to their intended use by the sponsor. There are three primary application areas of the method:

- **Supplier selection**. SCE was originally created for use in government source selections within the Department of Defense. In a software intensive project, SCE is a high value discriminator used to select from among suppliers. In source selection, the results of the SCE are used to characterize the process-related risk of awarding a contract to an offeror.[3] SCE is typically only one criterion among many used to select contractors. Applications include both prime contractor selection and subcontractor selection.
- **Process monitoring**. SCE has also been used in monitoring contractor processes (for example, after contract award by serving as an input for an incentive/award fee decision). SCE has also been used to help the sponsoring organization tailor its contract monitoring efforts by allowing it to prioritize efforts based on the observed strengths and weaknesses of the development organization's processes. These uses focus on a long-term teaming relationship between the sponsoring organization and the development organization.
- **Internal evaluation**. SCE is also used by companies to provide independent evaluations of their internal processes. Applications include measuring process improvement progress, conducting process audits to prepare for competitions that may include external SCEs, focusing on domains or product lines, and other project-specific evaluations. In this application SCE supplements other tools, such as CBA IPI, for appraising process improvement activities.

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3. Because SCE has been used extensively in source selection, in the SCE team training handouts and case study materials the terms *offeror* and *contractor* are often used to denote the development organization. The development organization is the recipient of the SCE. Similarly, in the training materials the term **acquisition agency** is often used to denote the **sponsoring organization**, which is the organization conducting the SCE. This document uses the terms *development organization* and *sponsoring organization* almost exclusively in anticipation of wider use of the method in other contexts.

For example, suppose that the Software Configuration Management (SCM) KPA was investigated during an SCE, and that the following observations were made about the processes in use at a particular development organization site:

- The investigation revealed well-documented procedures for the SCM change control process.
- The investigation noted that no training was available for software development personnel in the change control procedures.
- The investigation revealed an automated library system in use (but only on one project) that supported and enforced the procedures.
- The investigation revealed that there was a plan in place for implementing the library system across all of the projects.

The findings for this KPA might be that there was a strength (the well-documented procedures), a weakness (the lack of available training), and an improvement activity (the automated library system and the plan for implementing it across the organization).

The outcome would then depend on the ➠ **use (or application) of the SCE Method**. The findings belong to the sponsoring organization and could be used in many different ways—that is, the outcome could be different. For example, in a government source selection, the findings might be factored into a risk determination. The development organization might be given a “moderate” risk rating for Software Configuration Management based on the findings. The individual risk ratings for all the KPAs evaluated during an SCE would result in a composite SCE risk rating. This factor would be considered along with many others (such as cost, technical evaluations, prior performance, etc.) when awarding the contract. On the other hand, in a process monitoring situation, the same findings might lead the sponsoring organization to require that the automated library system be implemented on their development project, and some portion of an award fee might be tied to successful implementation of a training program in the procedures for SCM change control. In an internal evaluation, the findings might be used to set up an action plan for implementing throughout the rest of the organization.

Fundamentally, the SCE data collection model is used without change in any application of the method. However, how the team uses this data collection model depends on how the method itself is tailored during the Plan and Prepare for Evaluation Phase to meet sponsor needs. Recall the three primary SCE application types: supplier selection, process monitoring, and internal evaluation. These application types represent “families” of evaluations that share similar characteristics. The table below illustrates how an SCE might differ from one application to the next based on common parameters for describing an evaluation.

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	SCE Application		
	Supplier Selection	**Process Monitoring**	**Internal Evaluation**
Motivation	Obtain best value supplier	Improve supplier performance	Improve organization or project performance
Goal	Risk identification	Risk management	Risk reduction and organizational improvement
Objective	Support decision making: determine process risks	Support decision making: baseline and measure progress; understand team capability	Support decision making: baseline and measure progress; obtain independent review
Outcome	Award decision: executable contract	Award fee or value engineering decision Revised action and management plans	Competition readiness decision
Ownership of Results	Buyer, may be shared with supplier	Joint, buyer and supplier teams	Supplier management
Evaluation Emphasis	Evaluate capability: verify process, validate information	Measure progress	Check status: process planning, management, and control

Table 2-1: Application Differences

Various appraisals differ in their motivation, goal, objective, outcome, ownership of results, and appraisal emphasis. While there is much overlap between types, key differences separate them. A simple heuristic for thinking about what application type is most similar to your need is to ask, “Who is the sponsor, who will be on the team to conduct the evaluation, and how will the results be used?” The answers to these questions will principally determine the application type. For example, if the sponsor is a customer, and the evaluation will be conducted by an entirely external team (either a customer or third party team), and the results will be used to determine a contract award(s), you can be sure that this is a supplier selection application of the SCE Method. In this example, the motivation is to obtain the best value supplier, and the outcome is an award decision.

Specific tailoring tables of characteristics that affect risk in the evaluation results are provided in evaluator training (e.g., team size, time on site, team composition, CMM scope, etc.).

Part 3 Activity Descriptions

This part of the document contains the following sections:

This part describes the SCE Method in detail, with the primary focus on *what* is done rather than *how* it is done. The SCE V3.0 Method is composed of three phases with 15 activities.

Each activity section follows a consistent structure for describing each activity:

- a table summarizing the phase, a specific activity, its associated steps, and outcome
- an activity diagram
- purpose
- inputs
- action
- outputs
- outcome
- options (such as tailoring for acquisition)

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Table 3-1 below summarizes the activities of the SCE method and their purpose.

Phase	Activity	Purpose
Plan and Prepare for Evaluation	1. Analyze Requirements	Understand the business needs, objectives, and constraints to design the most appropriate appraisal, and to gain sponsorship and commitment for the appraisal.
	2. Develop Evaluation Plan	Create an artifact which will guide and define execution of the appraisal such that it is in concert with business needs and constraints.
	3. Select and Prepare Team	Ensure that an experienced, trained team is available and ready to execute the appraisal process.
	4. Obtain Organizational Information	Obtain information from the organization that allows the team to refine the plan and focus the investigation in subsequent activities.
	5. Analyze Instrument Data	Identify issue areas for further investigation during evaluation conduct, and get a preliminary understanding of the organization's operations.
	6. Select and Prepare Participants	Ensure the most appropriate personnel participate in the evaluation, and ensure that they understand the appraisal process and shared expectations.
	7. Prepare For Data Collection	Plan the detailed site intervention to make optimum use of available site visit time to attain evaluation goals and objectives.
Conduct Evaluation	8. Receive Presentations	Collect data by allowing organization personnel to explain their process (e.g., in presentations).
	9. Review Documents	Collect data by examining process artifacts (e.g., documents).
	10. Conduct Interviews	Collect data by interviewing process agents (e.g., managers, practitioners, and process owners).
	11. Consolidate Data	Transform the data collected into formal team observations of process strengths and weaknesses relative to the reference model (e.g., the CMM).
	12. Deliver Draft Findings	Validate observations and collect data by conducting interactive feedback sessions with participants.
	13. Make Rating Judgments	Make decisions about the organization's process capability, based on validated observations, relative to the reference model components investigated.
Report Results	14. Deliver Final Findings	Provide a clear and actionable summation of the evaluation results to the sponsor and the organization.
	15. Produce Reports and Support Follow-On Activities	Produce a formal baseline of the appraisal conduct and results for the sponsor and other stakeholders, and ensure the evaluation results are used appropriately to achieve stated business objectives.

Table 3-1: SCE V3.0 Activities and Their Primary Purpose

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3.1 Activity 1 Analyze Requirements

Table 3-2 and Figure 3-1 provide an overview of the steps in this activity.

Activity	Steps	Outcome
Analyze Requirements	Step 1A: Determine Evaluation Goals Step 1B: Determine Evaluation Constraints Step 1C: Determine Reference Model Scope Step 1D: Determine Organizational Scope Step 1E: Determine Evaluation Outputs Step 1F: Obtain Commitment	The decision to proceed with the evaluation, based on a shared understanding of the evaluation goals, constraints, and scope.

Table 3-2: Analyze Requirements

Purpose

Understand the business needs, objectives, and constraints in order to design the most appropriate appraisal, and to gain sponsorship and commitment for the evaluation.

Inputs

Evaluation requirements which include business context, sponsor objectives, and specific sponsor requirements

Resource constraints which include budget, personnel, facility, and project availability

Logistical constraints which include program plans, external schedule, geographic constraints

Action

This activity includes development of evaluation goals, constraints, and scope. Evaluation outputs and their use are determined. Development of the evaluation plan (Activity 2) may begin in parallel with obtaining commitment. Analyze Requirements ends with a commitment from the sponsor to proceed or not to proceed.

Determine ➠evaluation goals. The sponsor conveys the evaluation goals to the team leader. Evaluation goals will be directly correlated to the overall business objectives of the sponsor and the context within which the evaluation is being conducted. Some typical goals for SCE, which are directly related to the specific application of the method, include risk identification, risk management, and risk reduction and organizational improvement. Risk identification is for the purpose of selecting the best value supplier for a contract. Risk management is for improving supplier performance during execution of existing contracts. Risk reduction is aligned with internal evaluations and the need to improve organizational/project performance or process capability to improve competitiveness for future business.

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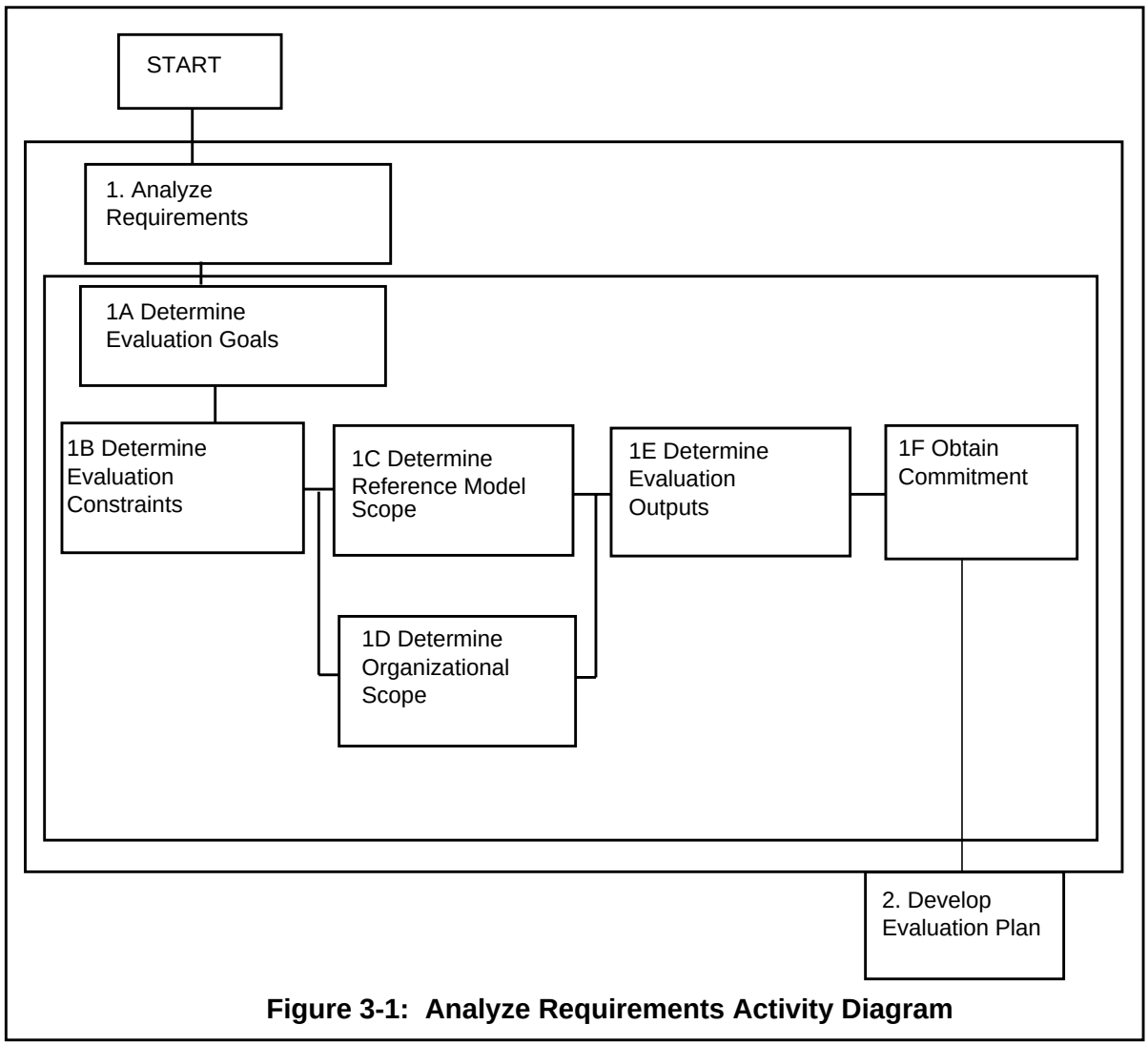

Figure 3-1: Analyze Requirements Activity Diagram

Note: The Plan and Prepare phase is a highly iterative set of activities. For example, in this activity, outputs might be determined early in the activity and would affect the reference model scope selected if maturity level ratings were needed. The diagrams are principally a simple graphical representation of the steps that must occur during the activity, generally when they occur, and generally what must occur before subsequent steps are completed. Most of the activity diagrams are easier to follow when beyond the Plan and Prepare phase (Activities 1-7).

For example, if an evaluation is being conducted internally to help prepare a site for an upcoming customer led SCE (risk reduction), it will imply certain types of activities for the team. Alternatively, if the sponsor wants to perform evaluations on existing subcontractors as a means of starting joint improvement efforts (risk management), that implies a different set of planning considerations.

As part of determining evaluation goals, the sponsor and team leader (or another technical focal point if the team leader has not yet been selected) will make the decision of what type of rating procedure will be done. This decision is related to evaluation goals because the rating baseline decision is a critical method tailoring parameter. This decision making step is called *determining the rating baseline.*

Table 3-2 depicts the two options available for determining the ➠ **rating baseline**. The chosen rating baseline option affects how much of the reference model is investigated (scope) and the amount of detail data within the scope that must be collected during the evaluation (coverage). Each option implies a different amount of ➠ **appraisal risk** that affects ➠ **method tailoring** decisions made during planning (Activity 2).

Depth	Breadth
Partial scope / full coverage	Full scope / partial coverage
Based on a subset of model components	Full model scope
Maturity level rating is not feasible	Maturity level rating is feasible
Items rated only when fully covered	

Table 3-3: Determining the Rating Baseline Option

The rating baseline decision directly affects the reference model scope selected. It indirectly affects the organizational scope and drives the time, labor, and cost of the evaluation determined in Activity 2, Develop Evaluation Plan. For example, if the sponsor selects the depth-oriented option, the team may be able to completely cover the critical components relatively quickly. Alternatively, a decision to rate maturity level based on a full scope and complete coverage of the model will require more resources than the baseline SCE V3.0 approach.

The SCE V3.0 method allows two options for the rating baseline. The options are called:

1. Depth-oriented — partial scope (within a maturity level's components), complete coverage.

This option is most similar to SCE V2.0 principles. It is the baseline SCE V3.0 method approach. Here a formal sampling technique is used to select parts of the model for investigation that are most similar to the "target" product profile, or those processes that will bear the greatest risk on project success. Complete coverage is required for those components that are selected for rating. A

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maturity level rating is not possible in this option due to the sampling approach used to select model components. Key process area ratings are not be possible unless all of the goals for that KPA are rated.

2. Breadth-oriented — full scope

There are two sub-options, either

- obtain complete coverage of the model components selected, or
- rate model components without complete coverage.

Full scope requires evaluation of all KPAs within chosen maturity levels. Obtaining complete coverage for a full scope evaluation is the most time consuming option. If the sub-option to rate without complete coverage is chosen, the team must determine a coverage factor and report the extent of coverage to the sponsor along with the rating. Basically, this simply means that if the team doesn't investigate an entire item, that information should be presented to the sponsor so that he or she can make the most informed business decisions. Coverage factors apply to the practices, common features, and goal components of the reference model.

Figure 3-2 depicts the rating baseline options, and includes a list of some key evaluation characteristics if the option is selected.

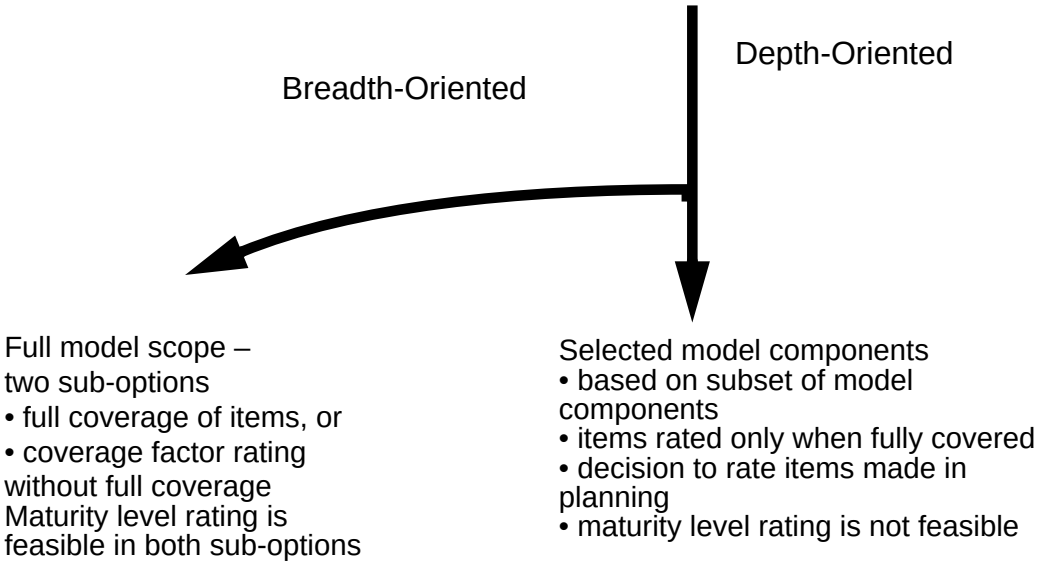

Figure 3-2: Determining the Rating Baseline Option

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The rating baseline options in SCE V3.0 are intended to meet the following objectives, which are elaborated in other parts of this document:

- provide options to users (user flexibility)
- allow maturity level rating (responsiveness to sponsors)
- rate items that are fully covered (judgment principle)
- decide what to rate up front (planning principle)

The **coverage factor ratings** noted in the figure above always go hand in hand with the rating values for model components, and when determined, are always part of the final findings briefing (see Activity 13, Make Rating Judgments, and Activity 14, Deliver Final Findings). A coverage factor rating is effectively a “caveat” on the rating provided to the sponsor – when any sampling approach is used, there is a chance that the information collected may not accurately reflect the state of the entire set. In SCE, a coverage factor rating provides the sponsor with a notion of how “complete” the team’s analysis was, and the sponsor can act accordingly in subsequent decision making related to the appraisal results.

When the option is selected to rate key practices and/or common features, they should be rated before the rating of goals in the following manner:

Key practices should be rated first. If there are weaknesses identified that, in aggregate, significantly impact the achievement of the KPA goal(s), the key practice should be rated as not satisfied, otherwise it should be rated satisfied. Common features should be rated after the key practices. If any of the associated key practices are rated unsatisfied, then the common feature is automatically rated unsatisfied. If the associated key practices are all rated satisfied or have not been rated, then the rating of the common features is based on whether or not identified weaknesses, in aggregate, significantly impact the achievement of KPA goal(s).

Once the key practices and/or common features have been rated, the KPA goals can be rated. If any of the lower level components have been rated unsatisfied, then the KPA goal(s) that are affected are rated unsatisfied. If the lower level components that map to a particular goal are all rated satisfied, then the rating of the KPA goal is based on whether or not the identified weaknesses that map to the goal, in aggregate, significantly affect the achievement of the KPA goal.

Determine evaluation constraints. The purpose of this step is for the sponsoring organization to understand the attributes of the product and establish resource boundaries within which the team must plan and execute the evaluation. The sponsoring organization generates a ➠ **profile** of product attributes (the Product Profile) for the product to be

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developed. These attributes are a constraint on the processes that will be needed and used to create the product. The attributes used in SCE are defined in Appendix E, and are illustrated in the example below.

An example Product Profile is shown in Table 3-3 below. The Product Profile should be developed by people with appropriate engineering experience. If the SCE team leader has been selected (see Activity 3), he or she should help with this effort.

Attribute Name	Example Product Profile
Application Domain	Command and control
Product Type	Anti-Submarine Warfare (ASW) — helicopter sono-buoys
Size	
Duration	24 months,
Team size	100 software engineers,
Estimated size	300 Thousand Source Lines of Code (KSLOC)
Reuse estimate	30% new 35% modified 35% reused Large amount of commercial-off-the-shelf (COTS) and non-developmental item (NDI) integration
Type of Work	Full development
Development Team Approach	Integrated Product Teams
Language(s)	Ada
Customer	Naval Air Systems Command
Applicable Standards	MIL-STD-498
Major Subcontractors	Yes
Precedence	Yes - replacement of existing system
Target(s)	M68000

Table 3-4: Example Product Profile

The profile is also used to refine the evaluation scope to best meet sponsor goals within identified constraints. Conversely, the scope can be used to identify resources the sponsor needs to allocate to the evaluation (see the temporal flow in the appendices for baseline method time estimates). The constraints established will be input to Activity 2, Develop Evaluation Plan, to be refined and finalized. The *SCE V3.0 Implementation Guide for Supplier Selection* [Barbour 96] provides additional cost and schedule estimates for an acquisition application.

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Determine CMM scope. Factors to consider in determining the CMM scope include the following:

- rating baseline option chosen
- evaluation constraints (such as the product profile, time, and cost)
- Target Process Capability selected

Evaluation goals (evidenced by the rating baseline option chosen) and constraints (evidenced by the product profile) are used to define the reference model scope. The sponsoring organization determines the key process areas to be evaluated. These key process areas form the boundary, or Target Process Capability, of the evaluation. An example would be to select all of the level two and level three KPAs from the CMM for Software, V1.1. This is a typical TPC for many types of organizationally oriented evaluations. A process monitoring or internal evaluation SCE might choose a particular subset of KPAs based on the results from previous appraisals. The process of refining the scope, using key process area goals, common features, and practices, may also begin during this activity (the fully refined scope is completed during Activity 2 and Activity 7).

The purpose of this step is to determine the process capability that is most appropriate for the business goals, and to document the desired capability as the Target Process Capability.

This step should be done by senior people with engineering experience who have a good understanding of the Product Profile attributes and process management concepts. If the SCE team members have been selected, they should help with this effort.

The Target Process Capability establishes the boundaries of the evaluation at a high level. The key process areas are the basis for evaluation at the development organization site(s) — a key process area is evaluated if and only if it is identified in the Target Process Capability. Organizations must understand what to expect when an SCE is conducted; the Target Process Capability must be communicated to the development organization(s) in order to facilitate the on site process.

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➠ **Determine organizational scope.** Organizational scope includes the number and type of projects selected for investigation.[1] The type of projects selected is directly related to the product profile. This decision is input into planning, and will affect what portion of the organization is evaluated (i.e., the appraised entity) (see Activity 6, Select and Prepare Participants). In this activity, the organizational scope is defined at a high level.

The selection of organizational scope and the selection of reference model scope are mutually reinforcing steps that are iterative in nature. The standard SCE for acquisition includes three projects within a product line or domain most similar to the planned program. A process monitoring SCE focuses on one project — the one being implemented. The breadth of the organization that is decided to be evaluated will affect the depth within the reference model that can be fully covered, given the cost and time constraints that are fleshed out in planning (Activity 2).

Determine evaluation outputs. Evaluation outputs are documented in the findings briefing delivered to the organization and sponsor at the conclusion of the site visit (see Activity 14). The outputs always include the findings of strengths and weaknesses in the key process areas investigated, and usually include the results of rating judgments made by the team (see Activity 13). Understanding how the outputs will be used is essential for detailed planning (see Activity 2).

For example, if the outputs (results) will be used to determine the risks in awarding a contract to a supplier, this information will affect the constraints, model scope, and organizational scope. This acquisition example implies a specific set of attributes of the acquired product, a specification of model components to be investigated in detail, and full coverage of the model components chosen for investigation.

Obtain commitment. This is the ultimate objective of Activity 1. All of the steps involving direct consultation with the sponsor are geared not only to determine information critical to the planning and conduct of the evaluation, but also to ensure the sponsor is committed to the effort. It is feasible that in analyzing requirements, the sponsor may decide not to go ahead with the appraisal. The sponsor will reemphasize his or her commitment throughout the process, including speaking at the opening meeting (see Activity 6), and participating in the final briefing (see Activity 14). Commitment by the sponsor is most visibly

1. The organizational scope is finalized during Activity 6, Select and Prepare Participants, when the specific site, projects, and evaluation participants are selected. Organizational scope includes the site, location, projects, and participants.

evidenced in writing as a sign-off on the evaluation plan. The initial commitment may be to go forward with the planning process. The final “sign-off” may be shortly before the site visit, based on refinements made through subsequent information gained or analyzed in other activities.

Outputs

Evaluation requirements

- evaluation goals
- evaluation constraints
- product profile

Evaluation scope

- reference model scope
- organizational scope

List of evaluation outputs

Sponsor commitment

Outcome

The decision to proceed with the evaluation, based on a shared understanding of the goals, constraints, and scope.

Options

Team Leader Selection (Activity 3A) may occur immediately, and this selection may be an input into Activity 1. This is a preferable option. However, the baseline method assumes that in most applications many of the Activity 1 decisions must be made by the sponsor prior to Team Leader Selection.

Rating baseline options are as indicated in the body of this section.

Additional constraints may affect an SCE for Acquisition. For example, the sponsor is not the senior site manager. In this case, approval for the evaluation should be obtained not only from the sponsor, but also through formal correspondence with the senior site manager for the appraised entity.

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3.2 Activity 2 Develop Evaluation Plan

Table 3-5 and Figure 3-3 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Develop Evaluation Plan	Step 2A: Identify Required Resources Step 2B: Identify Cost Step 2C: Identify Schedule Step 2D: Work Out Logistics Step 2E: Tailor Method Step 2F: Plan Use Of Evaluation Outputs	The sponsor and team leader agree on the planned course of action for the evaluation.

Table 3-5: Develop Evaluation Plan

Purpose Create an artifact which will guide and define execution of the evaluation such that it is in concert with business needs and constraints.

Inputs Evaluation goals, evaluation constraints, reference model scope, organizational scope, list of evaluation outputs (Activity 1), team leader selection (Activity 3), site information (Activity 4)

Action This activity includes both development of an initial plan and refinement of that plan. It may overlap Activities 3-6. Planning for use of evaluation outputs started in Activity 1 is completed during this activity. The evaluation plan is perhaps the most important artifact. It will guide and define execution of the appraisal such that it is in concert with the business needs and constraints. An initial plan can be generated immediately following consultation with the sponsor. Further refinement is done as detailed planning occurs, and new information comes to light in executing Activities 3-6. A final evaluation plan must be completed prior to the end of Activity 7, Prepare for Data Collection. Typically, resources, method tailoring, and planning use of outputs are finalized early on, while cost, schedule, and logistics are finalized later in the Plan and Prepare for Evaluation phase.

Identify resources, cost, and schedule. These three items go hand in hand. The sponsor will convey some indication of these parameters during Analyze Requirements (Activity 1). In Activity 2, these items are refined and finalized. Trade-offs are planned as a routine course of action. An example would be as follows:

An SCE for acquisition will require an in depth evaluation to assist risk determination in contract award decision making. Five site visits are anticipated, major subcontractors teamed with primes are expected, and the overall acquisition process must be completed within three months. Given

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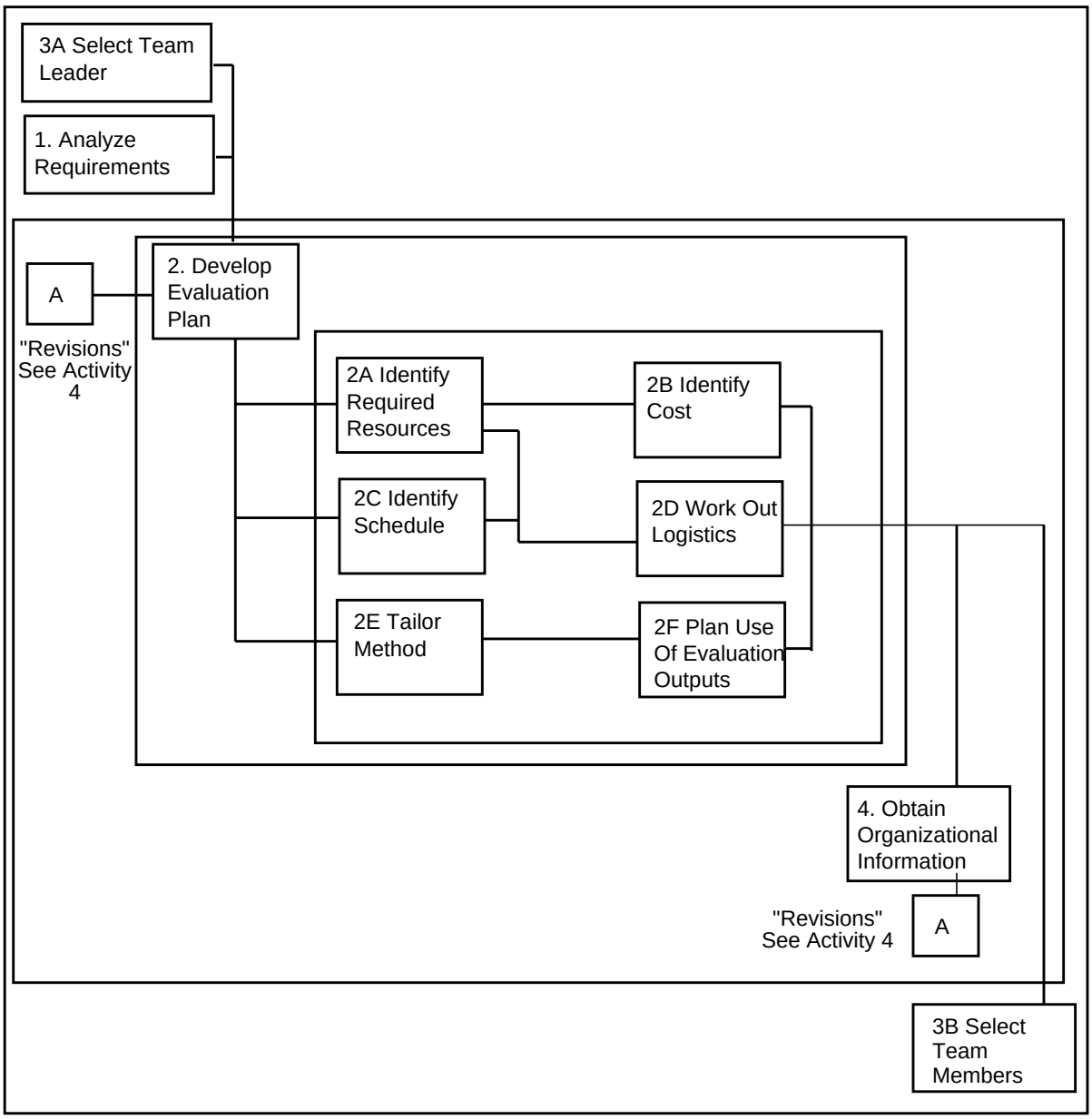

Figure 3-3: Develop Evaluation Plan Activity Diagram

these constraints, rating baseline option #2 was chosen (standard approach, investigating a subset of the model in depth, with full coverage but no maturity level as an output).

These decisions made in Activity 1 allow the team leader to perform detailed planning. Completing the required SCEs will each take the standard three days. A decision might be made to charter two teams, running in parallel, one

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to evaluate the primes and one to evaluate the major subcontractors. This ensures fairness, and allows enough time per site for the typical five person team to accomplish its mission within the acquisition schedule.

Work out logistics. The team leader must ensure that logistical items such as facility planning, site locations, travel and hotel arrangements are cared for. Usually, the team leader will delegate some of these tasks to a team member. The responsible party will work with a site focal point, or ➠ **site technical coordinator**, who is identified to assist the team throughout the process. In many SCE applications, the site technical coordinator may not be identified until Activity 4, Obtain Organizational Information, when the ➠ **site information packet** is received.

Tailor method. Method tailoring is directly related to the organizational scope and reference model scope steps. Most of the allowable tailoring options flow from these decisions. Tailoring decisions *always* affect the appraisal risk.

At the highest level, the following parameters are the most critical to the tailoring decision:

- the purpose for conducting the evaluation
- the breadth across an organization probed
- the depth within the reference model probed
- the associated rating baseline option chosen
- the time spent on site,
- the number, experience, and type of training needed of the team members

Other factors that affect tailoring include:

- what intervention techniques are chosen, and in what amount they will be used (e.g., 20% of site time spent interviewing managers, 30% of site time spent interviewing practitioners)
- whether draft and final findings will be provided on-site
- whether non-CMM issues will be evaluated and provided
- various templates, forms, and instruments chosen (reflecting the critical tailoring decisions above)

An example is deciding to use fully automated support to assist team members. This would allow for a large range of data collection and analysis in a broad scope evaluation that could be processed in a relatively short time.

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Plan use of ➠ evaluation outputs. In Activity 1, the evaluation outputs are determined. Specific planning for their use is done in Activity 2. This is particularly important in an SCE for Acquisition, because the standards for analyzing the evaluation results must be specified during this activity. Planning the use of the outputs is the last critical item which affects how the data is collected, and the level of rigor for data collection to support the planned use of the results.

Plan contents. The evaluation plan should document information on the following items

- evaluation goals (including the rating baseline option) and scope (including the reference model and organizational scope)
- SCE activities and schedule
- team members, resources, and budget
- logistical information
- appraised entity data (selected site, projects, participants, etc.)
- specified tailoring decisions
- planned use of the evaluation outputs and any expected follow on activities
- known risks, and any risk mitigation or risk reduction activities

The final evaluation plan should have an official “sign-off.” At a minimum, the sponsor and the team leader should sign the plan. The team members and the senior site manager, if possible, may also sign off on the plan to show commitment.

The plan should be considered a living document. Structuring it in a way that facilitates easy update to items that may change during the evaluation (e.g., schedule, interviewees, etc.) will help keep it up to date and make it simpler to obtain renewed commitment from the team and sponsor, if necessary.

Outputs Initial evaluation plan, revised evaluation plan

Outcome The sponsor and team leader agree on the planned course of action for the evaluation.

Options The evaluation plan does not have to be a single document. It is preferable to have one artifact which encapsulates all of the essential planning information. However, because of widely differing applications (such as a government acquisition and a commercial internal evaluation), this plan may be the collection of several artifacts.

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In a government acquisition SCE, the plan will consist of information contained in several documents including the acquisition plan, the source selection and evaluation plans (SSP and EP), the request for proposal (RFP), and the SCE team activity plan. The team's briefing to prospective offerors and to the appraised entity may also constitute documentation of the plan.

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3.3 Activity 3 Select and Prepare Team

Table 3-6 and Figure 3-4 below provides an overview of the steps in this activity.

Activity	Steps	Outcome
Select and Prepare Team	Step 3A: Select Team Leader Step 3B: Select Team Members Step 3C: Prepare Team (e.g., team training, team orientation, team building, team practice)	An experienced, trained team is ready to execute the evaluation process.

Table 3-6: Select and Prepare Team

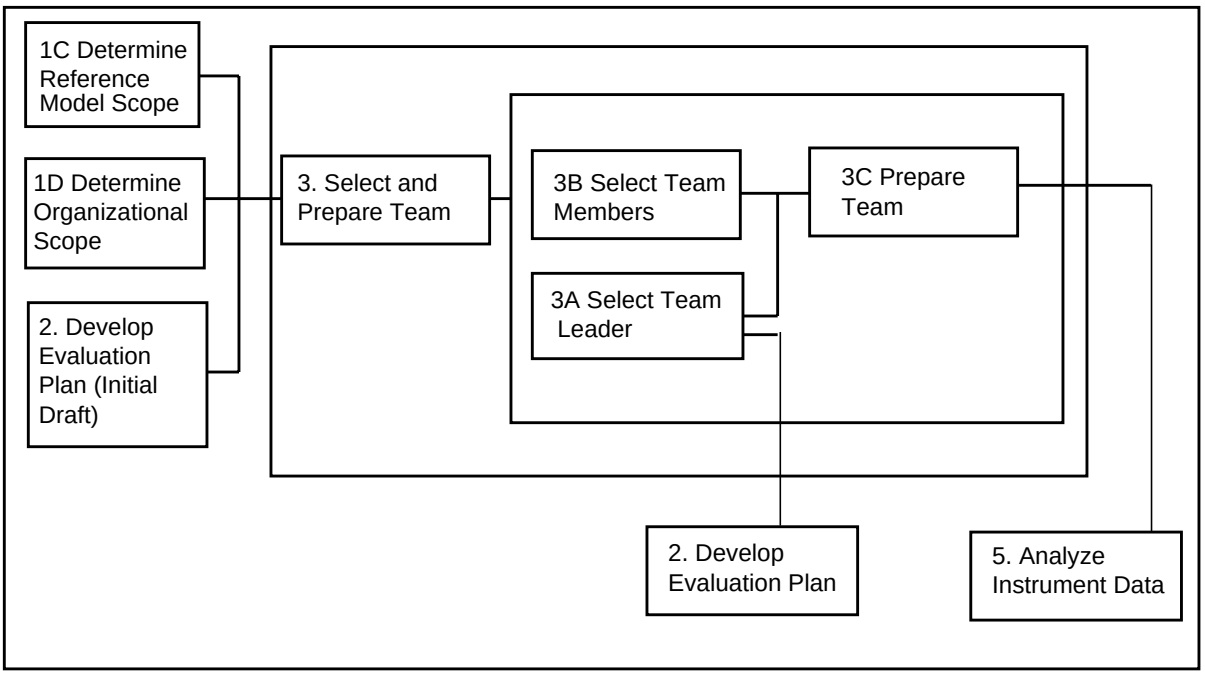

Figure 3-4: Select and Prepare Team

Purpose Ensure that an experienced, trained team is available and ready to execute the evaluation process.

Inputs Evaluation constraints, product profile, reference model scope, organizational scope (Activity 1), evaluation plan (Activity 2).

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Action

This activity includes selection and preparation of the evaluation team. It may occur after obtaining commitment (1F) and may provide input into evaluation planning. Preparing the team usually includes team training, team orientation, team building, and team practice.

The sponsoring organization selects the individuals who will conduct the SCE. All team members must be trained. If the sponsoring organization selects someone who is not trained, they must schedule training and allow enough time for completion of training. Team selection should be accomplished by someone senior enough in the organization to commit the resources for the duration of the period that SCEs will be performed. Using the team leader and team member selection guidance below will exceed all CAF requirements.

The Product Profile and Target Process Capability help define the expertise the team needs. The team requires expertise in each of the key process areas in the Target Process Capability and should have expertise with the product type and application domain from the Product Profile.

Select team leader. The team leader should be experienced both technically and managerially, and have participated in two or more SCEs as a team member prior to assuming team leadership duties. One team member must have at least 6 years management experience. Preferably, this is the team leader. Additionally, the team leader must have demonstrated skills in consulting, presenting, and facilitating. The team leader should also have experience in managing teams, because executing the SCE Method is by definition a team centered activity. These are in addition to meeting all requirements for team members, and the team member skills and experience listed.

The team leader may be selected at any time in the process. Preferably, the team leader is selected at start-up so that he or she may participate in analyzing requirements with the sponsor. Due to external constraints, such as an acquisition schedule and procurement regulations, the team leader may not be selected immediately at start-up. The team leader must be selected before initiating the planning process.

Select team members (team composition). At a minimum, the SCE teams must have members with an average of 10 years of appropriate development or management experience. The team as a whole must have at least 25 years technical experience as well as 10 years of combined management experience. Experience in the domain of method use is also helpful. At least

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two team members should have participated in previous SCEs. No team member should have less than five years of professional experience. The team members are external to the appraised entity (see options below).

The baseline SCE V3.0 Method calls for five team members. This number is recommended based on evaluation experience and human dynamics. Given the average team member experience, the typical evaluation scope investigated, and evaluation constraints, five members is usually adequate to ensure

- depth of experience in all the necessary technical areas (domain, reference model, etc.),
- evaluation method experience
- coverage of the evaluation scope in the allotted time and cost
- breadth to mitigate potential missed items
- ability to readily achieve consensus

Teams under four members may have insufficient depth and breadth of experience, and those with over six members typically have problems reaching consensus within evaluation time constraints.

Prepare team. Preparing the team includes training in the method and reference model, team building, and evaluation orientation. For a team to be successful, several criteria must be met. These criteria are discussed below; they include training, team composition, team leadership, team member experience and knowledge, individual skills, and team development skills.

Training. All team members must be trained in the SCE Method. Training should ideally occur in the two months just prior to the evaluation. Team members trained previously may require refresher training to ensure that all team members are using the same method baseline. Additionally, all team members need to demonstrate knowledge of the reference model used, either through formal training or other means (e.g., on the job experience using the CMM for Software). A major part of team building is accomplished through training. If team members were previously trained, time should be allocated to have the team members rebuild the team through evaluation activities. Orienting the team on the evaluation plan, or participating in producing it, is a good mechanism for building a team whose members were trained separately.

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Team member experience and knowledge. The team needs appropriate development, management, and acquisition experience that is applicable to the business need, evaluation requirements, and product profile. Collectively, the team must have knowledge of and experience with

- The application domain and product type.
- The management processes required to create an effective environment for the engineering and development of a software product.
- The major phases that engineering and development of a software product must go through.
- The support processes and management environment required within the engineering and development of a software product.
- The relationship between technology (in the form of methods and tools) and the support processes.

Individually, each SCE team member must have the practiced skills to:

- Perform all the roles required (e.g., facilitator, recorder, and participant).
- Conduct interviews (e.g., make an interviewee feel at ease, ask open-ended yet focused questions, keep the interviewee on track).
- Separate what an interviewee says from what a listener hears (i.e., cognizance of differences between facts, inferences, and judgments).

Team development skills. All of the SCE team members must actively work at the initial team building and then at continued development of the team. This requires skills in consensus building, conflict resolution, negotiation, and decision making.

Another mechanism that has been used by teams to increase their skill level and to build team capability is to perform a “practice” SCE. Although this can be a resource intensive part of team preparation, the ability to conduct a practice session with a volunteering organization can provide significant benefits in the learning curve of new team members, and insight for the recipient of the form of findings from the practice results.

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Outputs

Team leader selection

Team member selection

Prepared team

- method training
- reference model training
- team building
- evaluation orientation

Outcome

An experienced, trained team is ready to execute the evaluation process.

Options

In a reevaluation or subsequent follow on evaluations, some or all of the team members may have been trained at different times. In this scenario, team training is not required. However, the tasks of team building and team practice become much more important to success, since the team members may not have worked together before.

Various applications of the method imply different team compositions. The baseline method is for all external team members. An internal, organizationally focused, improvement oriented appraisal may necessitate that a majority of the team be from the organization being assessed, and therefore require a tailored appraisal, either SCE or CBA IPI. Alternately, a process monitoring evaluation resulting in an customer focused action plan would best be served with a joint customer/supplier team composition.

Different applications may also require different team sizes. Although the default is five, with a range of four to six, this can be tailored. For example, an internal evaluation to check the status of the configuration management KPA for one project may very well be done with two people who are experts in that area. The sponsor and team leader must weigh the evaluation requirements and scope to select the most appropriate team size and composition.

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3.4 Activity 4 Obtain Organizational Information

Table 3-7 and Figure 3-5 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Obtain Organizational Information	Step 4A: Identify Information Needed Step 4B: Request Information Step 4C. Provide Information (Organization)	Development organization information is obtained by which the team can finalize its evaluation focus, priorities, and logistics.

Table 3-7: Obtain Organizational Information

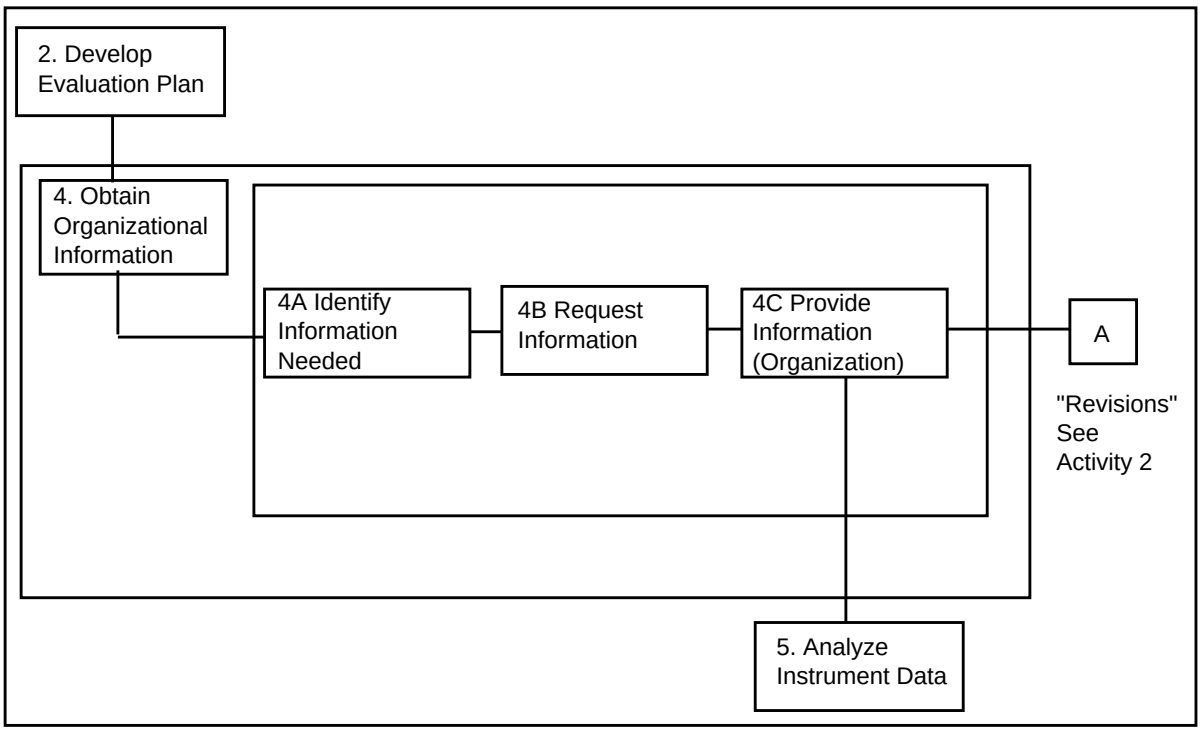

Figure 3-5: Obtain Organizational Information Activity Diagram

Purpose Obtain information from the organization that allows the team to refine the plan and focus the investigation in subsequent activities.

Inputs Product profile, reference model scope, organizational scope (Activity 1), evaluation plan (Activity 2).

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Action

Analysis of data collected during this activity may result in revision of the evaluation plan and indicate areas that the team will probe. It includes solicitation of site information and organizational/project responses to questionnaires.

Identify information needed. Identifying required information includes providing guidance templates and instruments to the appraised organization. Organizational information may include organizational questionnaires, project questionnaires/profiles, site information packets (including organization charts), and proposed project information (for acquisition).

If a site technical coordinator has not already been identified, the sponsor should request that this focal point be assigned and identified to the sponsor in the site information packet.

The questionnaires used will depend on the reference model used. The CMM Maturity Questionnaire V1.1 is used in CMM-based appraisals. Additional items such as organizational and project questionnaires may be used. Often, they perform a function similar to the profile templates. All profiles use the same attributes shown in the example in Activity 1. The difference is in who fills it out and from what perspective (desired product, planned product, or current products).

Request information. The sponsor formally requests the organization to supply needed information to the team. The collection of items provided to the team is called the site information packet. Besides the instruments and profiles filled out, other items requested and included in the site information packet are current organizational charts, site terminology, and high-level process information, such as a process documentation list.

Provide information (organization). This step is performed by the organization that will be evaluated. It is included in the method to ensure consistency in activities — the team needs to receive data from the organization in order to execute subsequent planning and preparation activities.

Outputs

Request for organization information, site information (from organization).

Outcome

Development organization information is obtained by which the team can finalize its evaluation focus, priorities, and logistics.

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Options

In some applications it may be beneficial to the sponsor to have the team evaluate the proposed project (one that does not yet have a track record of implementation). In this case, proposed project profiles and related data are requested from the organization in addition to the other items in this activity.

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3.5 Activity 5 Analyze Instrument Data

Table 3-8 and Figure 3-6 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Analyze Instrument Data	Step 5A: Receive and Summarize Instrument Data Step 5B: Examine And Review Instrument Data Step 5C: Develop Profile(s) Analyses	The team has a high level understanding of the site's operations.

Table 3-8: Analyze Instrument Data

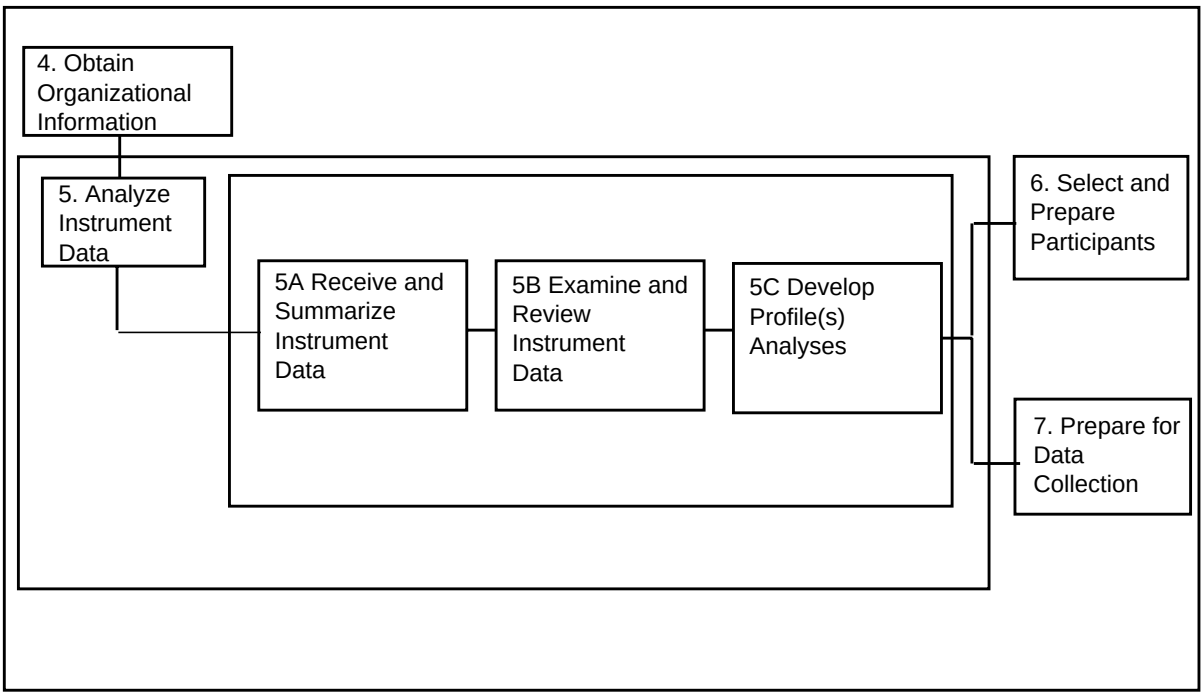

Figure 3-6: Analyze Instrument Data Activity Diagram

Purpose Identify issue areas for further investigation during evaluation conduct, and to get a preliminary understanding of the organization's operations.

Inputs Product profile (from Activity 1), site information (from Activity 4).

Action This activity includes review and analysis of all instrument responses. It begins when the first response is received and ends when all have been obtained and analyzed.

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Receive and summarize information. In the first step the team summarizes the information sent by the organization in the site information packet. Response Summary Sheets (RSSs) from the maturity questionnaires are typical outputs, since they help the team see patterns in the responses for investigation on site.

Examine and review instrument data. This step includes reviewing all instruments, including product profiles and questionnaires. It can be done in parallel with analysis of the data.

➠ **Product Profiles.** Several profiles are analyzed in this activity. Essentially, they revolve around two perspectives: the sponsor (customer) view of the product, and the producer (developer) view of the product (via examples of current products).

- The Product Profile (planned or desired) from Activity 1 represents the sponsor perspective.
- The Product Profile (proposed) from the development organization (Activity 4) represent the producer perspective.
- A Product Profile (actual, current) for each of the projects that has been submitted for evaluation by the development organization.

The development organization submits a Product Profile for each project that is a candidate for evaluation. The producer Product Profiles are based on the same attributes as the customer's Product Profile. The Product Profiles capture information about products the development organization has already developed or is developing, and they indicate development experience pertinent to the "target" product.

The SCE team uses the profiles to identify areas in which the development organization(s) may lack experience by examining the attributes in the various profiles submitted.

Questionnaires. The CMM V1.1 Maturity Questionnaire is the most common questionnaire based instrument used in an SCE. There are several that can be used

- maturity questionnaire
- project questionnaire
- organization questionnaire

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The team uses these instruments to better understand the basic structure, environment, products, and processes in an organization. During this step, the team tabulates and organizes the data in a way that facilitates analysis in the subsequent step.

Develop profile analyses. This includes identifying attribute mismatches and inconsistencies and anomalies in questionnaire data.

a. Identifying mismatched attributes. Mismatched attributes are identified by comparing the attributes in the sponsor (or target) Product Profile to the Product Profiles describing current projects[2]. The purpose of comparing is to look for similarities, not for exact matches. For example, a 98 KSLOC system would be considered a match for a 105 KSLOC system. Judgment and team consensus are used to resolve any questionable comparisons.

An overall attribute mismatch for an organization is defined to exist *only if none of the Product Profiles match* the sponsor Product Profile for that attribute. A Mismatch Identification Table is created to consolidate the information resulting from comparing the profiles submitted by a development organization. Later in the process, it may be important to note the *relative* amount of experience in an attribute related to the target product.

Attributes	Project Able	Project Baker	Project Charley	Project Delta	Project Foxtrot	Project Gamma	Org "A" Result
Application Domain	x	x		x	x	x	
Size	x	x	x	x	x	x	x

Table 3-9: Example Mismatch Identification for Two Attributes for Organization A

Mismatches for the projects are shown by an "x"; matches are left blank. The Product Profile attributes for Application Domain is acoustic signal processing, and the "Estimated Software Size" part of the Size attribute is 1,000 KSLOC. Every project submitted (except Charley) was a command and control system, and the size of each was under 300 KSLOC. Because all projects submitted showed a mismatch against the sponsor product profile in the Size row, the result column is filled in to indicate an overall mismatch for Organization A. Also of note is the fact that although only one project had relevant experience in the application domain, this is not an overall mismatch for the organization.

2. In an SCE for Acquisition, the development organization profiles are compared against their proposed product profile. The mismatches looked for are their current experience relative to what they say they will implement on the next project. The sponsor profile is used in this case only to help illuminate major gaps in technical understanding of the problem, indicated by mismatches between the developer's proposed product profile and the sponsor's product profile. This is important because in acquisition the sponsor will always be different from and external to the SCE recipient organization.

The purpose of this step is for the SCE team to identify areas in which the development organization(s) lacks experience, indicating a potential for risk. A development organization must have well-defined processes to mitigate the risk, especially if the development organization lacks product type or application domain experience.

The Product Profile (from Activity 1) represents a “customer view” of the product to be built, and the Product Profiles (from Activity 4) represent a “developer view.” Both of these give insight into development process risk. If there is a close match between the planned product and the development organization’s actual products, then the actual development processes currently in use are good indicators of the processes that will be used for the new development.

b. Questionnaire analysis. The team reviews the completed questionnaire(s) from the development organization(s) to identify inconsistencies and anomalies in the responses.

An ➠ **inconsistency** is an apparently contradictory response from the same project to two (or more) questions on the questionnaire that relate to the same key process area. An ➠ **anomaly** is a contradictory response to the same question by two (or more) projects. Both types of responses may indicate issues that should be probed on site. The information is captured in a form that can be used to help prioritize the amount of time spent investigating each topic area (Activity 7).

The team’s goal is *not* to validate the development organization’s response to the questionnaires; rather, the goal is to investigate the related topic areas to identify strengths, weaknesses, and improvement activities. Annotations in the comments column of the questionnaire(s) often indicate what documentation exists to support the answers to the questions. This information can be used by the team to tailor the requests for documentation (Activity 7) to be reviewed during the initial document review (Activity 9).

Outputs Profile and questionnaire analyses.

Outcome The team has a high-level understanding of the site’s operations.

Options A Product Profile for the proposed effort will also be submitted by the development organization(s) and analyzed by the user in acquisition applications of SCE. This Product Profile describes the development organization’s view of the proposed effort.

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One of the tasks performed is checking if the development organization's view of the product to be built is similar to the sponsoring organization's view. This is done by comparing the sponsor Product Profile to the developer *Proposed* Product Profile. Usually these are nearly identical. If they differ greatly, it should be investigated because it indicates a major difference in understanding about what the development project entails. Resolving these differences in understanding is not part of the SCE investigation, but should be brought to the attention of the sponsoring organization.

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3.6 Activity 6 Select and Prepare Participants

Table 3-10 and Figure 3-7 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Select and Prepare Participants	Step 6A: Select Site(s) Step 6B: Select Project(s) Step 6C: Select Participants Step 6D: Prepare Initial Briefing(s) Step 6E: Conduct Initial Briefing(s)	Site participants understand the evaluation process and are ready to take part.

Table 3-10: Select and Prepare Participants

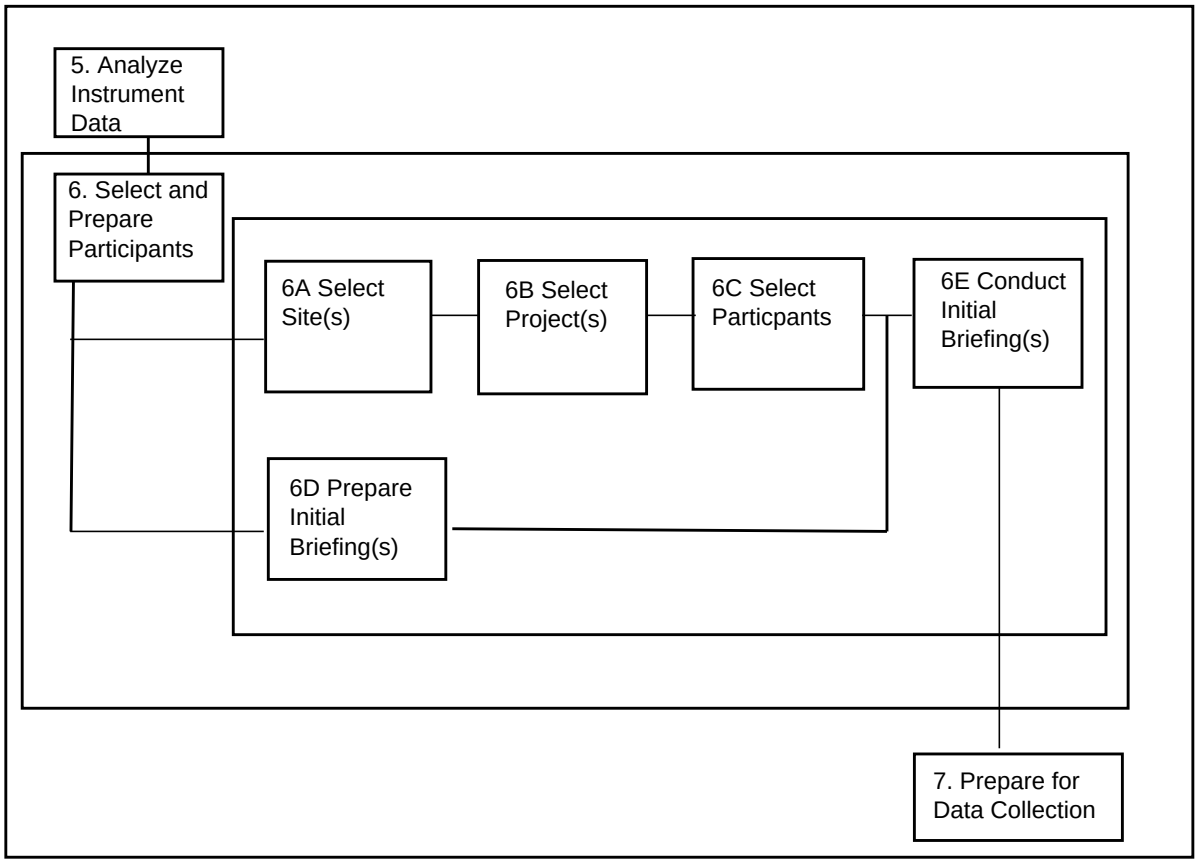

Figure 3-7: Select and Prepare Participants Activity Diagram

Purpose Ensure the most appropriate personnel participate in the evaluation, and ensure that they understand the evaluation process and shared expectations.

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Inputs Evaluation plan, site information, profile and questionnaire analyses.

Action This activity is an important mechanism for obtaining buy-in for both the evaluation process and its results. This activity enacts the first part of the classic communication technique, “tell them what you’re going to do, do it, and then tell them what you did.”

This activity identifies the specific organizational site(s), project(s) and participants in the evaluation. Selecting the site, projects, and participants is mutually reinforcing. A schedule and set of briefings describing the evaluation activities will be prepared and delivered.

Some of the factors to consider in accomplishing this activity are:

- management structure
- shared processes
- organizational and project responsibilities
- geographic dispersion of the appraised entity

These factors will affect how the team conducts the site visit, and more importantly, how the team conducts the site visit(s) within defined evaluation constraints. Information to perform this activity comes from the site information packet obtained in Activity 4.

Select site(s). The team needs to identify the place where the site visit will occur. Often, the terms “organization,” “site,” and “appraised entity” are used to discuss the same thing. However, in a typical evaluation, it is rare that all three terms reflect the same scope. The appraised entity is actually the result of selecting the organization, site and projects — it is the organizational units to which evaluation outputs apply. Given the site information provided by the organization in Activity 4, the team will select the location(s) where the majority of or most critical items will be produced. For an internal evaluation, this step is less complex, because much more information is known to the team earlier in the process. Remember that the sponsor and the senior site manager may not be the same individual. In an acquisition SCE, they will always be different.

Select project(s).The SCE team selects projects for investigation whose attributes most closely match their Product Profile. The number of projects selected varies depending on the specific application and the evaluation goals and constraints. The team uses all of the available information about the projects to make the selection. The purpose of this step is to select projects for evaluation that give the most insight into the processes that will be used on the planned, or target, development project. By evaluating the actual processes

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used on similar projects, the team obtains a clearer picture of the processes that are likely to be used on the planned development, or which need to improve to meet an intended target capability.

Select participants. The team also needs to determine who will participate in the evaluation. This decision, like most everything in the evaluation process, will depend on the evaluation goals and constraints. In all cases, participants will come from the projects selected and the groups that support those projects. Examples on how this foundation is tailored follow.

In an organizationally focused evaluation, results are being used to baseline process capability across the organization. The people selected to participate in group interviews (see Activity 10) might also come from projects other than the ones selected for depth coverage.

In a highly focused process audit on one project, the participants might be limited only to those working directly on the project, because an evaluation goal is to measure progress against an earlier baseline in key process areas under the direct control of that project.

A typical product line-oriented, customer-led SCE for acquisition will include approximately 25-50 people in interviews and presentations. An organizationally-focused internal evaluation used for appraising improvement progress may include as many as 75 people directly in interviews. Many more can be “touched” through use of instruments such as the CMM Maturity Questionnaire. Trade-offs in time and cost need to be considered.

The participants selected must be representative of the appraised entity. Factors to consider in ensuring this representation are:

- the size of the appraised entity
- the breadth of the appraised entity
- the characteristics of the appraised entity population
- the appraised entity’s development activities

Clearly, the smaller the entity, the more likely a greater percentage of the population can participate, and reduce the risk due to organizational scope. Participants will come from the projects selected, but support group people must also be included (such as from a software engineering process group). The participants should reflect the type of people and skill level that is typical for the appraised entity. The participants must have sufficient knowledge of the process activities in the organization that will be evaluated in the evaluation scope.

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Prepare and conduct initial briefing(s). The team also prepares an entry briefing; the entry briefing is used to set the development organization's expectations for the site visit. Initial briefing(s) used to prepare participants may be conducted at various times. They may begin shortly after the decision to conduct the evaluation, and may be held multiple times with different groups up to and including the first day of the site visit. Internal evaluations may include separate participants and opening "kick-off" briefings. The objective is to ensure participants know what the evaluation process is, and why it is being done. Prepared participants are much more at ease, which results in improved data volume, quality, and communication. It makes the job of the team easier.

Outputs Selected site(s), selected project(s), selected interviewees, initial briefing, prepared participants.

Outcome Site participants understand the evaluation process and are ready to take part.

Options The participant briefing and the opening meeting briefing (evaluation kick-off) may both be delivered on the first morning of the site visit. This option may be necessary when resources (financial or physical) are tightly constrained, or when the team is entirely third party and does not interact directly with the participants until day one of the site visit. Users should understand that the risk of participant resistance may increase in this scenario due to lack of time for internalizing the process, its purpose, and the expectations of management.

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3.7 Activity 7 Prepare for Data Collection

Table 3-11 and Figure 3-8 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Prepare for Data Collection	Step 7A: Prioritize Focus Areas Step 7B: Establish Interview Strategy Step 7C: Script Questions Step 7D: Establish Document Review Strategy Step 7E: Refine Evaluation Team Roles And Responsibilities	The team has finalized all plans and logistics and is ready to conduct the site visit.

Table 3-11: Prepare for Data Collection

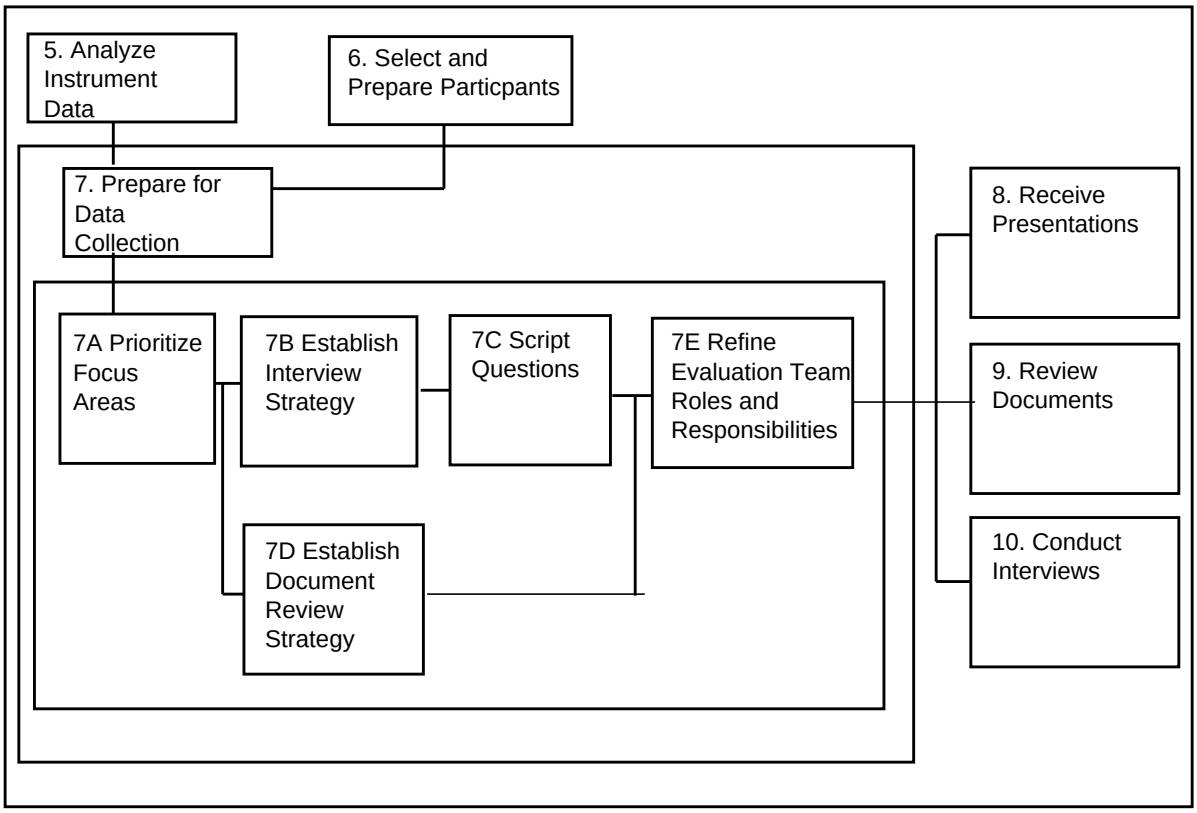

Figure 3-8: Prepare for Data Collection Activity Diagram

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Purpose Plan the detailed site intervention to make optimum use of available site visit time to attain evaluation goals and objectives.

Inputs Evaluation plan, organization charts (from site information), profile and questionnaire analyses, selected site(s), selected project(s), selected interviewees.

Action This activity provides the foundation for execution of subsequent activities. Specific prioritization of desired information and strategies for data collection (presentations, interview, document review) are developed. Refinement of roles and responsibilities (e.g., librarian, monitors or mini-teams) is accomplished. Activity 7 is accomplished iteratively with Activity 5, Analyze Instrument Data, and Activity 6, Select and Prepare Participants.

Prioritize focus areas — the topic areas to be investigated. The SCE team uses all of the information available to determine the topic areas that will be investigated. The team collectively describes and chooses their topic areas by doing this step. The topic areas refine the scope already identified in Activity 1, and reflect the rating baseline decision made in Activity 1. The topics are used to help prioritize site visit time and team focus.

- reference model topic areas are limited by the boundaries of the Target Process Capability identified in Activity 1. At least one topic area must be selected for each key process area in the Target Process Capability.
- The SCE team may select additional topic areas within the Target Process Capability based on their experience and judgment.

As noted above, team judgment is used to select topic areas. All of the information available to the team is used to make these judgments. Factors that might be considered include

- mismatches in profile attributes
- various organizational structures (For example, an organization without a separate quality assurance function might cause a team to focus more on the verifying implementation common feature, audits feature)
- a sponsor's "hot" issues (For example, if configuration management is a known issue area for a particular program manager or for a product line, the team might focus on the entire set of topics available in the configuration management key process area, and focus on fewer topics in other key process areas.)
- resource constraints (For example, a team might decide to focus on the implementation topic areas and less on institutionalization topic areas due to time constraints.)

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- purpose of the evaluation (For example, if an external sponsor wants to focus an organization's attention on providing resources or training to specific activities, the team might choose topic areas using the ability to perform common feature, resources and training features.)

Once the topic areas are selected, the scope of the SCE is refined by accounting for all evaluation constraints and information provided by the development organization.

Each topic focuses on one feature of the reference model. ➠ ***Features*** are characteristics common to all mature processes; the CMM V1.1 has five common features. The common features and their respective features are:

Commitment to Perform

- *leadership* — providing adequate senior management sponsorship and senior management oversight of process activities.
- *organizational policies* — written and communicated policies governing the key process area.

Ability to Perform

- *resources* — providing adequate resources (e.g., staff, funds, facilities, tools, input data).
- *organizational structure* — establishing process responsibilities and the organizational units to address process activities.
- *training* — providing training for groups and individuals (availability of training and orientation, and its timeliness, for the people who carry out the process activities).

Activities Performed

- *plans and procedures* — plans and procedures to support the activity.
- *work performed* — the evidence of the use of plans, procedures, and standards in implementing activities.
- *tracking* — how the work is tracked and how problems are identified.
- *corrective actions* — the identification and resolution of problems.

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Measurement and Analysis

- *take measurements* — taking measurements to determine the status of process activities.
- *analyze measurements* — taking and analyzing measurement data to determine the quality/functionality of the outputs of activities.

Verifying Implementation

- *reviews* — periodic and event driven reviews with senior and project management.
- *audits* — actions undertaken to perform independent reviews/audits of process activities and work products and reporting results.

Features indicate whether the implementation and institutionalization of a key process area is effective, repeatable, and lasting [Paulk 93a]. Recall that a feature as applied to a key process area goal constitutes a topic area for investigation. The key process area matrix is used to help visualize the selection process. The topics are used to plan the preliminary interview strategy and develop an interview schedule. The schedule is closely coordinated with the development organization's site technical coordinator.

Topic areas are necessary because a goal is too broad to be directly observable; each topic defines areas of observable, implemented work practices and their degree of institutionalization. Topics help the SCE team to structure the investigation, providing consistency across key process areas. Each topic serves as the basis of a set of questions that the team can ask or can seek in document review. Topic selection is a critical activity; the team must balance adequate reference model coverage against coverage of the organizational scope, and do so within the evaluation constraints and in line with the evaluation goals.

Establish the interview strategy and scripting questions. The team develops a high-level interview strategy and prepares materials to guide them during the interviews. This activity has four major components: (1) allocating time to various data collection techniques, (2) selecting interviewees, (3) creating interview worksheets, and (4) coordinating the interview schedule.

- **Allocating time to various data collection techniques.** Based on the topics selected, the team estimates the amount of time needed for interviewing and document review given the site visit time constraints established in the planning activity.

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- **Selecting interviewees.** The topics and the information about the organization's structure (from the site information packet) is used to decide who will be interviewed about each topic. Interviewees are not selected as individuals, but instead by position in the organization or by their functional area (e.g., Configuration Management, Software Quality Assurance, project manager).
- **Creating interview worksheets and scripts.** Interview Worksheets are prepared with an initial set of scripted questions, derived from the topics, for each interviewee; this keeps the interview focused.
- **Coordinating the interview schedule.** Finally, the team decides the preferred order for the interviews and coordinates with the site technical coordinator.

The team must also finalize logistical items planned for in Activity 2 — access to the facility, adequate working space, a conference room, telephone and copier access, and so on. The documents for initial document review were specified, but the team should ensure that the documents will be available in the working space assigned to them.

Establish document review strategy. During this step the SCE team identifies the documents they expect to review, especially for use during the initial document review. Once the projects are selected, the SCE team requests documents for the initial document review from the development organization. Document names will vary from organization to organization, but preliminary identification of documentation is critical. Typically, the team requests copies of pertinent organizational ➠ **policies**, ➠ **standards**, ➠**procedures**, and ➠ **directives** relating to software development. The team also requests project-level procedures, standards, and directives for the projects selected for review. This documentation defines both the organization-level processes and the high-level processes used on the selected projects. The team will also discuss how they will divide the large review task, establish team norms for use of documents, etc.

Refine team roles and responsibilities. This step is the last item prior to starting the Conduct Evaluation phase. Roles and responsibilities are established early on in the planning and team selection/preparation activities (Activities 2 and 3). Throughout the rest of the Plan and Prepare for Evaluation phase, the team will refine these roles as they become accustomed to each others' work habits and skills. If not already completed, the following roles, with associated team norms and responsibilities, should be formally established so that the team "hits the ground running" at the site.

- team leader
- key process area mini-teams or monitors

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- librarian — data manager
- appraisal process monitor

Outputs

Data collection strategy

- interview
- document review

Data collection tactics

- interview questions
- initial document request list
- roles and responsibilities

Outcome

The team has finalized all plans and logistics and is ready to conduct the site visit.

Options

Additional steps may be necessary in some applications like government source selection to ensure the sponsor that a “level playing field” is in place prior to the site visits. [See *SCE V3.0 Implementation Guide for Supplier Selection*.] [Barbour 96]

The quantity of topic areas selected as part of prioritizing site time must reflect the rating baseline decision made in Activity 1. The standard SCE approach is to select a subset of model components for investigation that best meet the intent of the sponsor’s use of the appraisal results.

Alternatively, a full scope, full coverage evaluation would effectively mean that all topic areas within the key process areas selected for the Target Process Capability must be evaluated (e.g., all goals and all features within a KPA for the CMM for Software)

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3.8 Activity 8 Receive Presentations

Table 3-12 and Figure 3-9 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Receive Presentations	Step 8A: Deliver Presentation (s) (Organization) Step 8B: Listen Step 8C: Ask Questions Step 8D: Take And Tag Notes	The evaluation team has a refined/updated understanding of the organization's process operations.

Table 3-12: Receive Presentations

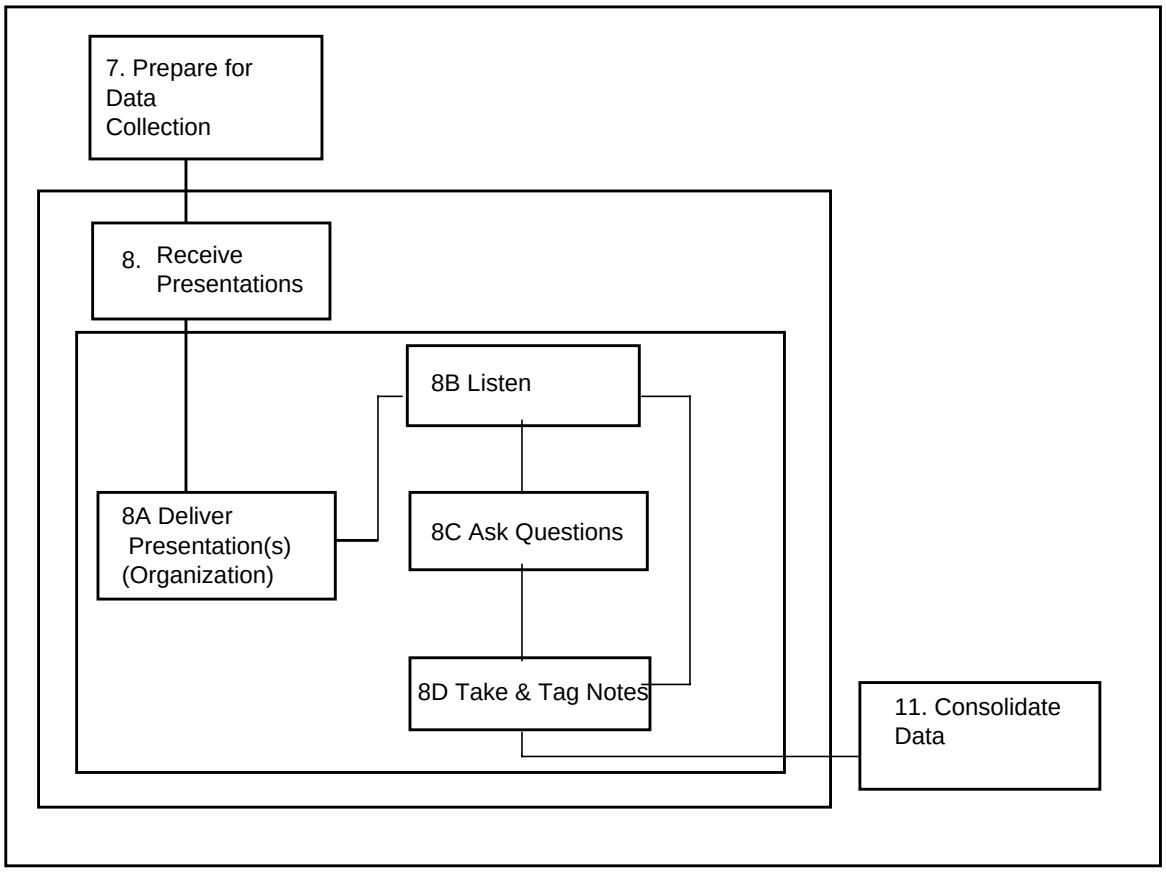

Figure 3-9: Receive Presentations Activity Diagram

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Purpose Collect data by allowing organization personnel to explain their process (e.g., in presentations).

Inputs Evaluation data

- Site information, appraisal schedule, development organization presentation

Action This activity begins the on-site data collection and consolidation process. The development organization's presentation(s) may include a process overview, organization overview, documentation overview, and/or improvement plan overview.

Deliver presentations. The entry briefing for the development organization's presentation should explain to the team:

- What the organization does (without giving a "marketing pitch" or a recital of their standard processes).
- The organizational structure (who does what), especially any changes that have occurred since the delivery of the site information packet (Activity 4).
- How responsibility, accountability, and authority are managed, particularly in regard to such items as configuration management, quality assurance, integration and test, requirements definition and management, systems test, and development.
- How the organization's process integrates responsibility, accountability, and authority through the development life cycle; the organization's description should be focused on the projects selected for review.
- The ➠ **organization-level documents** (policies, procedures, etc.) present a roadmap of how the documents are organized. The presentation may describe how the organization's documentation is laid out and how they relate to each other.

Listen, ask questions, and tag notes. This activity is much like an interview, except the forum for the participants to interact with the team is different. The forum for the team to collect data is a formal presentation from the organization. Like an interview, active listening is important. Clarifying questions are expected. The purpose of an in-brief is similar to the initial document review. The team tries to get a sound picture from a high level perspective of how the organization does business from a process perspective. For the in-brief to work well, it is imperative that the sponsoring organization provide instructions to the development organization as to the expected contents and format for the in-brief.

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Individual team member notes should be “tagged” as soon as possible, just as in an interview. Tagging notes refers to a shorthand notation that the team uses to quickly identify data in subsequent data consolidation sessions. Typical tagging includes noting how the fact or strong inference written in the notes relates to the reference model and whether it is indicative of a strength or a weakness. Observations generated from notes that come from presentations like the organization in-brief can be used to validate findings.

Outputs

Updated evaluation data

- site information, appraisal schedule, terminology, presentation slides

Working notes

Requests for additional data

Outcome

The evaluation team has a refined/updated understanding of the organization’s process operations.

Options

The team may receive a more in depth “demonstration” or “walk through” of work processes. This presentation would be geared to showing the team how processes are actually implemented, using information provided by the team, in advance, on the detailed processes that will be investigated on site. This presentation would be done on the first morning of the site visit, and could mutually support the initial document review activity.

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3.9 Activity 9 Review Documents

Table 3-13 and Figure 3-10 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Review Documents	Step 9A: Determine Information Needed Step 9B: Select or Request Documents Step 9C: Review Documents Step 9D: Take and Tag Notes	Understand processes actually implemented in the organization.

Table 3-13: Review Documents

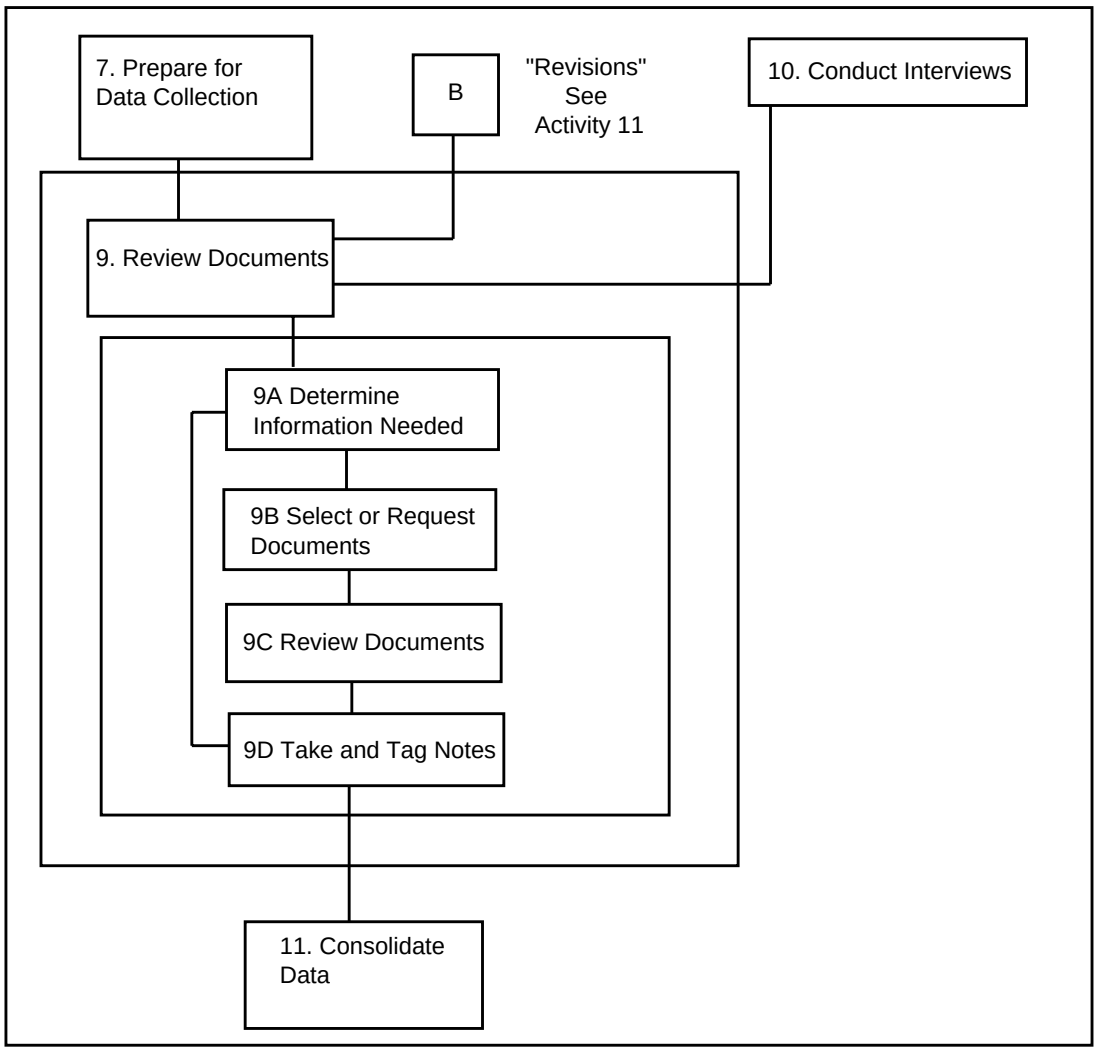

Figure 3-10: Review Documents Activity Diagram

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Purpose Collect data by examining process artifacts (e.g., documents).

Inputs Evaluation data

- Site information, initial document set, annotated worksheets/checklists, document review strategy

Action This activity is repeated multiple times. It is undertaken to understand processes as actually implemented in the organization — the track record of objective evidence of process use. The same basic process is used throughout the site visit, although the type of information sought will change as the team learns more about the organization's processes during the site visit. The team will

- Determine information needed, and if it can be obtained from a document.
- Select or request documents for review.
- Review the documents for the information needed, and
- Take notes and tag the notes relative to the reference model used.

The remainder of this section is devoted to discussing the different types of documents and document review tasks, when documents are reviewed, and how they relate to the method goals.

Three levels of documents are reviewed: ➠ **organization-level documents,** ➠ **project-level documents,** and ➠ **implementation-level documents**. Initial document review focuses on only the first two levels, and can often be started prior to the site visit. The "track record" documents are primarily reviewed on site. However, review of organization- and project-level documentation is not limited to the initial document review period.

Initial document review. The documents for initial document review were requested during Activity 7, Prepare for Data Collection. These include both project- and organization-level documents. The request must be previously coordinated with the development organization's site technical coordinator so that the documents will be readily available in the team's assigned work area.

The team examines their strategy and planning documents to determine what information the process documents can provide. The team then reviews the initial document set. Initial document review is focused on organization-level documents and high-level project documents.

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During the initial document review, the team gains further insight into each scheduled interviewee's proper role in the organization's operations. Information is collected as working notes. Initial document review is usually done before starting interviews, but may be interspersed with interviews.

The purpose of this step is for the team to determine the degree to which the organization-level documents and project-level documents define and support standard processes for the key process areas that are under investigation.

From this activity, the team gains a better understanding of the development organization's organizational structure and process, and is better prepared for exploratory interviews. By providing further insight into the policies and procedures that guide the organization's processes, the team can sometimes eliminate the need for a question during the interviews or sharpen the focus for a question.

Another objective of initial document review is to identify other documents from the development organization that may be needed by the team; this lets the team seek clarification through the site technical coordinator or from a participant during interviews.

The direct output of document review is a set of working notes. The team will understand the purpose and content of each relevant document and the document's relation to the topics that the team wants to evaluate. Subsequent interviews will be better focused; the team should have a better idea of which employees to interview about each topic and what to ask them.

Detailed document review. The team reviews project-level and implementation-level documents to validate information gathered through other sources such as interviews and higher level document review. Documents on this level provide an audit trail of the processes used and the work performed. Through these reviews, the team confirms or negates the proposition that the actual work practices implement the processes described in the organization- and project-level documents.

The purpose of this step is to search for objective evidence of how the processes are actually implemented, and how well they correlate to what the organization says is supposed to be done — this provides support for findings. In other words, the team determines whether the processes defined on paper and elicited from the interviews correspond to what the people on the projects are actually doing.

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Outputs Evaluation data (includes working notes)

Requests for additional data (e.g., documents)

Outcome Understand processes actually implemented in the organization.

Options Initial document review can often be conducted prior to the site visit. This is preferable in applications for internal evaluation and process monitoring, and may be necessary in broad scope evaluations in order to make optimum use of available site visit time.

Detailed document review can be done on an individual level, with mini-teams, and can also be done in parallel with consolidation interviews (see Activity 10).

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3.10 Activity 10 Conduct Interviews

Table 3-14 and Figure 3-11 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Conduct Interviews	Step 10A: Determine Information Needed Step 10B: Select or Request Interviewee(s) Step 10C: Ask Questions Step 10D: Listen Step 10E: Take and Tag Notes	Understand site personnel perspective on processes implemented in the organization.

Table 3-14: Conduct Interviews

Purpose Collect data by interviewing process agents (e.g., managers, practitioners, and process owners).

Inputs Evaluation data which includes evaluation schedule, site information, interview strategy, interview questions, working notes, annotated worksheets/checklists.

Requests for documents.

Action This activity is repeated multiple times. Interview types include all-on-one, all-on-many, few-on-one, and few-on-few (where the first term denotes number of team members and the second term denotes number of participants. The term “few” for team members assumes a mini-team approach, usually seen in follow-up interviews.)

Determine information needed. The team must always determine what information they need first. Determining what information is needed is an important way to ensure that the available (limited) site visit time allocated to interviews is conducted in the most efficient way relative to the evaluation goals. If there were no subcontractors on a planned procurement, for example, the team would not ask interviewees questions about the subcontract management KPA. Or if the team reached consensus that they have a sufficient number and type of observations to judge the “Plan the Software Project” goal (goal #2) of the Software Project Planning KPA, they would not need to ask additional questions about this area.

Select or request interviewee(s). The team must decide who might be able to provide needed information. The team must work with the site focal point to schedule the appropriate managers and topic area practitioners.

Some issues to consider when deciding on interviewing participants as individuals (all-on-one or few-on-one) or as groups (all-on-many, or few-on-few), include

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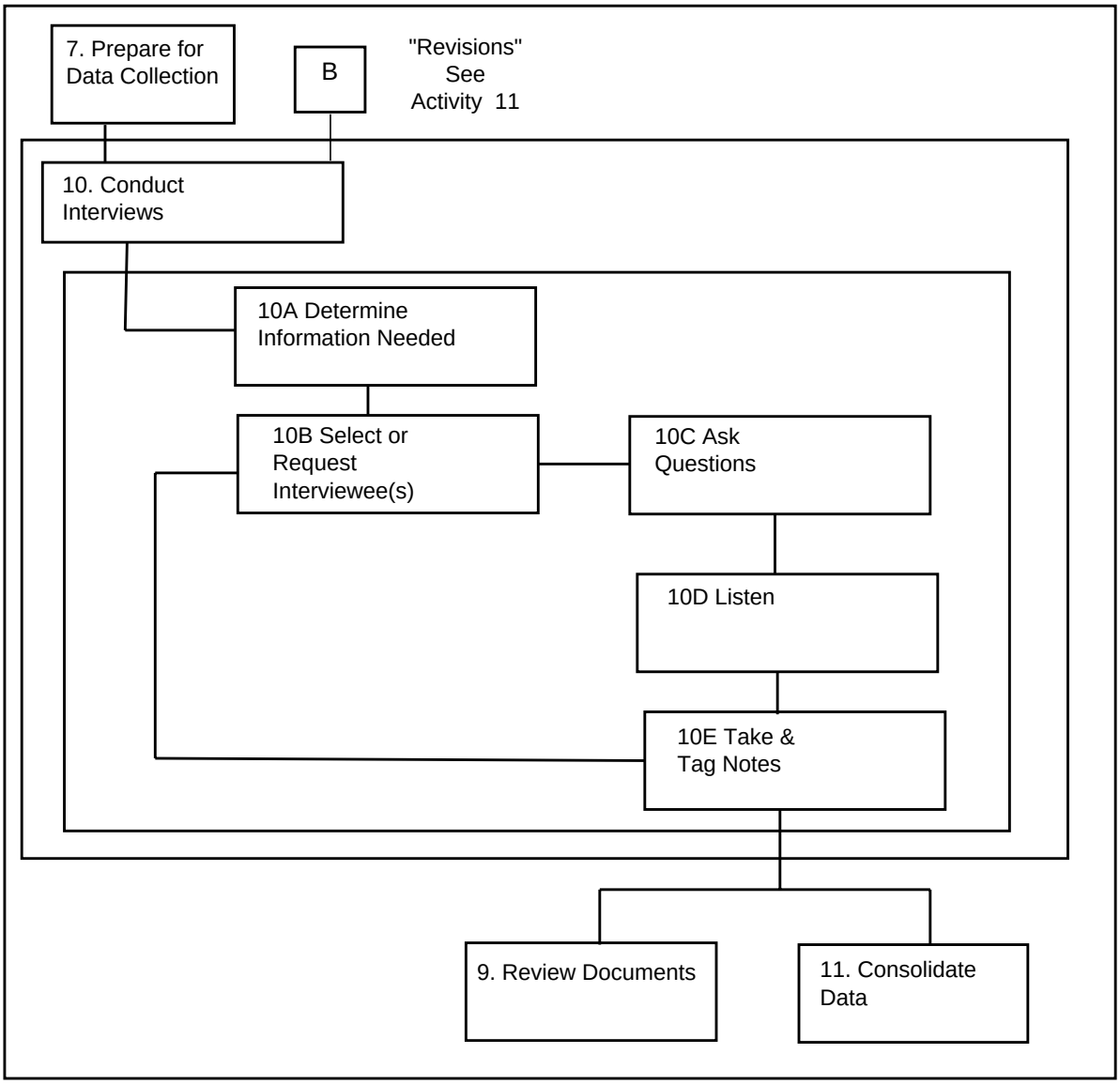

Figure 3-11: Conduct Interviews

- is the individual a manager or a practitioner? (It is generally more productive to interview practitioners in a group setting.)
- if the person was in the room with others, would other participants feel inhibited from an open exchange of information? (No one should be in a group interview if they will be less likely to openly disclose information.)
- is the person in the reporting chain of others to be interviewed? (To ensure unbiased responses, a manager should never be in an interview with subordinates.)

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- is the person an opinion leader? (Opinion leaders may bias the input of others in a group. Often it is more productive to interview them separately, or to take precautions in a group setting to avoid letting the individual dominate the session.)

Ask questions, listen, and take and tag notes. The interviewing steps are simple, but the activity clearly is not. Active listening and note taking are two critical skills that must be mastered to maximize the amount of data collected during an interview.

The remainder of this section discusses interview sessions, strategies for interviewing, and types of interviews that are used in the SCE method.

Interview sessions include both management and practitioner interviews. The baseline SCE V3.0 approach is:

- management interviews are all-on-one
- group (practitioner) interviews are all-on-many (with no managers present)
- follow-up interviews may be few-on-few or few-on-one

Interview strategies. One strategy is for the team to interview the organizational employees with responsibilities at the organization level, and then the employees with responsibilities at the project level. This is a “top down” strategy. An alternative strategy is to interview people by proceeding from one project to the next, and follow up by interviewing people with organization-level responsibilities.

Another strategy is to interview groups of individuals with similar functions across projects, and across the development life cycle (e.g., configuration management, design, test).

In any strategy used, the majority of the time spent interviewing should be at the practitioner level, since they are closest to the processes actually being implemented in an organization.

Interview types. SCE distinguishes exploratory interviews from consolidation interviews. **Exploratory interviews** have these characteristics:

- They provide insight into how key process areas are actually implemented.
- They determine the extent to which processes have been internalized.
- They identify critical ➠ **implementation-level documents**.
- They primarily use open ended and guided questioning techniques[3].

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Interviews help the team determine the extent to which the documented procedures and policies have been implemented throughout the projects. By asking project personnel about specific practices (e.g., design and code reviews), the team can evaluate whether the organization and project-level policies and procedures have been communicated to the people who need to implement them and if they are understood.

Exploratory interviews also point the SCE team to the implementation-level documentation for a project and guide the document review at that level. This documentation is used to validate both the interview responses and the higher level procedures during subsequent document reviews.

Consolidation interviews are specific sessions with people who have previously been interviewed, or who were identified as having specific information needed by the team. Consolidation interviews differ from exploratory interviews in the following ways:

- they are principally focused on validating data already gathered
- they are focused on seeking specific information needs
- they use more directed questioning techniques to obtain the information
- they may be conducted by a subset of the entire team
- they can run in parallel with other consolidation interviews

Every piece of information obtained during an interview can lead to identification of a strength, a weakness, or an improvement activity. Before information can be transformed into a finding, it must be validated. Central to the validation process is the accurate transformation of the raw data obtained in an interview. Active listening is required to transcribe data directly in the form that it was provided, without inserting personal judgments or biases. The first step in the transformation is to “tag” individual notes, citing relevant items such as mapping to the reference model, and noting potential strengths and weaknesses. Tagging notes is the link between the data collection activity and the consolidation activity. Taking sound notes that are tagged well will assist the transformation of notes into observations during consolidation (see Activity 11).

Outputs

Evaluation data (includes working notes)

Requests for additional data (e.g., documents, interviewees)

3. using guided questioning techniques focuses the interviewees on the topic areas important to the team rather than simply letting them discuss less relevant areas.

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Outcome Understand site personnel perspective on processes implemented in the organization.

Options In SCEs for Acquisition, procuring officials may decide that interviews must be all-on-one rather than all-on-many due to regulatory interpretations. All-on-one interviews are not the recommended style for collecting data from practitioners. Group interviews of functional and staff engineers allow the team to collect a greater quantity of data in a much shorter period of time. They can also increase the quality of the data by eliminating unrepresentative data coming from an individual who may be new to the organization, overly nervous about the interview, etc.

The team may break into parts, “mini-teams,” to conduct parallel follow up or consolidation interviews. The important principle is to adhere to the rule of “multiple eyes and ears.” A team always wants more than one individual participating in an interview. It helps ease the burden on the interviewer, and also helps mitigate potential recall and analysis errors during consolidation.

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3.11 Activity 11 Consolidate Data

Table 3-15 and Figure 3-12 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Consolidate Data	Step 11A: Organize and Combine Data - Assign KPA Monitor - Record observation - Consolidate observations Step 11B: Determine Data Sufficiency - Perform coverage check - Validate observations - Judge sufficiency of data for rating - Review consolidation work Step 11C: Review and Revise Data Gathering Plan - Identify information needed - Consolidate information needed - Revise data gathering plans	The team has an agreed to baseline of information known, information needed, and the strategy to obtain needed information.

Table 3-15: Consolidate Data

Purpose Transform the data collected into formal team observations of process strengths and weaknesses relative to the reference model (e.g., the CMM).

Inputs Evaluation data (ex. working notes, annotated worksheets/checklists, annotated draft findings presentation)

Action This activity is repeated multiple times. Consolidation of data is the crux of the data collection activity. In this activity collected data is analyzed and prepared for rating.

In the Activity 11 sub-steps listed in the table, the first three are individual key process area monitor or mini-team activities; the last seven are mini-team or whole team activities.

A critical requirement that must be met by this activity is to make data visible to the entire team for consensus. An additional SCE design constraint is to provide artifacts (forms) that can be populated with information in both automated and non-automated fashion.

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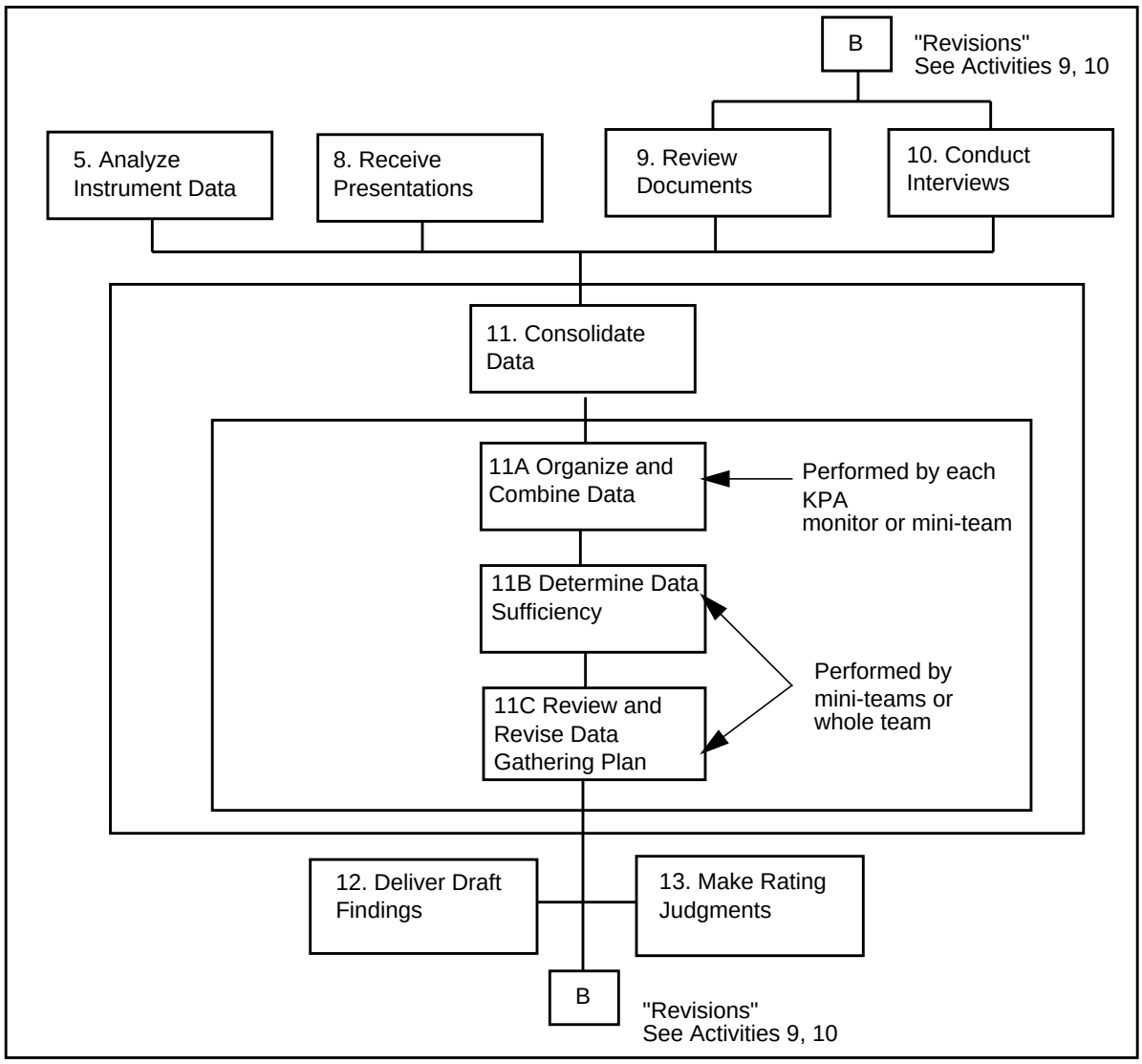

Figure 3-12: Consolidate Data Activity Diagram

Organize and combine data. Working notes that are used for consolidation come from multiple sources:

- Instrument analysis (Activity 5)
- Organizational presentations (Activity 8)
- Document review (Activity 9)
- Interviews (Activity 10)
- Draft findings presentation (Activity 12)

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➠ **Consolidation** is the decision making activity in the iterative information gathering and decision making process. Consolidation has three primary objectives:

- Organizing the information obtained from data gathering sessions and combining it into a manageable summary of data.
- Determining whether or not the information provides a sufficient basis for making judgments concerning an organization's process capability.
- If not, determining any revisions that should be made to the data collection plan to obtain the additional information required to make judgments.

Quality control checks are built into the consolidation process as part of the judgments made relative to the first two objectives.

During consolidation, the team assesses their progress toward the goal of validating topics. No particular format is specified for the caucus, but the following steps are typical:

- The team members review the topics focused on and the notes that resulted from the most recent data collection activities. Observations are generated and/or combined with others by team members and/or mini-teams.
- The team reviews any new observations, and identifies areas that require further clarification. The team validates the observations, meaning they agree that an observation is accurate, and that they have reached consensus on it (accepted, rejected, or modified the observation).
- Subsequent team consensus determines the sufficiency of the data for rating (observations that are validated, cover the area, and are corroborated). Sufficient observations automatically become candidate findings for delivery in the draft findings. (See Activity 12.)
- If the team cannot reach consensus at any point in the consolidation process, they identify what information is needed to resolve the outstanding issues, and generate a plan for collecting the information.
- If enough information has been gathered to make a determination about a topic, it is dropped from further consideration unless subsequent data collection related to other topics reveals new information on the "closed" topic. For example, if no subcontractors are used on the projects, findings related to subcontractor management would not be applicable, leading to a determination of "not applicable." (See Activity 13.)

Purpose. The purpose of the team consolidation is to analyze, share, and consolidate the available information in order to reach conclusions about the topics. The SCE team gathers a large quantity of data; caucusing helps the team sift through the information. Consolidating also provides a chance for the

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team to share diverse perspectives on the data, which helps prevent misinterpretations and premature decisions. Consolidation keeps the team focused on the evaluation objectives.

The standard consolidation tasks that occur throughout the site visit are:

- Team members or mini-teams determine potential strengths, weaknesses, or improvement activities based on the available information and annotate the information as ➠ **observations** on key process area worksheets. (organize and combine data)
- Mini-teams or the whole team validate observations based on what was heard or seen since the last consolidation session.
- The team determine data sufficiency for rating purposes.
- The team identifies a need for more data to confirm or negate an observation about one or more topics. This results in updated data collection plans — generating requests for additional documentation to review or additional interviews. (Review and revise data gathering plans.)

Judgments made during data transformations. There are many judgments that team members, mini-teams, and the whole team make throughout the site visit. In order to be validated, observations must be determined to be accurate. Accuracy of observations is continually checked by the team by evaluating

- wording
- basis (i.e., facts and strong inferences)
- categorization (against reference model components or non-reference model areas)
- classification (as strengths, weaknesses, or improvement activities)
- relevance and significance (only the most important and non-redundant items should be transformed into findings — the consolidation process should “weed out” unimportant data relative to meeting evaluation goals.)

The judgments required to derive observations from notes include:

- Determining that each observation is worded appropriately (i.e., is clear, concise, does not make use of absolutes, is expressed in site terms, and maintains confidentiality principles).
- Determining that each observation is based on facts documented in notes or on strong inferences drawn from those facts.
- Determining that each observation is relevant by determining that it can be categorized in terms of the reference model or otherwise has a significant impact on the organization’s process capability.

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- Determining that each observation is significant by determining that it can be classified as evidence of strength, weakness, acceptable alternative processes, or non-applicable processes.
- Determining that the set of observations does not contain redundancies.

Determine data sufficiency. Successful consolidation depends on the team's consensus-building ability. Data sufficiency is a result of the team reaching consensus on observations regarding their validity, coverage, and corroboration.

Judgments required to validate observations as findings include:

- Determining that each observation is valid by reaching consensus on the accuracy of the item (i.e., wording, factual basis, relevance, significance, and non-redundancy).
- Determining whether or not an observation is consistent with other findings (i.e., validated observations).
- Determining whether the set of observations fully cover the area of investigation (to the extent required by the rating baseline option).
- Determining whether or not a particular observation is sufficiently corroborated (i.e., having enough of the right kind and sources of data for observations).

Rules of corroboration. In order for an SCE finding (strength, weakness, or improvement activity) to exist, the following data sufficiency guidelines must be met:

- There must be objective evidence in the form of documentation to support the finding (lack of documentation, if sought out by the team, constitutes objective evidence).
- The team must observe supporting evidence from two or more sources, in independent sessions.
- The supporting evidence must include observations generated from interviews or presentations with the people who perform the related process, and reviews of documentation that result from executing that process
- The team must generate the findings through a consensus process. That is, there are no minority opinions opposed to the finding.
- The evidence must support the findings.

All judgments made by the team should be confirmed by at least two separate pieces of information. As the significance of the judgment increases, the team may decide that confirmation from three or more separate sources of information are needed. An example might be that, during consolidation, the

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team realizes that a particular observation is significant enough that it may cause a key process area to be rated unsatisfied (see Activity 13, Make Rating Judgments). In that case, they may decide that an observation which had an instrument as a source of the data is not sufficient to validate it. As a general rule, if there is any doubt at all about whether a finding is valid, the team should defer it to the consolidation step and should initiate additional data collection efforts.

Coverage rules. Determining data sufficiency is the consolidation step where previous decisions regarding coverage requirements are critical (see determining the rating baseline in Activity 1). The following guidance is provided to ensure adequate coverage of model components relative to the rating baseline chosen — preparing the team for the rating process to come (see Activity 13):

- A maturity level is covered if all of its key process areas and those of all lower levels are covered.
- A key process area is covered if all of its goals are covered.
- A goal is covered if all of its subordinate model components are covered (key practices of the activities performed and institutionalized common features)
- A common feature is covered if sufficient observations exist to judge the extent of institutionalization of the common feature.
- A key practice is covered when the team judges that the key aspects of the item are covered by the set of observations related to it.

When rating decisions are made based on data that does not completely cover the area of investigation, risk in the appraisal output increases and the ratings must be accompanied by an associated coverage factor which documents the CMM components that have been covered. This will allow sponsors to make well informed decisions using the available appraisal outputs. All coverage decisions must consider the nature of the findings relative to the reference model, the appraised entity, and the appraised entity's lifecycle(s). Explicit examination, documentation, and acceptance of alternative practices to the reference model must enter into this consolidation process.

Review and revise data gathering plan. If an observation cannot be validated, if doubt remains, or if consensus is not achieved despite additional documentation or interviews, then there can be no finding. The team must determine what information is needed in order to resolve the disagreement, and revise their plans to obtain the needed information.

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If the team identifies an observation that is a weakness, the development organization (through the site visit coordinator or in subsequent interviews) should be given an opportunity to produce evidence that might mitigate or refute the response that indicated a weakness. (See also Activity 12, Deliver Draft Findings.) By double checking, the team avoids making findings based on anomalous responses. The request for clarification should define the subject matter and ask if what the team observed or heard is representative. For example, the team might ask “We were not able to determine if the estimates for project size were based on actual data. Did we miss something?”

Summary. It is possible for a given component of the reference model to have strengths, weaknesses and improvement activities exhibited at the same time — for example, well-defined procedures (a strength), no training in the procedures (a weakness), and an ongoing course development effort for the new procedures sponsored by the organization (an improvement activity).

Outputs

Evaluation data

- Observations (reference model, non-reference model)
- revised data collection plan (document review and interview strategies)
- annotated worksheets/checklists,

Requests for additional data (additional/ new interviewees or documents)

Outcome

The team has an agreed to baseline of information known, information needed, and the strategy to obtain needed information.

Options

Consolidation can be done with individual key process area monitors, or can be done with KPA mini-teams. In applications using small evaluation teams, individual monitors are likely. In large scope applications, with large teams, the mini-team approach is most prevalent. Many people find the mini-team approach to be the best way to provide a “buddy” system of data collection, analysis, and corroboration. Having multiple people responsible for KPAs ensures that important information is not missed by the team, either during data collection activities, or during the consolidation activity.

The baseline SCE process supports using KPA worksheets for annotating, tracking, and consolidating observations. This technique is most easily automated. However, many teams are comfortable using KPA “wall charts” to perform the same consolidation functions. This technique is beneficial in a paper intensive process, and meets requirements for a good observation

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tracking system. Both techniques can work well. An important consideration in this decision is how the consolidated information is made visible to the whole team for tasks that require all team members to participate.

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3.12 Activity 12 Deliver Draft Findings

Table 3-16 and Figure 3-13 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Deliver Draft Findings	Step 12A: Prepare Draft Findings Presentation Step 12B: Present Draft Findings And Solicit Feedback Step 12C: Listen Step 12D: Take and Tag Notes	The quality of the evaluation data and results is improved, and credibility and buy-in to the appraisal process and its results is generated.

Table 3-16: Deliver Draft FIndings

Purpose Validate observations and collect data by conducting interactive feedback sessions with participants.

Inputs Evaluation data

- annotated worksheets/checklists
- observations

Action This activity includes preparation and presentation of the draft findings. Information obtained during the draft findings presentation will be used as inputs during development of the final findings.

In the Deliver Draft Findings activity, the team must prepare a briefing, deliver the briefing, and actively solicit feedback from the participants. Team members must take and tag notes like other data collection activities. An important aspect of the draft findings session is that it is both a data validation and data collection activity. Presenting observations to the participants is a data validation task. Participant feedback on the validity of the observations is sought. Asking questions of participants when they react to the briefing, or when seeking information still needed to validate an observation, is a data collection task.

Prepare draft findings presentation. The baseline SCE Method recommends delivering draft findings of weaknesses only. This assumes that participants will not quarrel strongly over perceived and validated strengths. This baseline approach optimizes time overall and ensures maximum time is spent validating weaknesses and collecting additional data to validate these and potentially new items.

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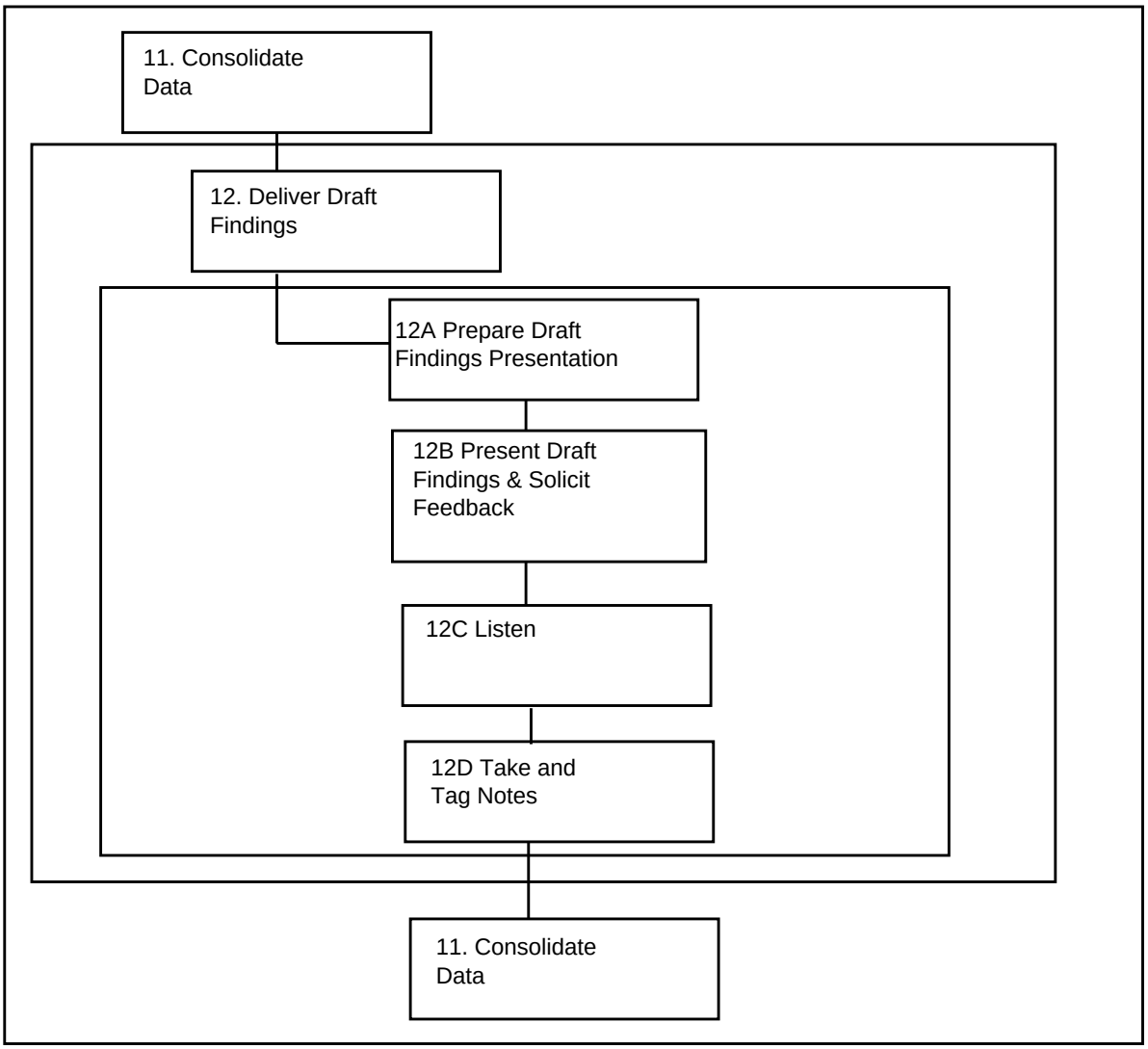

Figure 3-13: Deliver Draft Findings Activity Diagram

If the Consolidate Data activity is done properly, preparing the briefing is simple. Observations that the team has reached consensus on regarding validity and sufficiency are candidates for briefing in the draft findings presentation. If worded well, the observation can be transcribed directly onto a briefing chart because a validated observation, by definition, is a finding. (See the Glossary.)

Present draft findings and solicit feedback. The presenter is chartered with the task of actively soliciting feedback from the participants. The team leader may present the draft findings, or KPA monitors may be tasked to brief their respective areas. Setting expectations at the beginning of the session is critical.

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Participants need to understand the purpose of the session, and that only weaknesses are shown. They need to know that a significant amount of additional data will be fed back to them in the final findings presentation (Activity 14). There are always multiple feedback sessions at this point in the process. Practitioner participants and management participants are always briefed separately at this stage, to continue facilitating the most open exchange of information between the participants and the team.

Listen and take notes. Active listening is important to this activity, in the same manner as in Activity 10, Conduct Interviews. The team is looking for positive or negative affirmation of the findings presented. The team must solicit feedback. The session doesn't work if the participants don't respond. It is important to note non-verbal as well as verbal feedback. Working notes from feedback sessions include annotations made directly on the draft findings slides during the presentation delivery, in addition to individual team member notes. Team members tag their individual notes as in all other data collection activities.

Outputs

Evaluation data

- working notes
- draft findings presentation

Outcome

The quality of the evaluation data and results is improved, and credibility and buy-in to the appraisal process and its results is generated.

Options

A team may choose to use one of the following briefing formats:

- one person brief all of the draft findings for all sessions,
- one person brief all of the draft findings, but use a different person for each session, or
- multiple team members brief sections of the draft findings, based on their team roles/expertise areas, during each session.

A team may choose to brief strengths during this presentation also, but there are trade offs with available site visit time. The team leader should make this decision as part of planning to meet the intent of the evaluation goals. Or the team could choose to decide to use this option during the evaluation if data collected suggests that it would be better to also brief strengths (again to ensure appraisal goals are met).

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This activity may not be allowed in acquisition applications due to contractual and legal constraints in the procurement process. (See *SCE V3.0 Implementation Guide for Supplier Selection for Acquisition*.)

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3.13 Activity 13 Make Rating Judgments

Table 3-17 and Figure 3-14 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Make Rating Judgments	Step 13A: Judge Satisfaction of Key Practices (if selected in planning). Step 13B: Judge Satisfaction of Common Features (if selected in planning). Step 13C: Judge Satisfaction of the KPA Goals Based on Implementation and Institutionalization. Step 13D: Judge Satisfaction of KPAs Step 13E: Determine Maturity Level	A formal rating decision for each reference model component which was planned to be rated, and for which the team obtained sufficient data to meet method rules for conducting the rating.

Table 3-17: Make Rating Judgments

Purpose Make decisions about the organization's process capability, based on validated observations, relative to the reference model components investigated.

Inputs Evaluation data

- annotated worksheets/checklists
- working notes

Action This activity is the team task of deciding on the appraised entity's satisfaction of reference model components, based on validated observations (findings) collected by the team. Decisions on what model components to rate were made during requirements analysis and planning in Activities 1 and 2. This critical decision was made between the sponsor and the team leader. A sponsor could decide not to have any ratings provided as appraisal outputs.

Ratings are based on the components defined in the reference model. The rating process proceeds in a bottom up manner. If selected in planning, key practices and common features will be rated first. Goals are then rated, and the results are rolled up into KPA and maturity level ratings. Rating decisions are always made by the team as a whole. Recommendations may be made by mini-teams, but a consensus process must be invoked for all final rating judgments.

In SCE V3.0, using the CMM V1.1 as the reference model, the baseline process includes:

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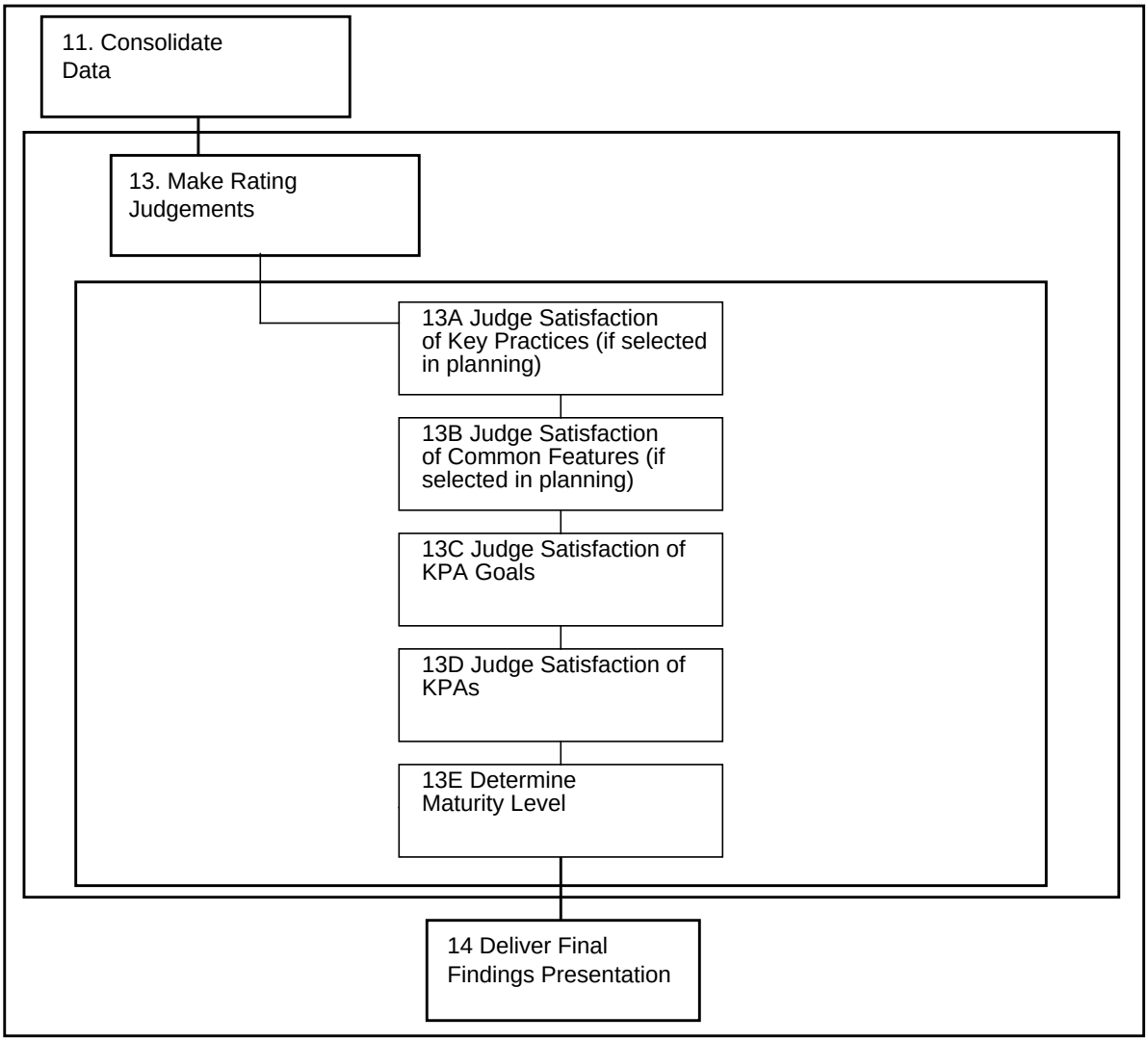

Figure 3-14: Make Rating Judgments Activity Diagram

Judge satisfaction of the goals. To fully satisfy a goal, an organization must both implement a process and also institutionalize its use. Thus both the activities (implementation) and other common features (institutionalization) must be satisfied for the goal to be satisfied. The team must judge whether each goal has been both implemented and institutionalized.

For example, resources are related to the ability to perform common feature. Resources are not typically assigned to a KPA based on an individual goal. Rather, resources are assigned to work efforts based on the need to meet all of the goals of that area. The notion of institutionalization aspects cutting across the entire set of KPA goals was also reflected in how the team initially prepared to collect data on the appraised entity, using the KPA matrix. (See Activity 7.)

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A goal is satisfied if the associated findings indicate that this goal is implemented and institutionalized either as defined in the reference model, with no significant weaknesses, or that an adequate alternative exists.

Judge satisfaction of the KPAs. This is a simple decision-making task. All of the goals for a specific KPA must be satisfied in order for the KPA to be satisfied.

Determine maturity level. This is a simple decision making task. All of the KPAs within a maturity level and within each lower level must be satisfied in order to be rated at that maturity level. Rating a maturity level is an optional output. Recall that maturity level can only be rated when the subordinate components making up that maturity level have been rated in accordance with the rules regarding the rating baseline option selected (see Activity 1). The decision to rate maturity level must be made during requirements analysis and planning, along with determining the rating baseline option.

Optional steps include judging satisfaction of key practices and common features.

The remainder of this section discusses what rating is, when it can be performed, how appraisal risk is measured, and what values it takes on.

➠ **Rating** is performed for any component for which ➠ **coverage** and ➠**validation** and ➠ **corroboration** rules have been met (see Activity 11). Rating a component is only performed when method rules have been met.

Coverage generally means the extent of “completeness” in the investigation of an item, and can be considered a “bottom-up” exercise. For example, if a practice called for the use of a documented procedure, incomplete coverage of a practice might be that a team found a “procedure” being used, but was not able to investigate the “documented” part of this practice.

Investigating a sampling of practices from a KPA constitutes incomplete coverage of that KPA and requires that a coverage factor be reported. Similarly, a sampling of practices from within a common feature, such as the ability to perform (in the CMM V1.1), constitutes incomplete coverage. A coverage factor should be provided with the common feature rating, also.

The coverage factor measure is the absolute number and percentage of practices fully covered within the rating component. In addition, reports must document the actual CMM components that have been covered. For example, in the Software Project Planning KPA there are 15 key practices of the activities performed common feature. If a team planned for and completed full coverage

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of 12 of the 15 activities performed key practices, that number (12) and the associated percentage coverage (80%) as well as the specific activities that have been covered would be placed directly on the form or chart showing the ratings. This concept applies to the practice of the other common features, also.

All of the goals of a KPA must be satisfied in order for the KPA to be satisfied. If a team chose during planning to not investigate all goals in a KPA, then the KPA could not be formally rated. Similarly, each KPA within a maturity level and each lower maturity level must be rated in order to determine whether the maturity level has been attained. A mapping of the CMM V1.1 key practices to the KPA goals is provided in the SCE training materials as a work aid for this process.

Rating values of reference model components are

- satisfied
- not satisfied
- not applicable
- not rated

A reference model component is satisfied if it is implemented and institutionalized either as defined in the reference model, or with an adequate alternative. The rating scale for maturity levels in the CMM for Software, V1.1 is an integer 1-5.

A reference model component is unsatisfied if there are significant weaknesses in the appraised entity's implementation or institutionalization of the item, as defined in the reference model, and no adequate alternative is in place.

A reference model component is "not applicable" if it does not apply in the organization's environment. A reference model component is "not rated" if the evaluation data does not meet coverage requirements or the item is outside the appraisal scope.

Rating hierarchy. Figure 4-20 depicts the rating output hierarchy used in the method. Recall that the findings of strengths, weaknesses, and improvement activities for each KPA are generated during the final consolidation activity (see Activity 11). The findings are the data element used to determine the satisfaction of reference model components.

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The SCE V3.0 rating output hierarchy is designed to support evolution to models with the same architecture as the CMM for Software V1.1. (e.g., TCMM).

Figure 3-4 should be read bottom-up. The lowest level components that were chosen in planning are rated first, and the results roll up into higher level component judgments. Recall that the components rated depend on the reference model scope and rating baseline decisions made in Activity 1, Analyze Requirements.

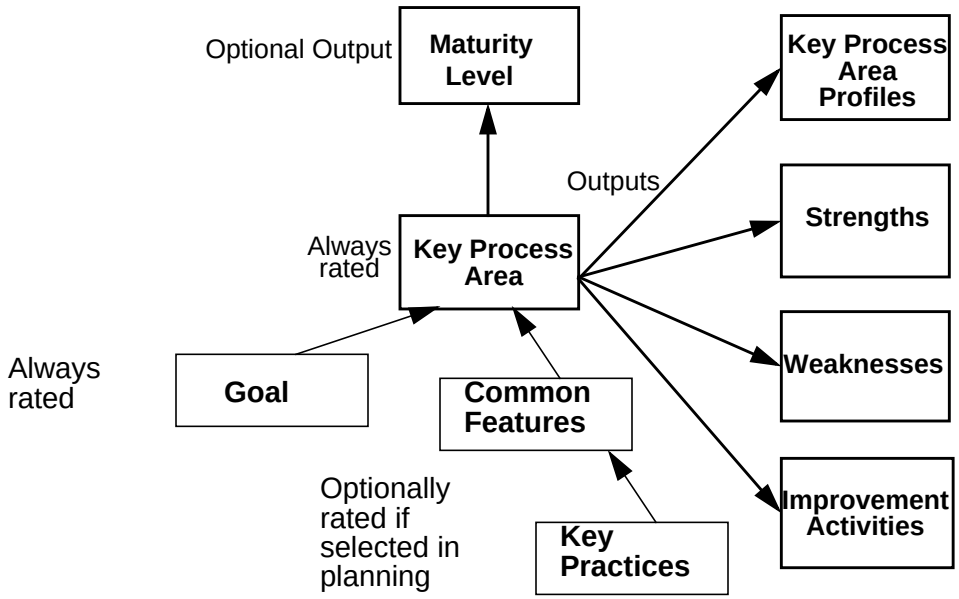

Figure 3-15: Overview of the SCE V3.0 Rating Output Hierarchy

Typical outputs are strengths, weaknesses, and improvement activities against each KPA investigated. KPA profiles will also be generated if ratings have been completed. A KPA profile is a graphical representation of the organization's process capability in terms of the model components that were rated

Outputs

Evaluation outputs which include ratings of reference model (e.g., CMM) components.

Evaluation data which includes annotated worksheets/checklists.

Outcome

A formal rating decision for each reference model component which was planned to be rated, and for which the team obtained sufficient data to meet method rules for conducting the rating.

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Options

It is always an option of the sponsor to forego any ratings at all, and to simply have the outputs be the findings.

The method offers two options for rating (see Activity 1, determining the rating baseline):

1. Depth-oriented — partial scope, complete coverage.

When an evaluation calls for a reduced scope investigation — in the model and/or in the organizational scope (similar to SCE V2.0) — the default approach is to fully cover and rate those model components that are specified during requirements analysis and planning [Activities 1 and 2],and that meet method rules for rating. Performing a maturity level rating cannot be done using this option, and complete coverage of specified items is required.

2. Breadth-oriented — full scope.

When a “full” model and organizational scope investigation is called for (e.g., all model components within several maturity levels and many projects covering a wide diversity of organizational business). There are two sub-options available. Either

- obtain complete coverage of model components prior to rating, or
- report coverage factors, to be delivered with the rating when complete coverage is not obtained.

Performing a maturity level rating may be done using this option, and complete coverage may or may not be required. However, the coverage factor should always be reported when rating decisions have been made without complete coverage. A maturity level, may only be determined when all KPAs within a level and all lower levels have been rated. A KPA may be rated when a sampling of practices from each of the goals of that KPA are covered.

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3.14 Activity 14 Deliver Final Findings

Table 3-18 and Figure 3-16 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Deliver Final Findings	Step 14A: Prepare Final Findings Presentation Step 14B: Present Final Findings Step 14C: Close Out Site Activities	The sponsor and the appraised organization understand and accept the team's findings.

Table 3-18: Deliver Final Findings

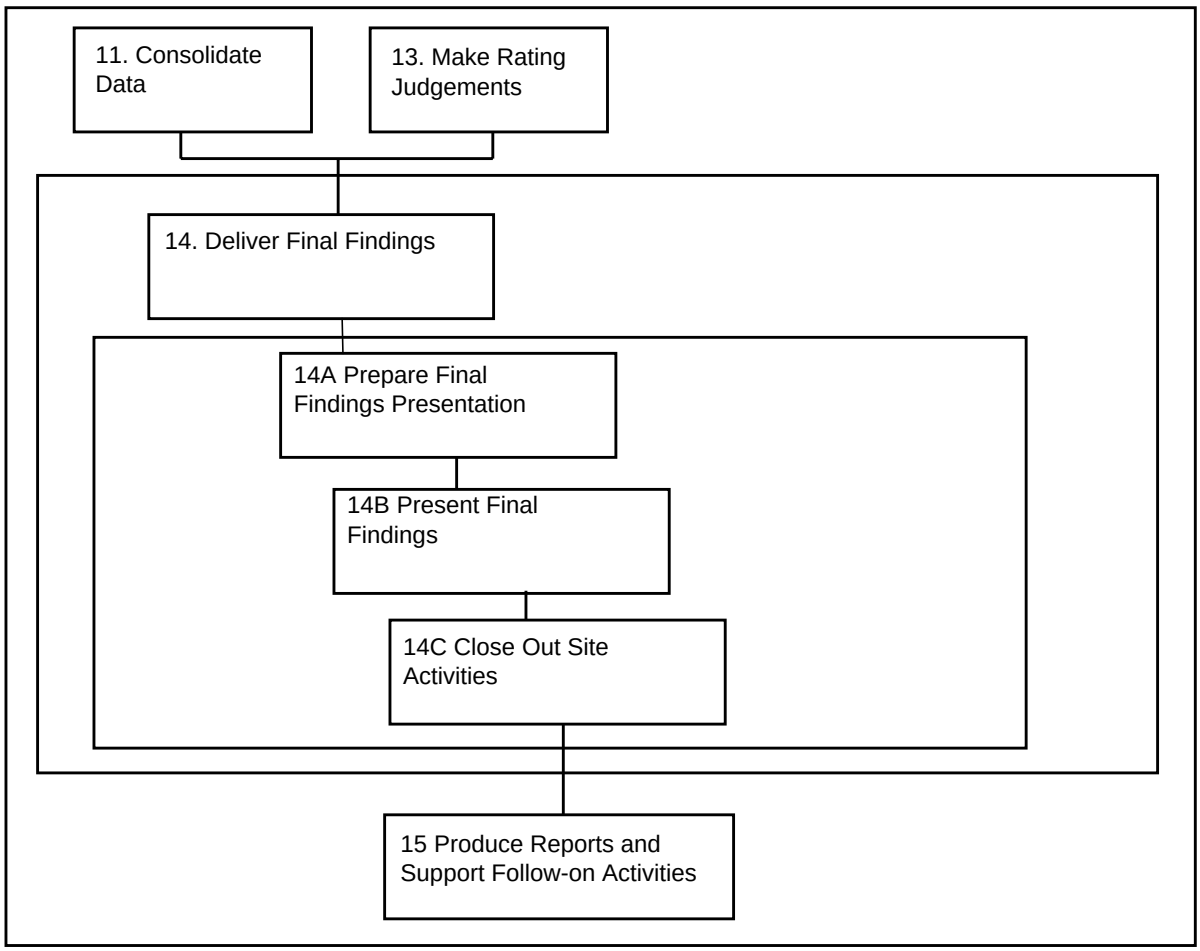

Figure 3-16: Deliver Final FIndings Activity Diagram

Purpose Provide a clear and actionable summation of the evaluation results to the sponsor and the organization.

Inputs Evaluation data

- annotated worksheets/checklists
- ratings

Action This activity includes preparation and presentation of the final findings. It also includes site close out activities such as assignment of report writing and follow-on activities. If a reference model component is reported as unsatisfied, there must be corresponding findings of weaknesses reported which caused the team to make that judgment. The team should be prepared to discuss the data upon which the findings were based, while adhering to previously agreed to confidentiality and non-attribution principles.

Prepare final findings presentation. This culminates the on-site activities. At this point, all team judgments have been made. This activity is designed to prepare the results to the sponsor and organization in a way that is most beneficial to meeting the original evaluation goals.

Much of the preparation of the briefing could be started in advance of the site visit, using a template. The template is then filled in with actual data (findings, ratings, data about the appraisal itself) during this step. At this point there should be no debate about the findings or ratings. The primary discussion is about how the judgments made by the team will be presented to best achieve evaluation goals.

Present final findings. The material is presented in a stand up briefing format. Typically, the team leader will be the sole presenter, with team members supporting the team leader during questions and answers with the participants. The professionalism with which the team has carried out its activities throughout the week will be evidenced by the manner in which the participants at the findings briefing react to the results.

At this briefing, it is highly encouraged to have as many people from the organization participate as possible, not just the people who were directly involved in the evaluation. During this briefing the sponsor or chosen delegate will reemphasize and renew his or her commitment to the evaluation process, and to the use of the results.

Final findings presentation content. The final findings presentation will contain the appraisal results in accordance with the evaluation plan. This always means reporting the findings of strengths, weaknesses, and improvement

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activities in each KPA investigated. KPA profiles are also reported for any model components that were formally rated (including maturity level if this option is selected). Global findings and non-reference model findings are also provided. Besides findings and ratings, the team should remind the participants about the

- method used to generate the results
- team qualifications and sponsorship for the evaluation
- amount of labor that was expended during the appraisal
- breadth and depth of the organization evaluated (number of instruments, projects, interviewees, and documents reviewed)
- next steps — how the results will be used, by whom, and when

Close out site activities. During the final period on site, the team, or perhaps only the team leader, will privately discuss with the sponsor any questions or concerns he or she has about the evaluation or its results. Confidentiality and non-attribution principles agreed to with the sponsor during planning are still in effect during this meeting. Discussion of next steps may occur at this time. The sponsor may also choose to have a select group of senior managers participate in this meeting.

Following the meeting with the sponsor, the team leader will work with the team in making assignments for generating the various reports that will be needed. Creating the reports is ultimately the team leader's responsibility, but is a shared tasking with the other team members. The team may concurrently begin closing out logistical aspects of the site visit when the team leader is meeting with the sponsor. It is important to make team assignments and the projected schedule for follow on activities that team members may be involved in while on site. It is easy to lose momentum after an appraisal. Taking on specific actions while on site will keep the momentum going.

Outputs

Final findings presentation, including

- global findings
- final findings
- non-reference model (e.g., non-CMM) findings
- ratings
- meta data about the evaluation itself

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Outcome

The sponsor and the appraised organization understand and accept the team's findings.

Options

This activity may occur at different times in some applications. The default option is to deliver the final findings at the close of the site visit. This is preferred for facilitating continuous process improvement goals. However, the delivery of the final findings to the appraised organization may be limited by legal and contractual constraints (such as in government source selection). Findings should always be delivered at the earliest possible time within these constraints.

Additionally, depending on how ➠**appraisal constraints** are factored into the evaluation plan, global findings and non-reference model findings may not be generated to save time throughout the site visit.

Presentation of the final findings is usually done with all participants and others in the organization at one time, but the organization may choose to have the team present the findings at multiple times during the last site visit day.

Meeting with the sponsor on the last site visit day is not feasible in an acquisition context, since the sponsor is not from the appraised organization. The senior site manager should be invited to the executive session.

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3.15 Activity 15 Produce Reports and Support Follow-On Activities

Table 3-19 and Figure 3-17 below provide an overview of the steps in this activity.

Activity	Steps	Outcome
Produce Reports and Support Follow-On Activities	Step 15A: Produce Reports - Findings Report - Outcomes Report - Evaluation Data Report - Method Evaluation Report Step 15B: Distribute Reports Step 15C: Preserve and/or Dispose Of Records Step 15D: Support Follow-On Activities	A formal baseline of the appraisal conduct and results is established and reports are delivered to stakeholders. The evaluation results are used to support business objectives.

Table 3-19: Produce Reports and Support Follow-On Activities

Purpose

Produce a formal baseline of the appraisal conduct and results for the sponsor and other stakeholders, and ensure the evaluation results are available to achieve stated business objectives.

Inputs

Evaluation artifacts

- evaluation plan
- site information
- all presentations
- all annotated worksheets/checklists
- all working notes

Action

This activity will require follow-through and commitment by the evaluation team. Execution of the activity will vary depending on the use of the appraisal outcomes.

Produce ➠appraisal reports. Several reports are generated. Each is briefly discussed below.

The findings (sometimes called “final”) report is an essential item for closing out an evaluation, because it defines the baseline of all activities and results from the team’s execution of the method. This baseline is used for subsequent

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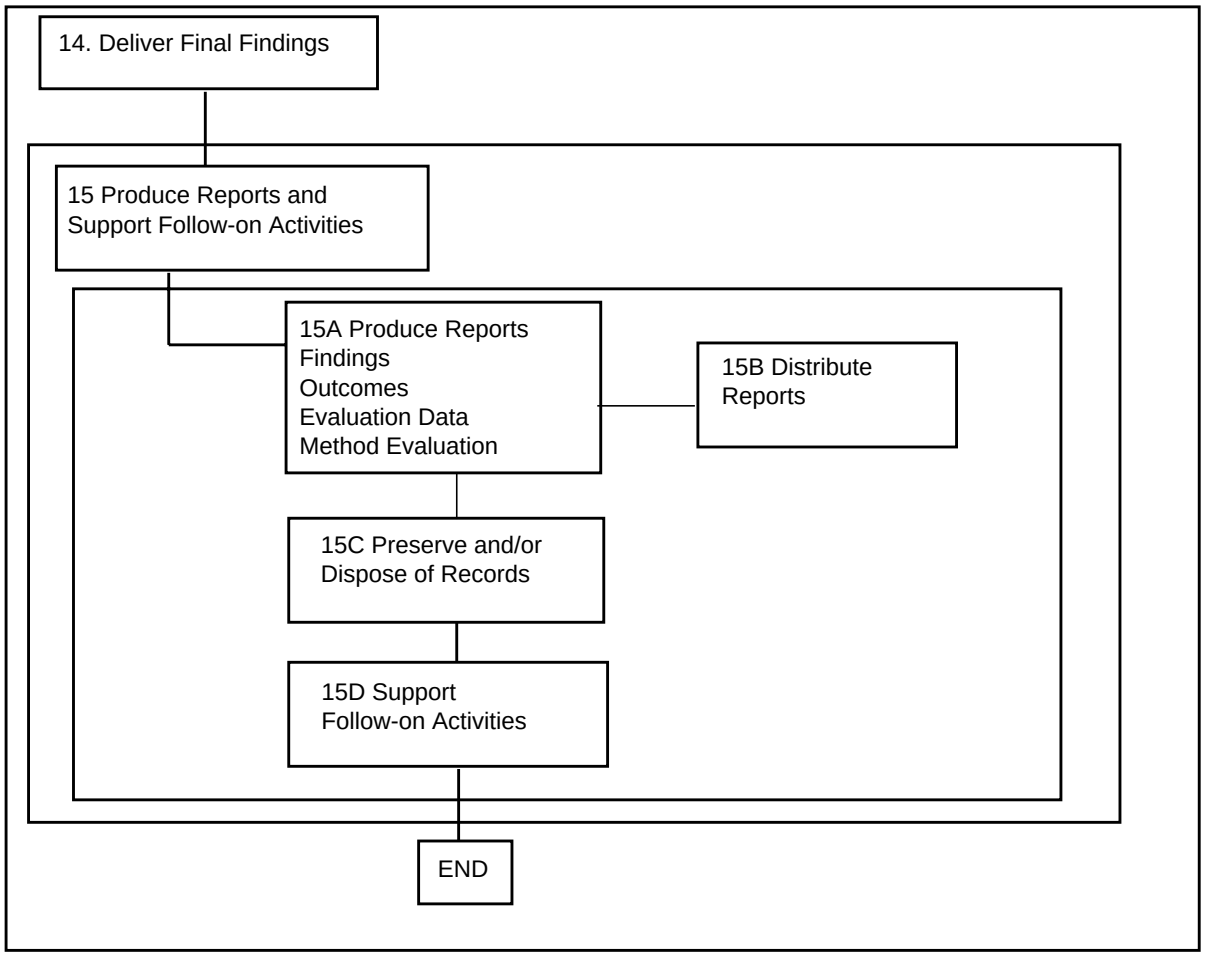

Figure 3-17: Produce Reports and Support Follow-On Activities Activity Diagram

reports, and also for use in subsequent appraisals (in all cases except a source selection SCE). The report should be completed as soon after the on site period as possible. Usually this should be no more than two weeks.

The findings report should contain the following information:

- Evaluation goals, requirements, and scope.
- Information common to all development organization(s), includes the Product Profiles, organization charts and other site information, and questionnaire responses.
- All worksheets and checklists.
- Objective evidence which serves as a basis for findings. (This section should be a formal description of the evidence supporting the team's findings rather than the actual evidence. The team will not be allowed to take the evidence with them.)

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- Findings, including a separate sheet for each KPA. The findings sheets should include references to the objective evidence which support them.
- Ratings (for all model components rated).
- Risks associated with the accuracy and completeness of evaluation outputs.

An outcomes report includes recommendations for use of the evaluation results, in accordance with the planned use of the results defined in Activities 1 and 2. In many applications, recommendations for use of the results will be combined with the findings report information in one document called the “final” report. The outcomes report documents the official baseline of what was done, and the recommended use of the results. The report should be completed as soon after the on site period as possible. Recommendations, depending on their nature, complexity, and use, can take skilled teams as much as two months to produce, depending on the level of effort allocated.

An appraisal data report is a summary of essential characteristics and results of the evaluation that can be submitted to bodies responsible for qualifying appraisers, or reporting state of the practice information to the community. An example of an institution supporting this role for the software community is the SEI. Software process appraisal data may be submitted directly to the SEI or through a cognizant sponsor institution (e.g., an acquisition agency).

The appraisal data report also documents items important to the qualification of individuals on the team by formalizing:

- who was on the team
- when they were trained
- what method they executed
- what the results were

A method evaluation report is a compilation of lessons learned and suggestions for improvement of the method used by the team, which is sent to the SEI.

Typically, the templates for all of these reports are provided to individuals as part of evaluator training. The findings and outcomes report may be tailored by the user. The appraisal data and method evaluation reports are standard.

Distribute reports and dispose of data. After the various reports are delivered to the appropriate stakeholders, the team leader is responsible for properly disposing of the evaluation data, in accordance with agreements

made with the sponsor during Activities 1 and 2. How the records will be preserved or disposed is dependent on the application of the method and its appraisal goals.

In *all* applications of SCE, strict non-attribution policies apply. However, confidentiality rules may differ by application. In an SCE for acquisition, the results are not “confidential” in that the sponsor is an outside organization from the recipient. But the results are only known to the sponsor and the recipient. Competing organizations do not see the results.

The recipient organization, if the sponsor agrees and it is planned for, may always choose to make the results known outside the organization. At a high level, this might be done for marketing and public relations reasons.

Support follow-on activities. Follow on activities are the tasks that the team leader and various team members might take to support use of the evaluation results. This is highly desirable to sponsors, due to the in depth, extensive site information that is gleaned by the team in a short time period. This knowledge can be put to use in many ways:

- assisting an evaluation board in identifying offeror risk
- assisting an award fee board in determining incentives to a contractor
- assisting the development organization in producing an improvement plan
- assisting action teams in planning specific process improvements

Outputs

Evaluation reports

- findings
- outcomes
- appraisal data
- method evaluation

Evaluation artifacts

Evaluation records disposition

Follow-up actions

Outcome

A formal baseline of the appraisal conduct and results is delivered to stakeholders.

The evaluation results are used to support business objectives.

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Options

A single, final report may include both the findings report information and the outcomes report information.

An organization may choose to make the results more broadly known and available than is standard, given adherence to non-attribution policies.

The form of follow on support varies depending on the intended use of the results. (e.g., risk identification in acquisition, award fee determination in process monitoring, action planning in internal evaluations).

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3.16 Summary of Inputs and Outputs

The table below summarizes the inputs and outputs of each activity.

Activity	Inputs	Outputs
1. Analyze Requirements	Evaluation requirements • business context • sponsor objectives • specific sponsor req'ts Resource constraints • personnel, facility, and project availability • budget availability Logistical constraints • program plans • external schedule • geographic constraints	Evaluation requirements: • evaluation goals • evaluation constraints - product profile Evaluation scope: • reference model scope, • organizational scope, List of evaluation outputs Sponsor commitment
2. Develop Evaluation Plan	Evaluation goals, Evaluation constraints, Reference model scope, Organizational scope, List of appraisal outputs, Team leader selection Site information	Initial evaluation plan, Revised evaluation plan
3. Select and Prepare Team	Evaluation constraints, Product profile, Reference model scope, Organizational scope, Evaluation plan	Team leader selection, Team member selection, Prepared team[1] • method training • reference model training • team building • evaluation orientation
4. Obtain Organizationali nformation	Product profile, Reference model scope, Organizational scope, Evaluation plan	Request for organization information, Site information (from organization)

Table 3-20: SCE V3.0 Activities and Their Primary Inputs and Outputs

1. Training in the appraisal method and demonstrated knowledge of the reference model are requirements for preparing the team.

Note: Throughout the document and in these tables, several assumptions are made to simplify discussion. Some items are consistent throughout all the activities and steps, and therefore are not repeated in each section. If an item generally affects all of the activities and steps, it is listed below.

- The CMM reference model is an input.
- Reference model knowledge is a constraint.
- Teamwork and interpersonal skills are a constraint.
- Method rules (for rating, coverage, etc.) are a constraint.
- Items completed during Activity 1 and 2 (reference model scope, organizational scope, budget, plan, etc.) automatically become constraints on the rest of the activities.

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Activity	Inputs	Outputs
5. Select and Prepare Participants	Evaluation plan, Site information, Profile and questionnaire analyses	Selected site(s), Selected project(s), Selected interviewees, Initial briefing, Prepared participants
6. Prepare For Data Collection	Evaluation plan, Organization charts (from site information), Profile and questionnaire analyses, Selected site(s), Selected project(s), Selected interviewees	Data collection strategy • interview • document review Data collection tactics • interview questions • initial document request list • roles/responsibilities
7. Receive Presentations	Evaluation data • development organization presentation • site information • appraisal schedule	Updated evaluation data • site information • appraisal schedule • terminology • presentation slides Working notes Requests for additional data
8. Review Documents	Evaluation data • site information • initial document set • annotated worksheets/checklists Document review strategy	Evaluation data • working notes Requests for additional data (e.g., documents)
9. Conduct Interviews	Evaluation data • appraisal schedule • site information • interview questions • working notes • annotated worksheets/checklists • interview strategy Requests for documents	Evaluation data • working notes Requests for additional data (e.g., documents, additional or new interviewees)
10. Consolidate Data	Evaluation data • working notes • annotated worksheets/checklists • annotated draft findings presentation	Evaluation data • observations (model and non-model) • revised data collection plan • annotated worksheets/checklists Requests for additional data (interviewees or documents)
11. Deliver Draft Findings	Evaluation data • annotated worksheets/checklists • observations	Evaluation data • working notes Draft findings presentation
12. Make Rating Judgments	Evaluation data • annotated worksheets/checklists • working notes	Evaluation outputs • ratings of reference model components Evaluation data • annotated worksheets/checklists

Table 3-20: SCE V3.0 Activities and Their Primary Inputs and Outputs (cont.)

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13. Deliver Final Findings	Evaluation data • annotated worksheets/checklists • ratings	Final findings presentation • global findings • final findings • non-model findings • ratings
14. Produce Reports and Support Follow-On Activities	Evaluation artifacts • appraisal plan • site information • all presentations • Initial briefing(s) • Organization • Draft findings • Final findings • all annotated worksheets/checklists • all working notes	Evaluation reports • findings • outcomes • appraisal data • method evaluation Evaluation artifacts Evaluation records disposition Follow-up actions

Table 3-20: SCE V3.0 Activities and Their Primary Inputs and Outputs (cont.)

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Appendix A SCE V2.0 to SCE V3.0 Activity Mapping

V2.0 Phase	V2.0 Step	V2.0 Purpose	V3.0 Activity Mapping
Phase 1: Evaluation Start	1. Develop Target Product Profile	Understand attributes of the software product and the project required to produce it.	Activity 1, Step 1B, Determine Appraisal Constraints
	2. Determine Target Process Capability	Determine the process capability that is most appropriate for the planned development—the Target Process Capability.	Activity 1, Step 1C, Determine Reference Model Scope
	3. Select Team	Have a trained team in place to execute the SCE.	Activity 3, Select and Prepare Team
Phase 2: General Preparation	4. Create Experience Table	Identify areas where the development organizations lack experience, indicating a potential for risk.	Not in default method; it is a source selection specific step. Will occur in source selection tailoring as part of Activity 5, Analyze Instrument Data.
	5. Create Critical Subprocess Area List	Define and document the scope of the SCE, in terms of critical subprocess areas within the Target Process Capability KPAs.	Deleted, concept done partially in Activity 1, Step 1C, Reference Model Scope. Not done as part of organizational profile analysis. Selection is now based directly on goals.
	6. Originate Validation Worksheets	Record the set of critical subprocess areas for all development organizations on forms that can be used in subsequent information collection efforts.	Deleted, annotating worksheets subsumed within various steps.

Table A-1: SCE V2.0 to SCE V3.0 Activity Mapping

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V2.0 Phase	V2.0 Step	V2.0 Purpose	V3.0 Activity Mapping
Phase 3: Specific Preparation	7. Select Projects to Investigate	Select projects for evaluation that give the most insight into the processes that will be used.	Activity 6, Step 6B, Select Projects
	8. Develop Key Issue Worksheet	Create a consolidated list of key issues for investigation at the development organization site.	Activity 7, Step 7A, Prioritize Focus Areas
	9. Develop Topic Lists	Select topics for probing the process implementation; topics define observable work practices that map to the critical subprocess areas.	Activity 7, Steps 7A, 7B, 7D, Prepare for Data Collection
	10. Add Topics to Validation Worksheet	Capture the consolidated topic list for use at a particular site.	Deleted, annotating worksheets subsumed within various steps.
	11. Prepare for Exploratory Interviews	Develop detailed interview strategy, including the team's decisions on who will be interviewed, when they will be interviewed, and what they will be asked.	Activity 7, Steps 7B, 7C, Prepare for Data Collection
	12. Prepare Entry Briefing	Establish the agenda for the initial organization meeting and set initial expectations for the site visit.	Activity 6, Step 6D, Prepare Initial Briefing(s)

Table A-1: SCE V2.0 to SCE V3.0 Activity Mapping (cont.)

V2.0 Phase	V2.0 Step	V2.0 Purpose	V3.0 Activity Mapping
Phase 4: Site Data Collection	13. Conduct Initial Organization Meeting	Clarify expectations of the SCE site visit.	Activity 6, Step 6E, Conduct Initial Briefing(s)
	14. Conduct Initial Document Review	Determine the degree to which the organization and project-level documentation define and support standard processes for the KPAs and subprocess areas under investigation.	Activity 9, Review Documents
	15. Conduct Exploratory Interviews	Provide insight into how the subprocess areas are implemented in practice, determine the extent that processes have been internalized by the development organizations, identify critical implementation-level documents.	Activity 10, Conduct Interviews
	16. Hold Team Caucus	Analyze, share, and consolidate information in order to reach conclusions about topics.	Activity 11, Step 11A, Organize and Combine Data
	17. Conduct Document Review	Search for objective evidence of how processes are implemented at the working level.	Activity 9, Review Documents
	18. Develop Preliminary Findings	Articulate conclusions about the subprocess areas based on the information available, guide subsequent information-gathering efforts.	Activity 11, Step 11B, Determine Data Sufficiency
	19. Create Consolidation Plan	Plan and initiate further data collection.	Activity 11, Step 11C, Review and Revise Data Gathering Plans
	20. Conduct Consolidation Interviews	Clarify any remaining issues by confirming or negating candidate findings through further interviews.	Activity 10, Conduct Interviews
	21. Conduct Final Document Review	Clarify any remaining issues by confirming or negating candidate findings through further document review.	Activity 9, Review Documents

Table A-1: SCE V2.0 to SCE V3.0 Activity Mapping (cont.)

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V2.0 Phase	V2.0 Step	V2.0 Purpose	V3.0 Activity Mapping
Phase 5: Findings	22. Determine Findings	Validate the preliminary findings and consolidate them by KPA.	Activity 11, Consolidate Data, and Activity 14, Step 14A, Prepare Final Findings Presentation
	23. Produce Findings Report	Document the SCE activities and provide a formal record of the findings.	Activity 15, Steps 15A, 15B, 15C, Produce Reports and Support Follow-on Activities
	24. Conduct Exit Briefing	Provide feedback to the recipient and conclude the SCE.	Activity 14, Step 14C, Close Out Site Activities

Table A-1: SCE V2.0 to SCE V3.0 Activity Mapping (cont.)

Notes: In SCE V2.0, there were no formal, explicit steps for

1. Analyzing all parts of the requirements activity (SCE V3.0 Activity 1A, 1E, 1F); these components of were described in sections of the implementation guide.
2. Documenting the appraisal plan (SCE V3.0 Activity 2); components of it were described in sections of the implementation guide.
3. Tailoring method use (SCE V3.0 Activity 2E), because the method was designed to be application (source selection) specific.
4. Obtaining organization information (SCE V3.0 Activity 4), as it was implicit in SCE V2.0 Steps 4, 7, and 8, and was explicitly described in the implementation guide (source selection specific).
5. Receiving presentations (SCE V3.0 Activity 8); this was described in guidance for executing SCE V2.0 Step 13.
6. Delivering draft findings (SCE V3.0 Activity 12), due to source selection limitations.
7. Making rating judgments (SCE V3.0 Activity 13) since Maturity Level determination was not an option.
8. Presenting final findings (SCE V3.0 Activity 14B), due to source selection considerations.
9. Supporting follow-on activities (SCE V3.0 Activity 15D), as prior method rationale was to strictly separate determination of appraisal results from the use of those results.

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Appendix B SCE V3.0 to CAF V1.0 Requirements Traceability Table

SCE V3.0 Method High-Level Architecture

The diagram below depicts the high level architecture of the SCE V3.0 Method. This architecture is adapted from the SEI CMM Appraisal Framework (CAF) [Masters 95].

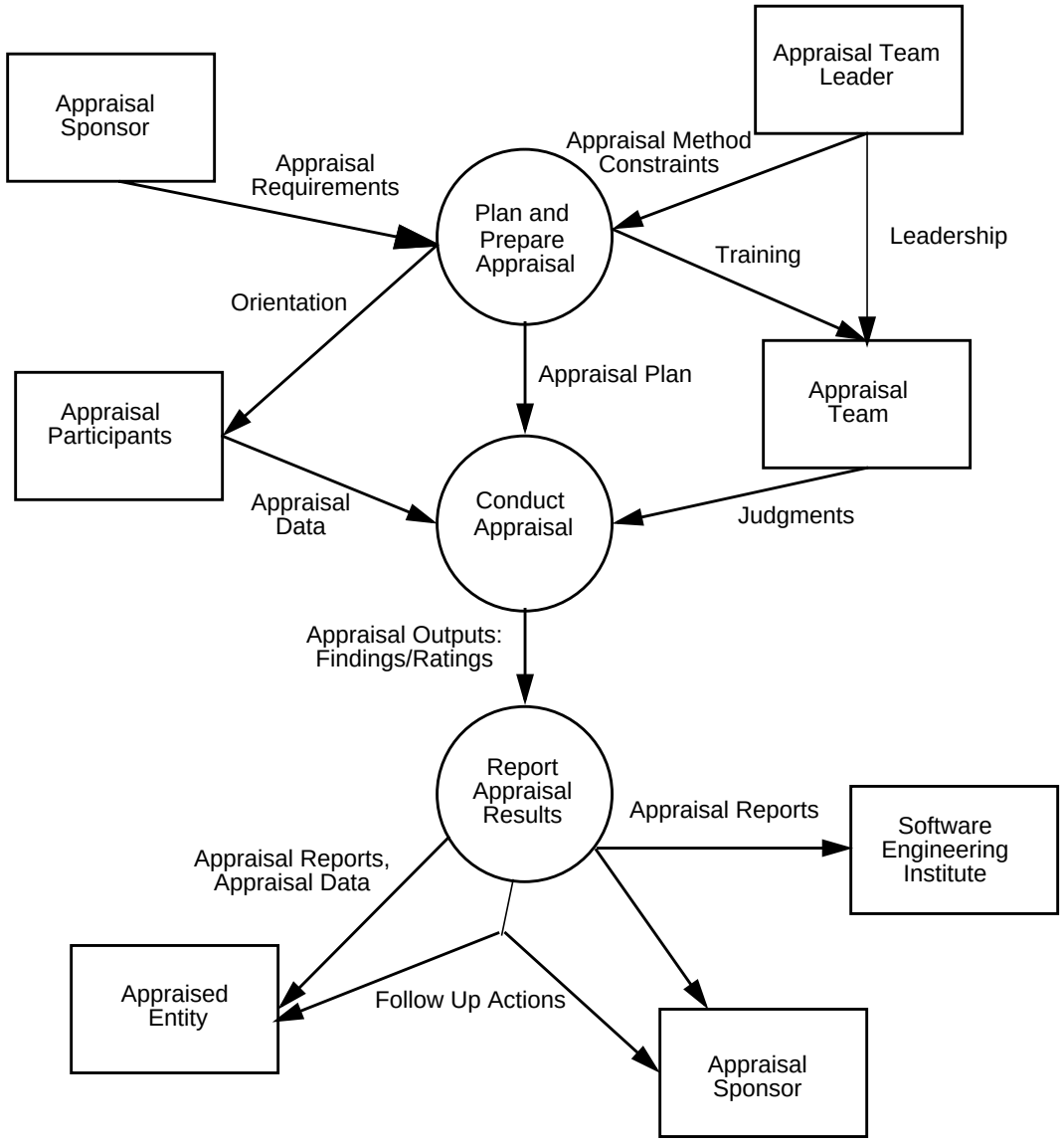

Figure B-1: SCE V3.0 High-Level Architecture

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The principal differences between this figure and the analogous figure in the CAF are

- follow-up actions are shown as an output of Report Results
- appraisal team leader provides leadership as an input to the appraisal team
- appraisal participants are depicted on the figure only once
- the appraisal plan is not shown as a direct input to Report Results
- appraisal outputs specify both findings and ratings

Phase	Activity	Steps	CAF V1.0 Req'ts
Plan and Prepare Appraisal	1. Analyze Requirements	1A Determine Appraisal Goals	R3
		1B Determine Appraisal Constraints	R3
		1C Determine Reference Model Scope	R4
		1D Determine Organizational Scope	R5
		1E Determine Appraisal Outputs	None
		1F Obtain Commitment	R6
	2. Develop Appraisal Plan	2A Identify Required Resources	R15
		2B Identify Cost	R15
		2C Identify Schedule	R15, R16
		2D Work Out Logistics	R17
		2E Tailor Method	R15
		2F Plan Use of Appraisal Outputs	R15
	3. Select and Prepare Team	3A Select Team Leader	R7, R8
		3B Select Team Members	R7, R8, R9
		3C Prepare Team	R10
	4. Obtain Organizational Information	4A Identify Required Information	None
		4B Request Information	R19
		4C Provide Information (Organization)	None
	5. Analyze Instrument Data	5A Receive and Summarize Instrument Data	R19
		5B Examine and Review Instrument Data	R19
		5C Develop Profile(s) Analyses	R19
	6. Select and Prepare Participants	6A Select Site(s)	R11
		6B Select Project(s)	R12
		6C Select Participants	R13
		6D Prepare Initial Briefing(s)	None
		6E Conduct Initial Briefing(s)	R14
	7. Prepare For Data Collection	7A Prioritize Focus Areas	R19
		7B Establish Interview Strategy	R19
		7C Script Questions	R19
		7D Establish Document Review Strategy	R19
		7E Revise Appraisal Team Roles and Responsibilities	R19

Table B-1: SCE Activities and Their Associated Steps and CAF Requirements

Phase	Activity	Steps	CAF V1.0 Req'ts
Conduct Appraisal	8. Receive Presentations	8A Listen 8B Ask Questions 8C Take and Tag Notes	R19 R19 R19
Conduct Appraisal (cont.)	9. Review Documents	9A Determine Information Needed 9B Select or Request Documents 9C Review Documents 9D Take and Tag Notes	R19 R19 R19 R19
	10. Conduct Interviews	10A Determine Information Needed 10B Select or Request Interviewees 10C Ask Questions 10D Listen 10E Take and Tag Notes	R19 R19 R19 R19 R19
	11. Consolidate Data	11A Organize and Combine Data 11B Determine Data Sufficiency 11C Review and Revise Data Gathering Plan	R20 R21, R22 R23, R24, R25
	12. Deliver Draft Findings	12A Prepare Draft Findings Presentation 12B Present Draft Findings and Solicit Feedback 12C Listen 12D Take and Tag Notes	R19, R21 R19, R21 R19, R21 R19, R21
	13. Make Rating Judgments	13A Judge Satisfaction of Key Practices 13B Judge Satisfaction of Common Feature 13C Judge Satisfaction of the Process Area Goals Based on Implementation and Institutionalization 13D Judge Satisfaction of Process Areas 13E Determine Maturity Level	R30, R31, R32 R30, R31, R32 R26, R28, R29, R30, R31, R32, R33 R26, R28, R29, R30, R31, R32, R34 R27, R29, R31, R32, R35
Report Appraisal Results	14. Deliver Final Findings	14A Prepare Final Findings Presentation 14B Present Final Findings 14C Close Out Site Activities	R36 R37 None
	15. Produce Reports and Support Follow-On Activities	15A Product Reports 15B Distribute Reports 15C Preserve and/or Dispose of Records 15D Support Follow-On Activities	R36, R37 R38 R39, R40 None

Table B-1: SCE Activities and Their Associated Steps and CAF Requirements (cont.)

Note: CAF V1.0 requirements R1-R2 (document the method, provide guidance for three phases of appraisal execution), and R18 (select artifacts to support method activities) are satisfied by creating the SCE V3.0 materials (Method Description, Implementation Guide, and Training).

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Appendix C SCE V3.0 Temporal Flow

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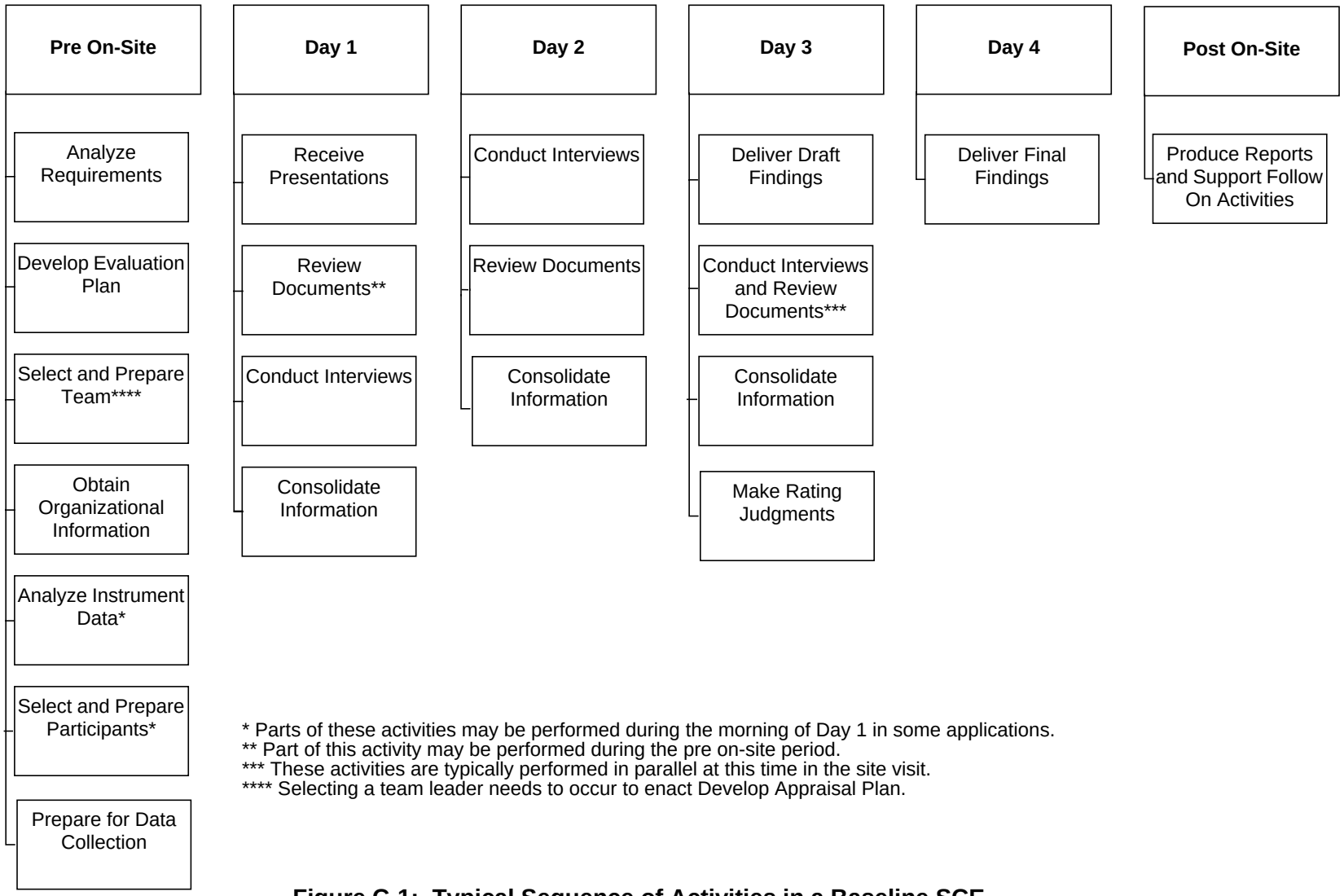

* Parts of these activities may be performed during the morning of Day 1 in some applications.
** Part of this activity may be performed during the pre on-site period.
*** These activities are typically performed in parallel at this time in the site visit.
**** Selecting a team leader needs to occur to enact Develop Appraisal Plan.

Figure C-1: Typical Sequence of Activities in a Baseline SCE

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Day	Time Allotted	SCE V3.0 Activity	Parallel Activities	Calendar Time and Notes
Pre On-site	8 hrs	1. Analyze Requirements		1 week
	16 hrs	2. Develop Evaluation Plan	Select and Prepare Team	2 weeks
	40 hrs	3. Select and Prepare Team	Obtain Organizational Information	4 weeks — assumes team training required; does not include travel
	4 hrs	4. Obtain Organizational Information	Select and Prepare Team	4 weeks (assumes an acquisition SCE)
	8 hrs	5. Analyze Instrument Data	Select and Prepare Participants	1 week
	16 hrs	6. Select and Prepare Participants	Prepare for Data Collection	2 weeks — time does not include any travel
	16 hrs	7. Prepare for Data Collection		Assumes multiple projects
On Site Day 1	1 hr	8. Receive Presentations		Initial Briefing from Ac6 may be done here
	2 hrs	9. Review Documents		Initial document review only — may be done during pre on-site
	4 hrs	10. Conduct Interviews		All-on-one management interviews typically
	3 hrs	11. Consolidate Data		
Day 2	6 hrs	10. Conduct Interviews		All-on-many (practitioner) interviews typically
	2 hrs	9. Review Documents		
	3 hrs	11. Consolidate Data	Review Documents	
Day 3	4 hrs	12. Deliver Draft Findings		
	2 hrs	9, 10. Conduct Interviews and Review Documents	Both done in parallel	Few-on-one interviews typically
	2 hrs	11. Consolidate Information	Review Documents, Conduct Interviews	Data collection is very focused
	3 hrs	13. Make Rating Judgments		
Day 4	4 hrs	14. Deliver Final Findings		
Post On-Site	32 hrs	15. Produce Reports and Support Follow-On Activities		8 weeks — Time allotted is minimum
Sub-Total	108 hrs	Plan and Prepare Phase		Includes training as a one time major event
Sub-Total	32 hrs	Conduct Evaluation Phase		
Sub-Total	36 hrs	Report Evaluation Results Phase	Follow on activities	Follow on time is additional

Table C-1: Temporal Flow of SCE V3.0 Activities

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Day	Time Allotted	SCE V3.0 Activity	Parallel Activities	Calendar Time and Notes
Grand Total	176 hrs			

Table C-1: Temporal Flow of SCE V3.0 Activities (cont.)

Appendix D SCE Information Flow

D.1 Introduction

The following figures depict the SCE V3.0 method from an information flow perspective. The diagrams were generated using a simple data flow diagramming tool. Due to features of the tool used, several points should be made in regard to the way information is depicted.

Notes

In order to improve readability of the diagrams, a few of the data flows are not depicted. For example, the data flow between Develop Evaluation Plan and Select and Prepare Participants showing the Evaluation Plan as an output from the former and an input to the latter is not shown. This input/output relationship is shown in the SCE V3.0 Activities Table preceding the flow diagrams.

The names of the processes do not always match the names of the method activities shown in the Activities Table due to the character number limitation of the DFD tool used. An example is that the “Plan and Prepare for Evaluation” phase is simply described as “Plan and Prepare” in the flow diagram.

Data Reports, generated from the DFD tool describing the information flow items, are provided in an appendix. In this version of the method description, the reports only describe processes, data stores, and external entities. The reader may wish to review these reports during or after looking at the information flows, because they contain textual information about each of the items.

D.2 How To Read These Information Flows

The information flow diagrams can be read much like a standard data flow diagram (DFD). The specific conventions embedded in the DFD tool used to create the diagrams are listed below.

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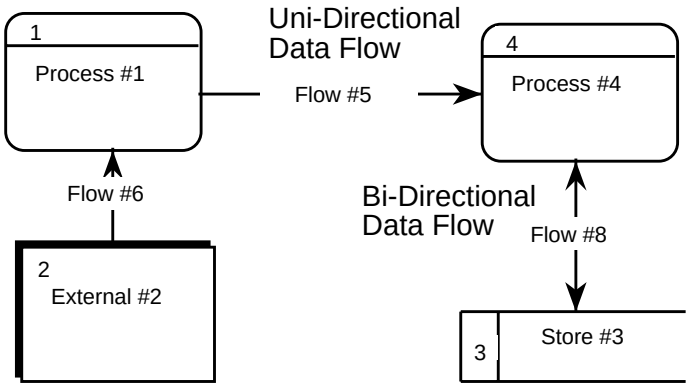
External entities, Data stores, Processes, and Data flows



External entities are shown as a box with a shaded background.

Data stores are shown a rectangle with an open side. Data stores are defined to allow the appropriate data flow inputs and outputs to processes.

Processes are shown as boxes with rounded corners. Processes in these diagrams are equivalent to method activities in the phase diagrams.

Data flows are depicted by the lines going between processes, external entities, or data stores. They can be either unidirectional or bidirectional.

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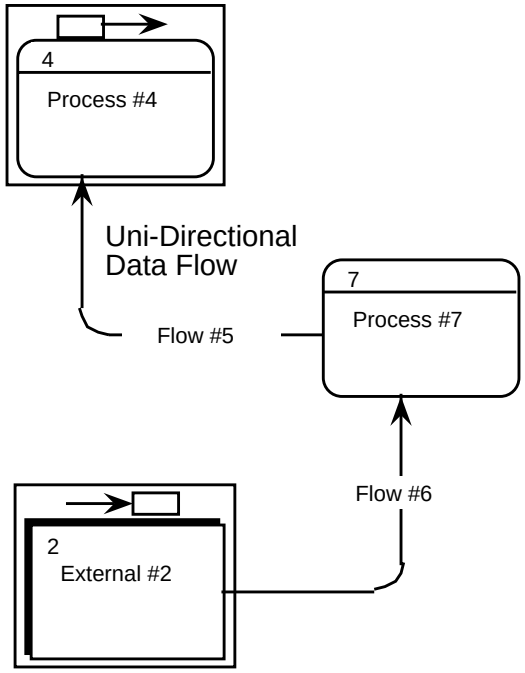
Inherited item, in-coming flow and Inherited item, out-going flow



An item with a small box and arrow on the top of it depicts a process, external entity, or data store inherited from a parent diagram. An arrow going “out” of the small box on top of the item depicts an inherited item with an **out-going flow**. An arrow going “in” to the small box depicts an inherited item with an **in-coming flow**. The name of the inherited item is exactly as stated on the parent item. The inherited items are used for consistency checking between parent and child diagrams in the DFD structure.

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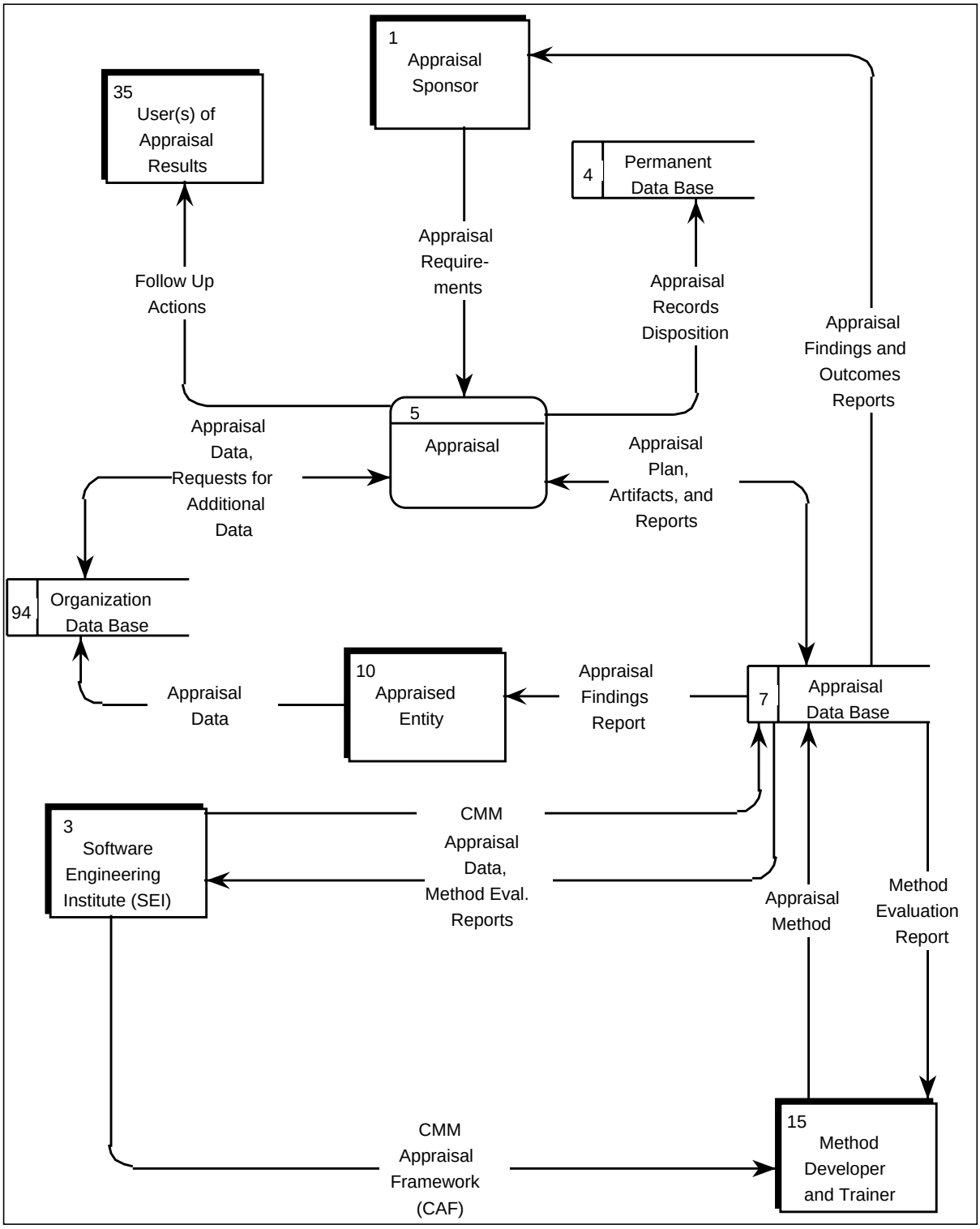

Figure D-1: SCE V3.0 System Diagram

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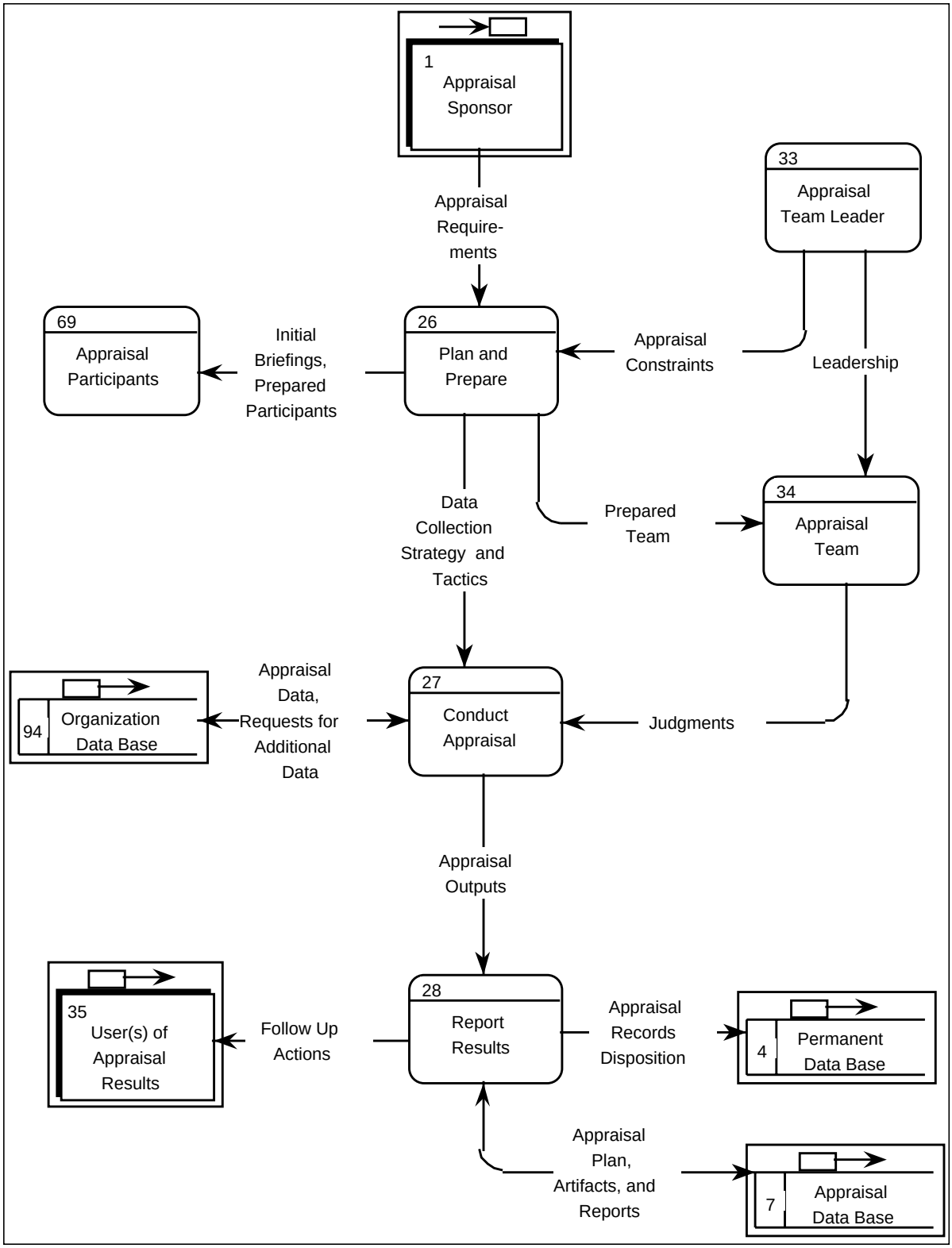

Figure D-2: SCE V3.0 Phase Diagram

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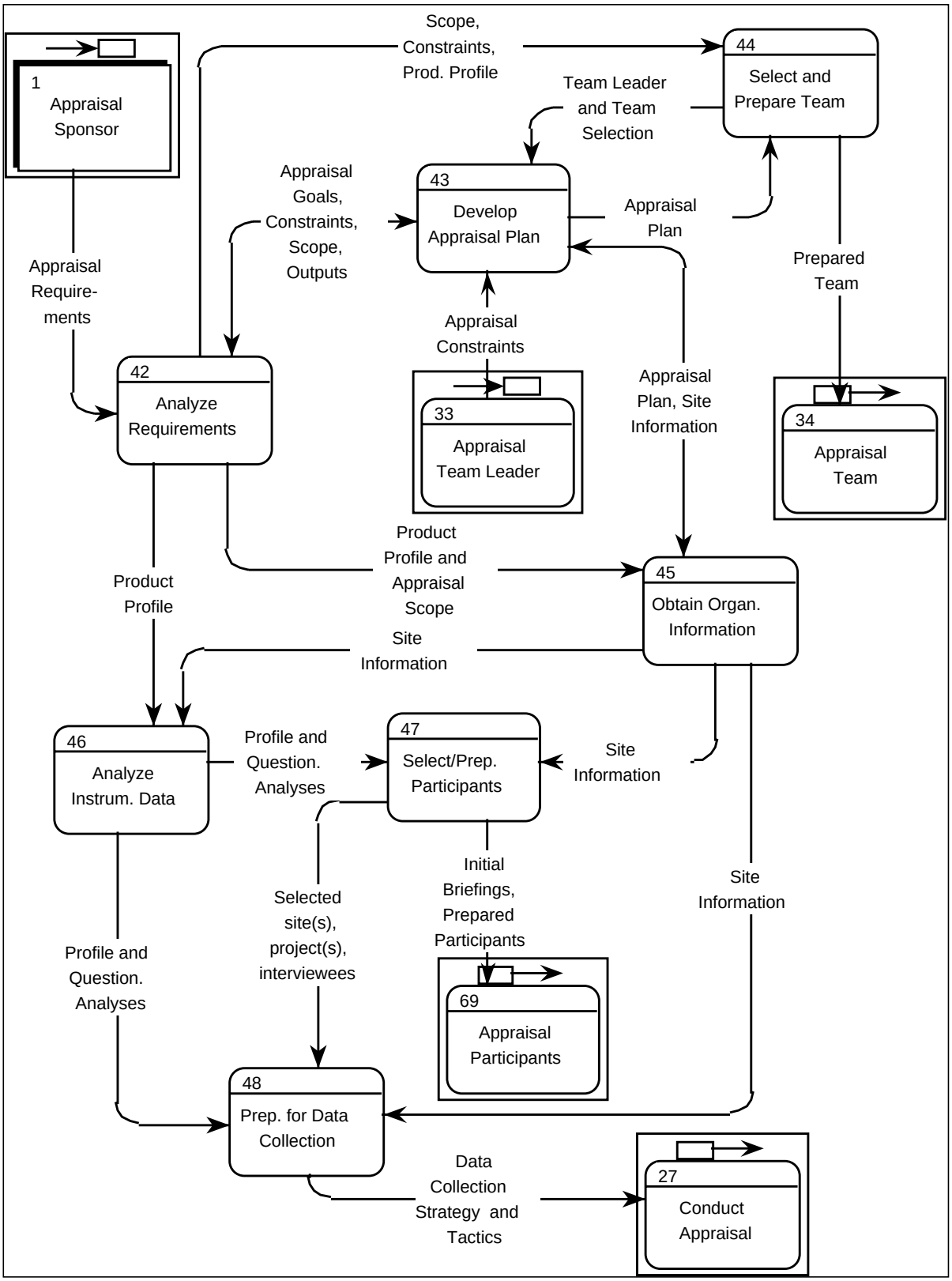

Figure D-3: Plan and Prepare for Evaluation Phase

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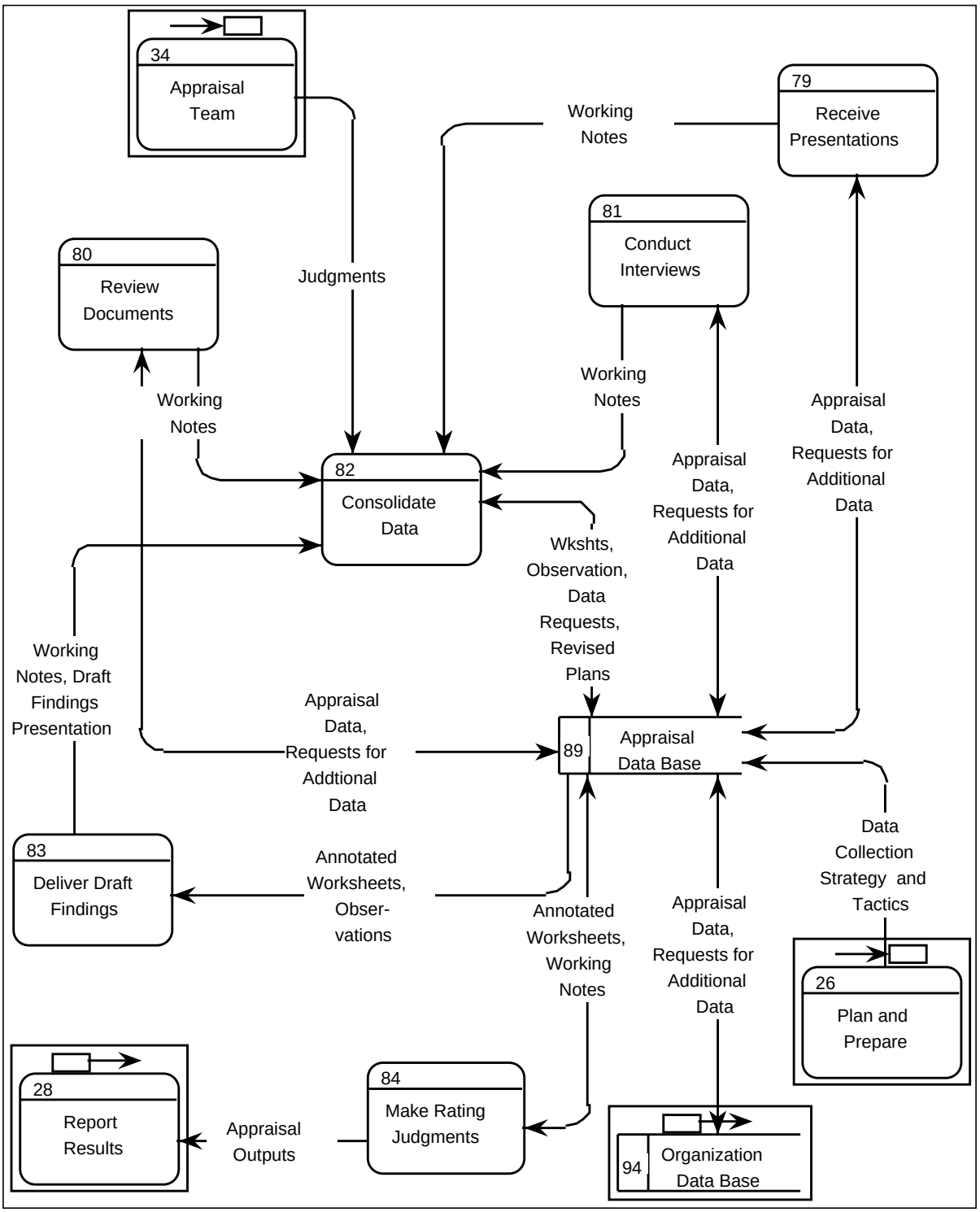

Figure D-4: Conduct Evaluation Phase

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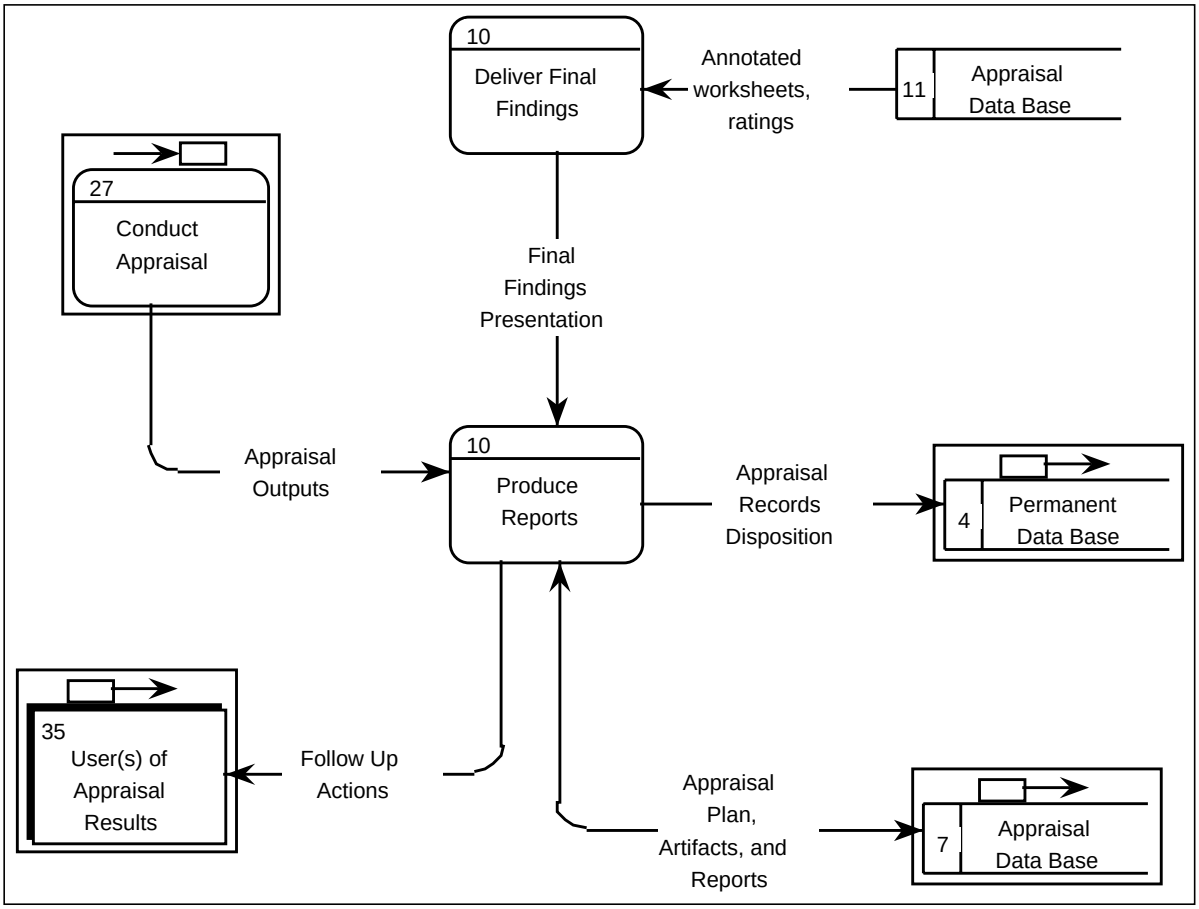

Figure D-5: Report Evaluation Results Phase

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Appendix E SCE V3.0 Version Description

The SCE method is designed to resolve outstanding community issues with the SEI appraisal methods. Summary level community requirements, collected by the SEI during the 1992-1993 time frame, can be summarized in the following broad areas:

- Baseline the SEI appraisal methods
- Make the methods public
- Incorporate the CMM into the SEI methods
- Align assessment and evaluation methods with each other

The first three bullets were addressed by previous versions of the SCE method. Evolution of SCE V2.0 to SCE V3.0 principally effects the fourth bullet, aligning SEI methods by incorporating the CMM Appraisal Framework (CAF). The CAF provides essential requirements for any method which chooses to be CMM-based. SCE V3.0 continues to be baselined, public, and make use of the published CMM.

Impact of major changes

The changes described above have made it easier to tailor an SCE to the business needs of the sponsor. They improve the utility and versatility of the method by providing more thorough and detailed guidance to users of the method. Finally, the changes continue to provide a baseline for orderly public evolution of the method.

The major changes from SCE V2.0 to V3.0 are:

- CMM Appraisal Framework (CAF) compliance
- implementation of requirements beyond minimum CAF compliance
  - support follow on activities
  - rate KPAs (if selected in planning)
  - plan use of appraisal outputs
- CMM knowledge is a prerequisite
- method independent of the application
- evaluation process improvement — reduction in the number of method activities
- Plan and Prepare For Evaluation phase changes
  - experience table used in acquisition applications only
  - elimination of subprocess areas — reference model boundaries determined directly from goals or other model components
- Conduct Evaluation phase changes — collect and record data
  - group interview techniques added

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  - presentations as a data collection tool added
  - instruments may provide a source of observations
  - explicit examination of key practices (when selected in planning)
  - explicit examination of alternative practices

- Conduct Evaluation phase changes — making judgments
  - explicit model coverage and judgment rules added
  - non-reference model findings are captured

- Report Evaluation Results phase changes
  - formal ratings have been reinstated and rating rules are explicit
  - ratings are provided for any model component that meets method rules and was explicitly planned for
  - maturity level rating is reinstated as an option
  - follow on activities have been added (support the use of appraisal results)

- Application changes
  - method is extendable for use with other models (such as the Trusted Systems CMM)
  - contractor teaming arrangements are addressed

CAF Compliance

The SCE method V3.0 fully implements the requirements of the CAF. The CAF defines requirements for method developers to implement should they choose to build a CMM-based method. The CAF is a critical component of the SEI strategy for meeting the customer community requirement of aligning the appraisal methods. A SCE V3.0/ CAF requirements traceability table is provided in Appendix B.

Implementation of requirements beyond minimum CAF compliance

- support follow on activities

  The CAF requirements end with the delivery of appraisal reports and the proper disposition of the appraisal data. SCE V3.0 includes activities supporting use of the appraisal results to help meet business objectives. Relative to SCE V2.0, this specifically means that one or more SCE team members are expected to assist the procurement officials in determining risk assessments using the SCE findings. Users have routinely asked that this important aspect be addressed in the SCE method documentation. Principally, this comes in the form of additional guidance in the *SCE V3.0 Implementation Guide for Acquisition*.

- rate key practices and common features (if selected in planning)

  The CAF requirements for rating CMM components addresses goals, KPAs, and maturity level (if selected as an option). SCE V3.0 includes rating key practices and common features of the CMM if these components are selected during appraisal planning, and the data collected by the team meets the method's coverage and corroboration rules. This addresses user needs of increasing the specificity of appraisal results to better support follow on activities such as action planning and risk assessment.

- plan use of appraisal outputs

  The CAF has no requirements directly related to planning the use of appraisal outputs. This is related to the CAF not requiring support of follow on activities. In SCE, this planning has always been an important aspect, since the government regulations enforcing source selection procedures dictate that this planning occur up front, prior to conducting a site visit. In SCE V3.0, planning the use of appraisal outputs up front in the appraisal process will continue to be supported by the method.

In general, the rigorous process that users have come to expect in executing the SCE method will continue.

CMM knowledge is a prerequisite

User feedback over the past three years has made it very clear that successful implementation of the SCE method is highly dependent on the CMM knowledge of the team members. Lack of this knowledge has been an important reason of perceived inconsistencies in SCE results, and for increasing difficulties in properly executing the method. Much of this relates to the sheer size and depth of the CMM. CMM knowledge has always been strongly recommended. Requiring CMM knowledge, coupled with improved and expanded CMM training associated with evaluator training, will help achieve the community repeatability and consistency goals.

Method independent of its application

The preparatory steps conducted in previous version of the SCE Method focused each SCE on the software processes that contribute the most to risk for the planned development. When the method was question based, SCE teams looked at essentially the same software processes each time the method was used. By emphasizing the KPAs and subprocess areas, the SCE V1.5 and V2.0 methods allowed a team to select the areas for evaluation that are most important for the given use of the method. This tied the method directly to its application, but limited its evolution to other uses and the comparability of results across applications.

In the design of SCE V3.0, the application of the method has been separately documented. this allows greater flexibility in the baseline method, while continuing to provide the implementation detail which was greatly valued by the original sponsors of the method. This separation is principally achieved by improving the *SCE V3.0 Implementation Guide for Acquisition*.

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Evaluation process improvement — reduction of the number of activities

Both SCE V1.5 and V2.0 have the same 24 discrete steps, divided into 5 phases. Documenting the “as is” appraisal process used in the SCE method during the period between 1991-1994 was an important step towards satisfying customer concerns about public documentation, and created a sound basis for process improvement in the method.

In SCE V3.0, the original 24 steps and 5 phases have been reduced to 15 activities and 3 phases. This was accomplished by

- mapping SCE phases directly to the CAF phases
- deleting redundant or “low-level” steps
- recombining several steps with similar functions
- adding 9 implicit or missing high level activities and detailed steps

The result of these improvements is a net 37% reduction in overall process activities while simultaneously increasing the completeness of appraisal process coverage. Thus, the method is more intellectually manageable, allowing teams to focus more time on the technical challenges of collecting and making judgments about process data, rather than on the execution of a complex set of steps.

Plan and Prepare For Evaluation phase changes

- experience table used in acquisition applications only

  This change is linked to the goal of separating the baseline method from its associated applications. The previous published versions of SCE were tightly coupled to meeting the needs of the original method sponsor (the U.S. DoD) for a specific application — source selection. This coupling, although extremely valuable to the sponsor, limited and constrained innovative uses of the method for process monitoring or internal evaluation. Since the experience table is principally used by teams in the general preparation activities designed to set a “level playing field” in an acquisition, this aspect could be specified in the method supplement for acquisition, rather than in the baseline SCE V3.0 method.

- elimination of subprocess areas — reference model boundaries are determined directly from goals or other model components

  The KPAs in the maturity model were refined to include subprocess areas in an earlier version of SCE.[1] Also, a set of elements [2] (now called *features*) common to all of the subprocess areas was defined to help the teams select topics to be evaluated. This was necessary at the time because of the shift away from a question-based method to a model based method, and because it was implemented prior to the release of the CMM.

1. In version 2.0 of the SCE Method, the subprocess areas are derived from the goals of CMM v1.1 [Paulk 93a]. Previous versions of the SCE Method were not CMM-based.

2. Previous versions of SCE used the term *element*. In version 2.0 of SCE, the term *features* was used in place of *elements*. The term has changed; the concept has not.

Collectively, subprocess areas and their common elements improved the SCE team's ability to probe specific software processes. As the method and model evolved, and the SEI intent to align the appraisal methods became clear, the original notion of subprocess areas changed to be directly mapped to the CMM V1.1. The subprocess areas in SCE V2.0 were defined by a one-to-one relationship to the goals of the CMM V1.1 KPAs. As such, the value added to the method no longer outweighed the added burden of terms, forms, steps, etc. The SCE V3.0 method was simplified by tying activities for determining reference model scope directly to the CMM, eliminating the need for subprocess areas.

Conduct Evaluation phase changes — collect and record data

- group interview techniques added

  Previous versions of SCE defined interviews as solely a "many-on-one" activity. This satisfied procurement officials desire for "unbiased" input. However, recipient organizations have for years complained about the "intimidation factor" of this process on junior level practitioners, and have requested others to be present in the room to avoid "mistakes." This was especially important to recipients in a source selection context.

  Furthermore, the SEI Software Process Assessment (SPA) method solely used group interviews ("many-on-many"), called Functional Area Representatives (FARs), to obtain data from practitioners.

  SCE V3.0 has addressed industry concerns about the many-on-one SCE interview and inconsistencies with assessment methods by adding group interviews to the baseline method. Allowing groups of related practitioners to be interviewed together potentially increases the amount and breadth of data collected, reduces the intimidation factor, and is consistent with CBA IPI.

  Options for conducting practitioner interviews in a many-on-one mode have been retained to allow flexibility for sponsors. Management interviews may also be done in a many-on-many mode in addition to the standard many-on-one style.

- presentations as a data collection tool added

  The baseline SCE V3.0 method explicitly adds the use of presentations to collect and validate data. Thus, organizational presentations to the team may generate observations, and presentations by the team to the participants may also generate data as well as validate preliminary findings. Options in acquisition for minimizing team interaction with the site participants in feedback sessions has been retained.

- instruments may provide a source of observations

  In the original SCE method [Humphrey 87b], the questionnaire essentially defined the method. In SCE V1.5 and V2.0 [SCE 93, SCE 94], the maturity questionnaire was only used as a starting point by the team in focusing effort and prioritizing time on site. Data from the questionnaire could not be used as part of the consolidation and judgment process. This was due in part to the limitations inherent in previous versions of the questionnaire, the method, and the model.

  In SCE V3.0, instrument data can be used to generate observations used during the consolidation and judgment activities. Instrument data includes the CMM Maturity Questionnaire V1.1, and the SCE profiles. There are specific rules for how these items can be used.

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- explicit examination of key practices (when selected in planning)

  Although SCE teams have routinely used the entire CMM since it was published, previously published versions of the SCE method did not explicitly encourage direct examination of key practices. This was based on a principle well documented in the CMM and supported by industry that the CMM key practices are not intended to be prescriptive. There was a general concern that SCE teams examining key practices would create an environment that was too “audit-like.”

  User and recipient feedback over time has strongly suggested that although this is a valid concern, it belies how people actually use the CMM as a reference model. SCE V3.0 allows explicit examination of key practices when these items are selected by the sponsor and the team during appraisal planning. Rating of these items cannot occur unless method rules have been followed (see rating of key practices and common features in this section). Coupled with improved training and explicit examination of alternative practices, the risks cited above are minimized.

- explicit examination of alternative practices

  SCE V3.0 has added explicit examination of alternative practices to those in the CMM. This activity is embedded within the method and associated training. This supports concepts in the CMM, allowing organization greater flexibility when concerned about externally led evaluations, and allows SCE teams to examine processes in greater detail and report results with much more specificity than in the past.

Conduct Evaluation phase changes — making judgments

- explicit model coverage and judgment rules added

  SCE V3.0 has added explicit model coverage and judgment rules. These concepts were supported by previous SCE versions, but were not as explicit as necessary to fully support repeatability and consistency goals. The CAF requirements are embedded in the SCE V3.0 method. Method documentation provides additional guidance.

- non-reference model findings are captured

  Previous versions of SCE limited teams to collecting data and reporting results only in those pre-defined CMM components identified in planning. SCE V3.0 has made collection and reporting of non-reference model findings a part of the baseline method. Thus, information that comes up during a site visit that may be important to the recipient organization and the sponsor, but is not directly related to the model, is not lost.

Report Evaluation Results phase changes

- formal ratings have been reinstated and rating rules are explicit

  Earlier versions of the method only reported the appraisal findings (strengths and weaknesses). In SCE V3.0, ratings rules have been added such that model component satisfaction ratings can be produced by the team. This helps achieve the goal of improving communication of appraisal results between the team and their sponsors.

- ratings are provide for any model component that meets method rules and was explicitly planned for during the plan and prepare appraisal phase

  Method rules now require the team to rate a model component if it is planned to be rated, and the team is able to meet related method rules for coverage and validation during the site visit. Assuming these rules are met, teams shall rate the associated component. This helps achieve the goal of providing more specific actionable results to the sponsor.

- maturity level rating is reinstated as an option

  Maturity level ratings can be useful to describe improvement goals, or for process improvement efforts, or for describing capability to customers. In earlier versions of the SCE method, the method and model documentation was not sufficiently robust to allow teams to repeatedly and consistently determine maturity ratings. The key issue was in translating the detailed findings of strengths and weaknesses into a “satisfaction” determination. User feedback has shown that both types of information are needed to support sponsor business goals and process improvement goals. These considerations, coupled with improvements in the method, its associated documentation and training, and its reference model have allowed the method developers to reinstate maturity level ratings as a viable option to users. This is the first time since the release of the original Maturity Questionnaire [Humphrey 87b] that there has been an explicit scoring mechanism built into the method.

- follow on activities have been added (support use of appraisal results)

  This activity is a key link between the appraisal process and the system level process that uses the method results. Users and recipient organizations have requested more information on translating findings into useful outcomes, such as risk identification in an acquisitions. SCE V3.0 adds guidance for this activity in the baseline method.

Application changes

- contractor teaming arrangements are addressed

  In the 1980’s, use of the SCE method focused on one site, principally because the majority of the system and software was typically created and integrated at one location. With increasing use of contractor teams and subcontractors in the 1990’s to produce important portions of the system and software, SCE V3.0 includes a discussion of conducting SCEs in this environment. This discussion can be found in the *SCE Version 3.0 Implementation Guide for Supplier Selection.*

- method is extendable for use with other models (such as the Trusted Systems CMM)

  An essential design characteristic of SCE V3.0 was to prepare a “generic” appraisal process that would maintain fidelity to the CMM for Software V1.1, but would also be extendable to the various new models that have recently been created or are in development. SCE V3.0 builds in the ability to readily evolve to these models without requiring sponsors and users to build, learn, and maintain additional appraisal methods.

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Appendix F Attribute Definitions

This appendix contains definitions of the attributes used in the SCE method. The attributes specify important characteristics of a product or environment for developing a product that significantly impact the processes that are implemented by the organization.

The attributes allow an SCE team to make comparisons between profiles in a systematic way. Attributes are used to compare previous development organization and end user experience to the attributes of the current, target, or desired development. This comparison identifies potential risk areas that help to refine and focus the SCE.

The same attributes are used to populate all of the profiles used in the method. These profiles are created and used during the Plan and Prepare for Appraisal phase. The profiles are an “instrument” data collection mechanism.

F.1 Profile Attributes

Application domain

The *application domain* attribute indicates the area of subject matter expertise.

There is no accepted taxonomy of application domains; however, the concept is widely understood and used. Information systems, command and control systems, weapon systems, simulation systems, training systems, avionic systems, sensing systems, and so on are all recognized and accepted as different application domains. What makes application domains different is the operational environment that uses the system. The unique characteristics of the operational environment are

- The mission for which the system is needed.
- The roles and responsibilities of the people who interface with the system.
- The resources that the system depends upon, which defines the potential limit of the services that the system can provide the people in the operational environment.

Product type

The *product type* attribute refers to the particular aspect of the application domain which the system will support or to the type of service which the system will provide. It may be considered a subset of the application domain.

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For example, communications or displays could be product types in a command and control system, a weapons system or other application domain. Although there may be similarities in the communications subsystem in the various application domains, they each have their own set of unique problems that must be addressed.

Size

The size attribute is composed of three related attributes.

- *duration*
- *team size*
- *estimated size*

The *duration* is the estimated or required length of time to deliver the product. It is usually specified in number of months. The *team size* is the number of engineers (e.g., software developers) who will be involved in the project. This includes both direct roles (e.g., design) and support roles (e.g., quality assurance). The *estimated size* is the base element used in planning an effort. The parameter used depends on the system being built and the purpose of the appraisal. In a software system, the size would be stated in source lines of code, number of function points, or some similar measure suited to the development.

There is no standard way of measuring the size attributes. For an SCE, the specific method used is not as important as consistently using whatever method is chosen so comparisons will be meaningful.

Reuse estimate

The *reuse estimate* attribute indicates the development organization's approach to building the product. It is correlated with the size attribute. Reuse estimates are indicated by the percentage of the product that is

- new
- modified (from existing components)
- reused (previous components used as is)

Processes implemented for accomplishing high amounts of reuse are significantly different from processes for developing new items.

Type of work

The *type of work* attribute is used to indicate the portion of the life cycle which will be performed by the development organization.

The following are examples of different types of work that may be required:

- full development: The development organization is required to build a product based upon the system requirements. The development organization will typically be required to complete software requirements, top level design, detailed design, code and unit test, and acceptance testing at the development organization's site.
- code development: The development organization is required to develop code according to the system requirements and software top level design provided by the issuing authority. This type of development might be done under a delivery order contract. The development organization may do the detailed design, coding, integration, and testing, but the system testing may be done by the customer.
- system development without coding: The development organization may be required to do all the work except the software detailed design and development.
- a prime contract acquisition: In a large system acquisition there may be many organizations who subcontract significant parts of the system, especially software parts. The prime contractor allocates system requirements to the subcontractor, integrates the components, and conducts acceptance tests.

Development team approach

The *development team approach* attribute is related to how the developer organizes itself to produce the system; the degree to which various development and support groups, and the customer, interact and are brought to bear on the effort. This attribute is indicated by various development approach terms, such as:

- integrated product teams
- multi-functional teams
- interdisciplinary
- standard functional

Processes implemented will differ significantly between standard functional and integrated product team approaches. This is not intended to be an all inclusive list. There is no industry standard taxonomy for describing the various approaches to development. Again, consistency in the terminology used is most important.

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Language(s)

The *language* attribute indicates the programming languages in which the software code is written (or will be written). If multiple languages are used or expected, showing the languages and percent of the system implemented in them is useful.

Customer

The *customer* attribute indicates who the development is being done for. Examples include a:

- defense agency
- federal agency
- commercial market
- commercial client
- foreign government
- company internal organization

Applicable standards

The *applicable standards* attribute indicates the standards that are imposed on the project that produces the product, such as ISO-9000-3, MIL-STD-498, DoD-STD-2167A, DoD-STD-2168, or draft MIL-STD-499. Standards often reflect the development and operational “rigor” which is required by customers in specified application domains, product types, and types of work. They could include buyer specific standards, emerging industry standards or reference models, or development organization specific standards.

Major Subcontractors

The *major subcontractors* attribute is used to indicate whether the development organization has or plans to have outside sources produce a substantial amount, primary components, or mission critical aspects of the system functionality. If there are no major subcontractors, this item is not applicable to the evaluation. The major subcontractors attribute does not replace the subcontract management process area of various reference models.

Precedence

The *precedence* attribute indicates whether the developer, end user, and customer (if different from the end user) have experience with the planned, target, or desired system and the environment for producing that system. The values for this attribute are “no” (meaning the entity creating the profile believes the system is unprecedented), or “yes” (meaning the system is precedented to the entity creating the profile.) Systems that are providing a new capability tend

to have more requirements changes that exert stress on existing process capability. Also, if known, a percentage of the system deemed to be unprecedented is useful information.

Target

The *target* attribute indicates the hardware, software, and telecommunications environment that the developed system will operate in.

F.2 Other Related Items

Status and environment information on the current projects submitted for evaluation is asked for by the sponsor on another instrument. The profiles which use these attributes are used by the team during the project selection step during preparation activities. Status and environment items are listed below.

Schedule

The *schedule* attribute is pertinent to current work efforts reflected in the Product Profiles submitted for evaluation by the recipient. They identify where the development organization is on each project.

- Start

The *start* attribute shows when the project actually began.

- Current month

The *current month* attribute is the number of months since the start of the project.

- Current phase

The *current phase* attribute refers to the life cycle phase of the development which the project is currently in, such as requirements analysis, design, coding, unit, integration, or acceptance testing.

- Requirements ends

The *requirements ends* attribute shows how long after the start of the project the requirements phase was completed or is scheduled to be completed.

- Design ends

The *design ends* attribute shows how long after the start of the project the design phase was completed or is scheduled to be completed.

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- Coding ends

The *coding ends* attribute shows how long after the start of the project the coding phase was completed or is expected to be completed.

- Testing ends

The *testing ends* attribute shows how long after the start of the project the testing phase was completed or is expected to be completed.

- Schedule adjustment

The *schedule adjustment* attribute shows how many months the schedule has slipped, or been formally changed, since the original plan.

Environment

The *environment* attribute refers to the hardware, software, and telecommunications environment used to develop the system. This is the systems and software engineering environment. This attribute is principally concerned with the tools component of the environment (rather than the people or process aspects). This is important information because automated tools differ in the type of methodologies, degrees of tool integration, levels of process enforcement, and amount of process flexibility they support.

A list of major tools used is appropriate. Important information sought is:

- principal development methodologies incorporated in the tools
- degree of integration between tools
- level of process enforcement embedded in the tools
- process management support tools used

Terms depicting the environment, such as “integrated CASE,” may also be useful. There is no industry standard taxonomy for this area, although there are emerging standards that can be referenced which discuss these items.

Appendix G Glossary

Ability to perform: One of five common features in the CMM for Software. The ability to perform reflects the preconditions that must exist in the project or organization to implement the software process competently. Ability to Perform typically involves the features of resources, organization structures, and training.

Accuracy: An observation is considered to be accurate if the appraisal team agrees that it is based on what is heard and seen, is worded appropriately, and is correctly categorized and classified [Masters 95].

Activities performed: One of five common features in the CMM for Software. Activities performed describe the roles and procedures necessary to implement a key process area. Activities performed typically involves the features of establishing plans and procedures, performing the work, tracking it, and taking corrective action.

Activity: A key practice of the activities performed common feature in the CMM for Software.

Acquisition: The cradle-to-grave life cycle of a system or product, and one of the primary applications of the SCE method. When used during the pre-contract award phase of an acquisition, may be called a source selection SCE, in reference to the U.S. Department of Defense (DoD) term for the process of selecting a supplier in an acquisition. When used during the contract execution phase, may be called a process monitoring SCE. The purpose of a supplier selection SCE is to provide input to the sponsor on the process capability of one or more development organizations. The outcome from a supplier selection SCE is the selection of the best value supplier for performance of a planned contract. SCE results are just one aspect considered in the sponsor's decision. (See acquisition agency and sponsoring organization.)

Acquisition agency: An organization responsible for developing, delivering, and supporting a system or product. Not normally the producer of the product. For purposes of this document, an acquisition agency is the appraisal sponsoring organization when applying the SCE method for the purpose of selecting a supplier. (See sponsoring organization.)

Alternative practice: Practices which are implemented differently from those described in the reference model that may accomplish the goals of a process area.

Anomaly: A contradictory response to the same question on the questionnaire, or from other data collection mechanisms, by two (or more) projects. May indicate an issue that needs to be probed further. Related to *inconsistency*.

Applicable standards: An attribute used in SCE. This attribute indicates the government or commercial development and quality standards that are imposed on the project or organization, such as DoD-STD-2167A, DoD-STD-2168, MIL-STD-1521B, or MIL-STD-498, or ISO 9000-3.

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Application of the SCE method: Synonym for *use of the SCE method*.

Application domain: An attribute used in SCE. An application domain is “a bounded set of related systems (i.e., systems that address a particular type of problem). Development and maintenance in an application domain usually require special skills and/or resources. Examples include payroll and personnel systems, command and control systems, compilers, and expert systems” [Paulk 93b]. For SCE, this is an attribute used within the various profiles. *The application domain* attribute indicates the area of subject matter expertise needed to translate system requirements into software requirements, and indicates significant differences in the engineering practices which transform the software requirements into accepted code.

Appraisal: An expert or official valuation of something [AHD 85]. In the context of model-based process appraisals, an appraisal is an examination, by a trained team, of an organization's current practices from a process management perspective. This is a dynamic concept — the act of appraising (contrast with appraisal method).

Appraisal constraints: Constraints that affect appraisal conduct such as budget limitations, schedule limitations, and resource limitations (people and facilities) [Masters 95].

Appraisal goals: The desired outcome of an appraisal process [Masters 95].

Appraisal method: The documented process for conducting an evaluation or assessment of something. Specific to SCE, the sequence of steps performed for evaluating the process capability of an organization relative to a reference model. Also, a set of activities, tools, and techniques used by people to appraise the process capability of an organization at a given point in time. An appraisal method describes a process — “a sequence of steps performed for a given purpose” [IEEE]. The term appraisal method typically refers to the method itself, but may also be used to connote the method and its associated documentation and training materials.

Appraisal outputs: Any lasting artifact produced by the team in executing the appraisal. In SCE, the primary output from the site visit is the set of findings. Often synonymous with appraisal results, although in the SCE context appraisal outputs is a broader term, because results only relate to the findings and ratings generated.

Appraisal reports: The set of documented artifacts created by the appraisal team as a result of conducting an appraisal. These reports include: findings briefings and reports, an outcomes report, an appraisal data report, and a method evaluation report. Collectively, they form the official record, or baseline, of the appraisal for subsequent use by the sponsor or other stakeholders in the data and/or process executed. All reports are generated after the conclusion of the site visit except for the findings briefing.

Appraisal requirements: Appraisal goals and constraints [Masters 95].

Appraisal risk: Risk is a measure of uncertainty of attaining a goal, objective, or requirement pertaining to technical performance, cost, and schedule. Risk level is categorized by the probability of occurrence and the consequences of occurrence. This includes the adverse consequences of process variability [MIL-STD-499B]. For SCE, appraisal risk has two components: technical risk inherent in the method as defined or tailored, and process risk in executing the method. Appraisal risk is manifested in the likelihood (probability) of errors in the results (i.e., that the findings and ratings are incorrect). (See *rating baseline.*)

Appraisal scope: The boundaries of the investigation, in terms of the breadth within the organization and the depth within the reference model used. The organizational entities and CMM components selected for investigation [Masters 95]. (See *organizational scope* and *reference model scope*.)

Appraised entity: The organizational units to which appraisal outputs apply. An appraised entity may be any portion of an organization including an entire company, a selected business unit, a specific geographic site, units supporting a particular product line, units involved in a particular type of service, an individual project, or a multi-company team [Masters 95].

Artifact: an object produced or shaped by human workmanship [AHD 85]. For model based process appraisals, artifacts are the products resulting from enacting a process.

Attributes: characteristics of a software product or project. The attributes used in SCE are defined throughout this glossary and are discussed in another appendix of the method description.

Audit: An independent examination of a work product or set of work products to determine compliance with specifications, standards, contractual agreements, or other criteria [Paulk 93b].

Candidate findings: Synonym for observations. Candidate findings are observations for which there is not yet enough objective evidence to make a decision (an unvalidated observation). (See *observations.*)

Caucus: A meeting in which the team analyzes information they have learned while on site during appraisal conduct, including interviews, document review, and presentations, to transform data into observations and finally into findings. SCE teams routinely participate in caucuses, or team meetings, during an SCE site visit. These caucuses are designed to help achieve consensus among the team members. SCE team members analyze, share, and consolidate information in order to reach conclusions about what was seen and heard as a result of their data collection activities. (See *consolidation.*)

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Capability Maturity Model[1] **(CMM(SM)):** "A description of the stages through which software organizations evolve as they define, implement, measure, control, and improve their software processes" [Paulk 93b]. For SCE this is a model which is used to evaluate a development organization's process capability. (See *maturity model*.)

Commitment to perform: One of five common features in the CMM for Software. Commitment to perform reflects the actions that the organization must take to ensure that the process is established and will endure. Commitment to perform typically involves the features of establishing organizational policies and senior management sponsorship. A commitment is a pact that is freely assumed, visible, and expected to be kept by all parties [Paulk 93b].

Common feature: "An attribute that indicates whether the implementation and institutionalization of a key practice is effective, repeatable, and lasting" [Paulk 93b]. There are five common features defined for CMM v1.1: commitment to perform, ability to perform, activities performed, measurement and analysis, and verifying implementation.

Competitive range: Key term relating to the acquisition use of the SCE method in government source selection. By law (10U.S.C. 2304 [g]) written or oral discussions in negotiated procurements must be conducted with all responsible offerors who submit proposals within a competitive range. The determination as to which proposals are not in the competitive range, and the exclusion of offerors either before or as a result of written or oral discussions, will be made by the Contracting Officer, subject to the approval of the sponsor. The sponsor may designate the evaluation team chairperson to accomplish this function.

The competitive range must be determined after evaluation of all proposals received, on the basis of price or cost, technical, and other salient factors including proposal deficiencies and their potential for correction. The competitive range must include all proposals which have a reasonable chance of being selected. The objective is not to eliminate proposals from the competitive range, but to facilitate competition by conducting written and oral discussions with all offerors who have a reasonable chance of being selected for an award [USAF 84].

Consistency: The degree of uniformity, standardization, and freedom from contradiction among documents or system components. Consistency of an appraisal method refers to the ability of different appraisal teams using the same method to conduct appraisals of the same scope to produce non-conflicting results [Masters 95].

Consolidation: The decision making activity in the iterative information gathering, organizing, and analyzing components of the SCE process. The activities conducted by the appraisal team to transform raw data collected from the recipient organization into observations and findings. Consolidation activities occur throughout the site visit.

1. Capability Maturity Model and CMM are service marks of Carnegie Mellon University.

Contract monitoring: A specific application of the SCE method. Euphemism for process monitoring. Part of the process monitoring "family" of evaluations. (See *process monitoring*.)

Corroboration: In SCE, a synonym for confirmation. All appraisal observations must be confirmed by information from different sources and different data gathering sessions prior to use as findings. This is sometimes referred to in the SCE method as rules for confirming observations.

Coverage: The extent to which data gathered fully addresses reference model components, organizational units, and life cycle phases within the scope of an appraisal [Masters 95]. For SCE, the link between coverage and rating is important. One or more validated observations that the team agrees fully cover the area of investigation and meet method rules for corroboration (multiple sources, multiple sessions, documentation, etc.) are said to be sufficient for rating the reference model items. (See *sufficiency for rating, validation, and corroboration*.)

Customer: An attribute in SCE. This attribute indicates who the development is being done for.

Data: Information, especially information organized for analysis or used as the basis for a decision [AHD 85].

Data collection: The method activities related to obtaining information from the appraised entity for the purpose of evaluating process capability. Four data sources are used in the SCE method: interviews, document review, presentations, and instruments.

Development organization: An organization that develops and/or maintains software products. The development organization is the recipient of an SCE.

Development organization community: All of the development organizations that are evaluated during an acquisition use of the method. In an acquisition these are the offerors (or all of the offerors remaining after a competitive range determination), and possibly their subcontractors.

Development team approach: An attribute used in SCE. It is related to how the developer organizes itself to produce the system; the degree to which various groups interact and are brought to bear on the effort.

Directive: An order or instruction describing actions that must be performed and authorizing their performance.

Document: Any lasting representation of information available to the people doing development and management work. A document can be viewed as an external memory for people. Documents can be paper or electronic. Any process artifact can be considered a "document" in an SCE.

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Document review: One of four primary data collection sources used in SCE. The process of examining documents to find evidence of the processes used by a development organization. Documents can define and standardize processes, can indicate commitment to use the processes, can provide an audit trail of processes that were used, and can reflect data about process performance. Three levels of documents are reviewed during an SCE: *organization-level, project-level, and implementation-level*.

Environment: An attribute used in SCE. It refers to the hardware, software, and telecommunications environment used to develop the system.

Evidence: Data on which a judgment or conclusion can be based [AHD 85].

Effective process: A process that can be characterized as practiced, documented, enforced, trained, measured, and capable of being improved [Paulk 93b].

Evolution: A gradual process in which something changes into a different and usually more complex or better form [AHD 85].

Evaluator: Evaluate, to examine and judge carefully. [AHD 85}. In the context of SCE, evaluator is referring to the individual on a team performing an evaluation on behalf of a sponsor.

Fact: A statement whose content can be verified as true through the senses [Masters 95].

Feature: One of a set of process attributes that provide a view of “whether the implementation and institutionalization of a key practice are effective, repeatable, and lasting” [Paulk 93b]. The features used in SCE come directly from the common features of CMM v1.1. They add a level of detail that is appropriate for generating topics for investigation. Examples of features are policies, resources, and training. Features are listed within each common feature defined in this glossary. (See *common feature.*)

Fidelity: Faithfulness to obligations, duties, or observances. [AHD 85]. Fidelity in an appraisal means adhering strictly to the reference model used to appraise processes. CMM fidelity refers to the use of CMM components, and CMM components alone, as the basis for rating an organization's software process maturity [Masters 95]. A method shows good fidelity if it is consistent, repeatable, accurate, and precise. Its results are thus comparable across and within organizations, and errors are minimized. Fidelity is closely related to *reliability*.

Findings: Findings are the primary output from executing the SCE method. Final findings are used to develop the findings briefing and final report. Findings are validated observations. Findings consist of strengths, weaknesses, or improvement activities in one of the reference model components within the scope of the appraisal. Findings may also be generated in non-reference model areas from data that does not directly correspond to the reference model used, but that are significant to the success of the organization’s operations. (See *results.*)

An observation that has been accepted by the team as valid. Findings include strengths, weaknesses, evidence of alternative practices, and evidence of non-applicable practices. A set of findings should be accurate, corroborated, and consistent within itself [Masters 95].

Goal: A summary of the key practices of a key process area that can be used to determine whether an organization or project has effectively implemented the key process area [Masters 95].

IDEAL approach: A systems approach or life cycle framework for implementing process improvement activities. IDEAL stands for the five phases of the approach: Initiating, Diagnosing, Establishing, Acting, and Leveraging [Radice 93].

Implementation-level documents: The third of three levels of documents reviewed during an SCE. These are documents which provide an audit trail of processes that were used, and can be used by the development organization to collect data about process performance.

Improvement activity: A process improvement that is not yet institutionalized—for example, a pilot program that implements a new configuration management process. In SCE, it indicates potential mitigation of risk due to implemented process. In this sense, an improvement activity is a weakness that if institutionalized would be considered a strength.

Inconsistency: An apparently contradictory response from the same project to two (or more) questions on the questionnaire, or from other data collection mechanisms, that relate to the same process area. May indicate an issue that needs to be probed further. Related to *anomaly*.

Inference: A conclusion based on a fact. They are not facts. In SCE, strong inferences may be used as a basis for observations, in addition to facts. Strong inferences are readily verifiable by further data collection.

Institutionalization: The building of infrastructure and corporate culture that support methods, practices, and procedures so that they are the ongoing way of doing business, even after those who originally defined them are gone [Masters 95].

Institutionalization common feature: One of four common features in the CMM for Software that are related to institutionalizing methods, practices, and procedures: commitment to perform, ability to perform, measurement and analysis, and verifying implementation [Paulk 93b].

Instrument: One of four primary data collection sources used in SCE. An instrument is typically a questionnaire, survey, profile, or other written item used to collect data. Instrument data is typically collected and analyzed prior to the site visit.

Internal evaluation: One SCE application type. Various internal evaluation uses are tailored applications of the SCE method. Typical internal evaluation uses include: process baselining, process improvement progress measurement, process audits, and domain, product line, or

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project specific appraisals. Preparing for an external, customer led evaluation is often a reason that an organization conducts an internal evaluation. Related to acquisition and process monitoring SCE applications.

Interviewing: One of four primary data collection sources used in SCE. The process of questioning personnel from the development organization to find evidence of the processes used by the development organization. Interviews provide insight into how processes are implemented and show the extent to which processes have been internalized by members of the development organization.

Judgment: The exercise of making sound and reasonable decisions (verb) [AHD 85]. In SCE, judgments refer to individual and team decisions in the data transformation process from notes to observations, observations to findings, and findings to ratings. (See *notes, observations, findings, and ratings.*)

Key Practice: The infrastructures and activities that contribute most to the effective implementation and institutionalization of a key process area [Paulk 93b].

Key process area (KPA): “A cluster of related activities that, when performed collectively, achieve a set of goals considered important for establishing process capability” [Paulk 93b]. Each KPA contributes to the environment in which development organizations create software products. Within the CMM, the KPAs are organized into five basic levels of process maturity to describe the progression from an ad hoc software process to one that is well defined and can act as a stable foundation for continuous process improvement.

Language(s): An attribute for SCE. This attribute indicates the programming languages in which the code is to be written, or in which it has been written.

Mapping: The relationship between actual practices in the software process implementation and the process areas within the reference model used.

Maturity level: “A well-defined evolutionary plateau toward achieving a mature software process” [Paulk 93b]**.**

Maturity model: A model of organizational activity used for evaluating a development organization’s process capability. The maturity model has a defined structure, and is available to the public.The maturity model used in SCE V3.0 is the Capability Maturity Model (CMM) for Software V1.1 [Paulk 93a].

Measurement and analysis: One of five common features in the CMM for Software. This common feature describes the need to measure the process and analyze the measurements. Measurement and analysis typically includes the feature of examples of the measurements that could be taken to determine the status and effectiveness of the Activities Performed.

Method: A means or manner of procedure, especially a regular and systematic way of accomplishing something [AHD 85]. An appraisal method consists of appraisal activities, processes, and rating strategies along with associated data structures, definitions, and usage instructions. (See *appraisal method*.)

Method tailoring: Making, altering, or adapting to a particular end [AHD 85]. In SCE, tailoring refers to selecting options, based on the appraisal goals, that may affect appraisal risk. The selection process, led by the team leader during appraisal planning, of refining or extending the standard, or baseline, method to best fit the needs of the sponsor and the appraisal goals defined during requirements analysis. In SCE the principal tailoring options include varying the *organizational scope, reference model scope, and rating baseline*. These options in turn drive lower level tailoring options for team size, skills and experience, and time on site. There are also numerous low level implementation options relating to forms, templates, and instruments (appraisal method *artifacts*) available for conducting the appraisal.

Notes: The transcription of raw input data (from instruments, presentations, interviews, and documents) by an individual team member, usually in the form of written text, into information formatted such that it can later be used to form observations about processes. In SCE, the formatting is done by various means, including “tagging” notes relative to the reference model used.

Observation: An inference or judgment that is acquired from or based on observing [AHD 85]. An observation is information extracted from the notes of data collection sessions [Masters 95]. Observations are classified in terms of strengths and weaknesses, and categorized by reference model component. In SCE, observations are always based on facts or strong inferences.

Organization-level documents: The first (or top) level of three levels of documents reviewed during an SCE. These are the policies and procedures which establish the development environment for all company project activities. Organizational level documents define the process and management constraints the organization places on projects.

Organizational scope: The part of the appraisal scope that defines the breadth of the investigation within the development organization. Typically described in terms of a project or number of projects, but may also relate to a product line or domain. The organizational units that comprise the entity being appraised [Masters 95]. (See *appraisal scope*.)

Outcome: How the findings (SCE results) are used by the sponsoring organization—for example, in risk determination for an acquisition, risk management for process monitoring, or process improvement for an internal evaluation.

Policy: “A guiding principle, typically established by senior management, adopted by an organization to influence and determine decisions” [Paulk 93b].

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Precedence: An attribute used in SCE. This attribute indicates whether the principal stakeholders in the system (acquirer, end user, developer) have experience with the type of system to be built. Systems that are providing a new capability tend to have more changes to the requirements than do ones that are replacing existing systems.

Presentations: One of four primary data collection sources used in SCE. Presentations can either be delivered by the appraisal team to the recipient organization, or can be delivered by the recipient organization to the appraisal team. Usually these presentations are provided in a viewgraph, briefing format allowing interaction between the team and the participants. Presentations can delivered either for the purpose of data collection or data validation. (See *data collection* and *validation*.)

Procedure: A written description of a course of action to be taken to perform a given task [IEEE 91].

Process: A sequence of steps performed for a given purpose [IEEE 91].

Process capability: “The range of expected results that can be achieved by following a process” [Paulk 93b].

Process maturity: The extent to which a specific process is explicitly defined, managed, measured, controlled, and effective. Maturity implies a potential for growth in capability and indicates both the richness of an organization's software process and consistency with which it is applied in projects throughout the organization [Paulk 93a].

Process monitoring: One of the primary applications of the SCE method. In process monitoring, SCE results can serve as an input for an incentive/award fee, as a basis for value engineering incentive payments, or can be used to help the sponsoring organization tailor its contract monitoring efforts.

Procuring Contracting Officer (PCO): The PCO is the acquisition agency person responsible for all communications with the offerors (development organizations) in an acquisition application of SCE. The PCO ensures that the entire source selection process is consistent with applicable regulations. The PCO is also responsible for advising the sponsor on the interpretation of the findings to ensure a consistent and objective award decision.

Product profile: See *Profiles***.**

Product type: An attribute in SCE. The product type attribute refers to the particular aspect of the application domain which the system will support or to the type of service which the system will provide. For example, displays or communications could be product types in a command and control system, a weapons system, or another application domain. Although there may be similarities in the communications subsystem in the various application domains, they each have their own set of unique problems which must be addressed**.**

Profiles: A profile is the set of attributes (such as Application Domain, Product Type, and Size) associated with a product and the environment that supports development of the product. There are three types of product profiles used in SCE: a “target” Product Profile created by the sponsor organization, representing the customer view and reflecting a “desired” state; Product Profile(s) from the recipient reflecting attributes of a current effort(s); and a “proposed” Product Profile created by the offeror in response to an acquisition application reflecting the developer view of planned work.

Project: An undertaking requiring concerted effort, which is focused on developing and/or maintaining a specific product. The product may include hardware, software and other components. Typically a project has its own funding, cost accounting, and delivery schedule [Masters 95].

Project-level documents: The second of three levels of documents reviewed during an SCE. These are documents which define the development processes in use for a particular project. Project level documents define the detailed processes that are used to manage, coordinate, and integrate the engineering activities required for the development.

Rating: A position assigned on a scale; standing. [AHD 85] Ratings are judgments associated with findings. A characterization of an organization's process relative to a component of the reference model used in the appraisal. Rating types in SCE include satisfied, not satisfied, not rated, or not applicable. The rating scale for maturity level is taken directly from the definition contained in the reference model (e.g., Levels 1-5 in the CMM for Software). Ratings can be applied to any component of the reference model that is planned for by the team to achieve appraisal goals and if collected data meets all method rules for *coverage* and *corroboration*. (See *appraisal goals, coverage and corroboration.*)

Rating baseline: “Base” is the supporting part or layer; foundation. The fundamental principle or underlying concept of a system or theory; basis. The fact, observation, or premise from which a reasoning process is begun” [AHD 85]. A baseline is a specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development...[Paulk 93b]. In SCE, choosing the rating baseline option is the fundamental *method tailoring* decision, made during *appraisal requirements* analysis. This decision drives subsequent planning and execution of the method. It specifies the choice of method “rigor” made by the *sponsor* (in consultation with the team leader or senior site manager). It reflects the *reference model scope* and *coverage* requirements enabling team *rating* judgments to be made. The SCE method provides two rating baseline options: depth oriented and breadth oriented (See Method Description for more detail.)

Recipient: The appraised entity that receives the appraisal. Synonymous with development organization. (See *appraised entity* and *development organization.*)

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Reference model scope: The part of the appraisal scope that defines the depth within the reference model used that will be investigated during the SCE. Items outside the defined scope of the SCE cannot be looked at during an acquisition application of SCE. (See *appraisal scope*.)

Reliability: The ability of a system or component to perform its required functions under stated conditions for a specified period of time [IEEE 90]. In SCE, the method is the "system." Reliability is generally used to refer to the repeatability and consistency of the appraisal method. The ability to attain appraisal results that accurately characterize an organization's software process [Masters 95].

Repeatability: The ability to attain the same appraisal results if an appraisal of identical scope is conducted more than once in the same time period [Masters 95].

Request for Proposal (RFP): A government acquisition document that describes characteristics of the system the sponsor wants to acquire. It is used in an acquisition application of the SCE method. This document is used to solicit proposals from commercial development organizations (offerors) and to communicate the characteristics of the desired system to the offerors. In source selection, this is the document that specifies that an SCE will be performed, how it will be performed, and what is expected of the offerors to respond to the customer's need. The RFP is a key artifact describing the appraisal plan in an acquisition application.

Results: A synonym for the SCE findings. This is the primary output of the SCE. In addition to findings, the results may include reference model ratings (such as maturity level), and draft recommendations, depending on the application of the method and the goals documented in the appraisal plan. Appraisal results are always provided to the sponsor, and should be provided to the appraisal recipient (development organization). (See *findings, appraisal outputs.*)

Reuse estimate: An attribute used in SCE. It indicates the development organization's approach to building the product. It is correlated to the size attribute.

Sampling: A set of elements drawn from and analyzed to estimate the characteristics of a population. During an appraisal, data collection is planned to provide a sampling of the process data related to the reference model components, organizational units, and life cycle phases within the scope of the appraisal [Masters 95].

Site: A geographic location of one or more of an organization's units that participate in an appraisal.

Site information packet: The set of materials requested by the sponsor, and provided to the appraisal team by the recipient organization, for use in planning and preparing for the appraisal. In SCE, it includes information such as organization charts, site terminology lists, document hierarchy and model content mapping, product profiles (including the proposed product profile for an acquisition SCE), responses to instruments, etc.

Site technical coordinator: The technical focal point assigned by the recipient organization to assist and facilitate the appraisal team in conducting its activities.

Site visit: The collection of SCE activities that encompass the investigation by the SCE team at a development organization's site.

Size: An attribute for SCE. The size attribute indicates the magnitude of the product (and hence the required project). Size is composed of three related attributes. The *contract duration* is the estimated or required length of time for the development of the product. The *team size* is the number of developers who will be involved in the project. The *estimated size* is the amount of code to be developed (in a software system)**.**

Software Capability Evaluation (SCE): A method for evaluating the software process of an organization to gain insight into its software development capability. SCE can also be defined as a method for evaluating the processes of an organization to gain insight into its business capability. Which model processes are evaluated is determined by the sponsor during appraisal planning (e.g., software, people, acquisition).

Software development plan (SDP): "The collection of plans that describe the activities to be performed for the software project" [Paulk 93b].

Software process capability: "The range of expected results that can be achieved by following a process" [Paulk 93b]. For purposes of an SCE, software process capability reflects those processes which provide an environment for development teams to produce software products. The processes evaluated include decision making processes (such as software project planning), communication processes (such as intergroup coordination) and technical processes (such as peer reviews). (See *process capability* and *process maturity.*)

Software process implementation: A tailored set of practices that defines how software development work is supposed to be done.

Source selection: The government term for a acquisition process to select a supplier. An acquisition application of the SCE method is used to provide results that are factored into the source selection decision. In source selection, the results of the SCE are used by the sponsoring organization to characterize the process-related risk of awarding a contract to an offeror. SCE is only one criterion among many used to select contractors in government acquisitions. (See *acquisition* and *acquisition agency.*)

Source Selection Authority (SSA): The individual responsible for the conduct of the government source selection (acquisition) process. In an acquisition application of the SCE method, the SSA is the sponsor. The SSA is the final arbiter on the use of SCE, approves how the SCE results will influence the award decision, and makes the award decision. (See *acquisition, acquisition agency, source selection advisory council, and source selection advisory board.*)

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Source Selection Advisory Council (SSAC): The SSAC is chartered by the sponsoring organization (acquisition agency) with collecting and analyzing the evaluations of each offeror. This group performs risk assessment activities. This is the only group permitted to compare the SCE results (strengths and weaknesses) of the offerors against one another. The SSAC may recommend to the sponsor how the SCE findings will be incorporated into the award decision at the pre-RFP release briefing.

Source Selection Evaluation Board (SSEB): This is the government group that evaluates the offerors' proposals against defined evaluation standards in an acquisition application of SCE. This group performs risk identification tasks. This group develops the evaluation standards and receives approval to use them from sponsor before the issuance of the RFP. The SSEB is usually organized into technical and cost teams important to the award decision. If the findings of an SCE are being factored into the source selection decision as an Evaluation Criterion, the SCE team leader should be a member of the SSEB. The SSEB prepares, prior to the release of the RFP, an evaluation standard that will incorporate the SCE results into the source selection process.

SSEB Chairperson: The SSEB chairperson coordinates all activities of the SSEB related to the acquisition. The chairperson will facilitate the incorporation of SCE into the source selection documentation and monitor the various evaluation teams, including the SCE team.

Sponsor: The decision maker in the organization that commissions the SCE to be performed and uses the findings (results). Evaluator results are always provided to the sponsor. The individual who authorizes an evaluation, defines its goals and constraints, and commits to use of evaluation outputs [Masters 95].

Sponsoring organization: The organization that commissions the SCE to be performed and uses the findings. (See *sponsor* and *acquisition agency*.)

Standard: "Mandatory requirements employed and enforced to prescribe a disciplined, uniform approach to software development" [Paulk 93b].

Strength: Indicates the team judgment of an effective implementation of a component of the reference model. In SCE, a strength further indicates a particular part of the organization's capability that is sufficiently robust to mitigate the development risks due to process.

Implementation of practices which in an appraisal team's judgment, improve an organization's software process capability. CMM related strengths are effective implementation of one or more of the CMM key practices or one or more alternative practices that contribute equivalently to the satisfaction of KPA goals [Masters 95].

Subcontractor: A development organization that is contracted to work for another development organization to produce products.

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Subcontractors: An attribute in SCE. This attribute is used to indicate whether the development organization intends to use subcontractors in the development, and is a factor if they lack experience with subcontract management.

Sufficiency for rating: The extent to which observations meet appraisal method's rules, thus satisfying the prerequisites for rating. Sufficiency judgments are composed of a series of team judgments regarding the validation, coverage, and corroboration aspects of observations.

Target: An attribute in SCE. This attribute indicates the hardware configuration that the developed software will run on when operational.

Target Process Capability: The process capability that is most appropriate for the planned development; the process capability desired by the sponsoring organization for the product to be developed. The Target Process capability consists of a set of process areas within the reference model used, and helps establish the boundaries of the SCE investigation—a process area is evaluated if and only if it is part of the Target Process Capability.

Topic: A topic is a focused subject matter area probed during the SCE investigation. Topics are a subset of process activities that work towards achieving a specific process area goal. Topics are intended to be detailed enough to focus the investigation on observable, documented work practices, but sufficiently abstract that they avoid prescribing how the process area is implemented. Topics are selected by considering the intersection of a process area goal and its associated reference model features.

Type of Work: An attribute for SCE. This attribute indicates the portion of the development life cycle which will be performed. As examples of different types of work, in “full software development” a development organization is required to build a product based on the system requirements, while in “code development only” the development organization is required to develop code according to the system requirements and software top level design provided by the issuing authority.

Use of the SCE method: Executing the SCE method within a particular context. The principal high-level uses of the SCE method are in acquisition, and process monitoring, and internal evaluation. This is sometimes referred to as the application of the method.

Validation: To substantiate; verify. Valid refers to producing the desired results [AHD 85]. In SCE, validation refers to the process of substantiating observations made about processes, using rules for confirming observations defined in the method. A valid observation is one that is accurate and has been agreed to by the team through a consensus process. Validated observations are equivalent to findings after the team concludes that data coverage and corroboration rules have been met. The rationale for validation is related to the data element objective of an SCE, obtaining an accurate picture of process capability at a site.

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Verifying implementation: One of five common features in the CMM for Software. This common feature describes the steps to ensure that the activities are performed in compliance with the process that has been established. Verifying implementation typically encompasses the features of reviews and audits by management, quality assurance, and other support units.

Weakness: Indicates the team judgment that an effective implementation of a component of the reference model is not institutionalized. In SCE, a weakness indicates a particular part of the organization’s capability that has characteristics that increase the risks due to process.

Ineffective implementation of or lack of practices which, in an appraisal team's judgment, interfere with effective performance of software development tasks. CMM related weaknesses are an ineffective implementation or lack of implementation of one or more CMM key practices with no acceptable alternative practices in place [Masters 95].

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This report describes Version 3.0 of the Software Capability Evaluation (SCE) Method. SCE is a method for evaluating the software process of an organization to gain insight into its process capability. This version of the SCE Method is based on the Capability Maturity Model (CMM) defined in *Capability Maturity Model for Software, Version 1.1* [Paulk 93a]. It is compliant with the CMM Appraisal Framework (CAF) [Masters 95]. This document is an update to SCE Version 2.0 [CBA Project 94].

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