



Software Engineering Institute

CMMI[®] for Acquisition (CMMI-ACQ) Primer, Version 1.2

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Abstract

Using relevant best practices from the CMMI® (Capability Maturity Model® Integration) for Acquisition (CMMI-ACQ) model, this primer defines effective and efficient practices for acquisition projects. These best practices address activities that include monitoring and controlling contractors and suppliers that develop products and services and deliver services. The practices in this primer provide a foundation for acquisition process discipline and rigor that enables product and service development and service delivery to be repeatedly executed for ultimate acquisition success.

This primer can be used by projects that acquire products or services in government and non-government organizations to improve acquisition processes. Selected content of the CMMI-ACQ model is used in this primer as a basis for helping readers unfamiliar with CMMI to begin their process improvement journey. After using this primer, most organizations will want to implement the CMMI-ACQ model.

This primer can also be used by acquisition organizations that manage several related acquisition projects (e.g., product centers, acquisition commands) to establish an acquisition process improvement program. However, organizations at that level should consider using the CMMI-ACQ model instead because it includes organizational process management practices.

1 Introduction

The *CMMI[®]-ACQ Primer* is a stand-alone guide that describes best practices for use in the acquisition of products and services and prepares users for implementing the *CMMI for Acquisition (CMMI[®]-ACQ)* model¹ for process improvement. This primer focuses on efficient and effective acquisition processes and practices that are implemented by first-level acquisition projects, such as those conducted by a system program office or program manager in the Department of Defense (DoD). The information contained in this primer can also be used by organizations that manage multiple programs (e.g., product centers, acquisition commands) to implement process improvement activities; although, at that organizational level, the CMMI-ACQ model is more beneficial (see Section 1.3).

1.1 PURPOSE AND OBJECTIVES

Acquisition projects are complex because they are directed outward toward acquiring products, systems, services, and capabilities to meet a set of operational expectations and directed inward toward ensuring that the acquisition process is conducted with discipline. The CMMI-ACQ model incorporates this duality by recognizing that some activities are under the direct control of the acquisition project, while others involve monitoring or facilitating the success of external partners and suppliers.

System development projects face the challenge of meeting aggressive performance, cost, and schedule objectives. At the same time, acquisition leaders work to create a flexible environment for acquisition projects while drastically decreasing acquisition cycle times and improving credibility. Rising levels of system complexity; increasing software contribution to overall system functionality; demands for agile, adaptable products; and shortened delivery timeframes place stress on existing acquisition practices. Congressional and DoD-level guidance emphasizes software acquisition process improvement, including the measurement of process performance.

The objective of the CMMI-ACQ model is to influence the outcome of the acquisition process, delivering the right capabilities to operational users on schedule and at predictable costs through the disciplined application of efficient and effective acquisition processes. Applying this approach requires renewed dedication to defining, implementing, measuring, and maintaining the acquisition processes fundamental to a technically sound project.

Acquisition projects perform a number of processes to achieve success. The goals and practices for these processes are described in general terms to support the numerous variations in application that occur in different acquisition environments. Because variations in execution are at the discretion of the acquisition project, the CMMI-ACQ model focuses on “what” should be done not “how” it is done; it does not prescribe specific implementation approaches.

¹ The CMMI-ACQ, V1.2 model is a collection of best practices that is generated from the CMMI V1.2 Framework. This collection includes acquisition best practices from government and industry for acquiring products and services.

1.2 CMMI TERMINOLOGY

This primer uses terminology from CMMI-ACQ, which groups the process areas into the following process area categories:

- Process Management (i.e., Organizational Management)
- Project Management
- Support
- Acquisition

The Process Management, Project Management, and Support process areas are part of the CMMI Model Foundation (CMF) and are common to all CMMI models. This fact makes it convenient to align processes between the acquirer and the supplier if the supplier is using the CMMI for Development (CMMI-DEV) model. The Acquisition process areas are specific to the CMMI-ACQ model. This primer includes selected Project Management and Support process areas that define the requirements for managing and defining processes within acquisition and all of the Acquisition process areas.

The Process Management process areas in the CMMI-ACQ model provide details on how to define and improve processes within the context of the organization in which the acquisition project resides. The CMMI-ACQ model also contains those Project Management and Support process areas considered to contain practices at a higher level of maturity than those contained in this primer. For more information about Process Management and high maturity process areas, see the CMMI-ACQ model at <http://www.sei.cmu.edu/publications/documents/07.reports/07tr017.html>.

Project Management	Project Planning (PP) Project Monitoring and Control (PMC) Integrated Project Management (IPM) Requirements Management (REQM) Risk Management (RSKM)
Acquisition	Solicitation and Supplier Agreement Development (SSAD) Agreement Management (AM) Acquisition Requirements Development (ARD) Acquisition Technical Management (ATM) Acquisition Verification (AVER) Acquisition Validation (AVAL)
Support	Configuration Management (CM) Decision Analysis and Resolution (DAR) Measurement and Analysis (MA) Process and Product Quality Assurance (PPQA)

Figure 1: Process Areas Covered in this Primer

CMMI terminology should be understood in both the acquisition and process improvement contexts. For example, in the CMMI Product Suite, the following terminology is important to understand:

- The term *project* denotes a managed set of interrelated resources that delivers one or more products to a customer or end user. A *project* (or *program*, depending on local interpretation) refers to the entire acquisition project or, perhaps, to major subsets of the acquisition project. The scope of the term is tailored to the specific acquisition.
- The term *organization* is typically used to denote an administrative structure in which people collectively manage one or more projects. Projects share a senior manager and operate under the same policies. Examples of acquisition organizations include larger or “super” program offices, product centers, acquisition commands, program executive officers, and service/component acquisition executives.
- The term *work product* is any artifact produced by a process.
- The term *product* denotes a tangible output or a service that is a result of a process and that is intended for delivery to a customer or end user. A *product* is a work product that is delivered to the customer. The term *system* is not used; the term *product* is used instead. And the term *product* includes *services*.
- The term *supplier* is used instead of the term *contractor*, since agreements can take forms other than contracts, such as a memorandum of agreement.
- The term *supplier agreement* is used instead of the term *contract*. A *supplier agreement* is a documented agreement between the acquirer and supplier (e.g., contract, license, or memorandum of agreement).

Decide how these terms apply in your environment.

1.3 IMPROVING PROCESSES FOR ACQUISITION

Process improvement can be viewed from two perspectives: at the project level and at the organization level. Both are important for sustained process improvement in an acquisition organization.

1.3.1 Project-Level Process Improvement

Acquisition projects ensure the practices they perform effectively reduce risks associated with common management, technical, and support issues that arise during the project. The specific practices in Section 2 and the generic practices in Section 3 represent the project-level practices that can be used to identify gaps in the project’s implementation or process-related risks. Careful use of selected measures can help gain insight into the effectiveness of project-level process implementation.

In addition, higher level acquisition organizations with multiple projects or with oversight responsibility can use these practices to identify areas that may require a process improvement focus. A project that has well-defined processes has a greater ability to deal with risk and complexity.

1.3.2 Organizational Process Improvement

Process improvement at the organizational level creates an effective environment and infrastructure that allows acquisition projects in the organization's span of control a greater probability to succeed. When a project has clear guidance, starter templates, historical data, and a strong process culture at the organizational level, it is more likely to sustain effective practices and ultimately achieve its objectives.

Acquisition organizations that manage multiple programs (e.g., product centers, acquisition commands, program executive offices, service/component acquisition organizations) can improve by working with successful projects to capture success stories; measuring the effectiveness of processes across the projects they manage; and beginning to build a standard set of acquisition practices, proven by their success in real projects, for use in subsequent projects. Senior leaders can establish an infrastructure and strong process culture that rewards projects that build realistic plans and execute according to those plans.

Acquisition organizations can improve both the capability of their organizational processes, as well as the capability of selected project-level processes across the organization, by using the CMMI-ACQ model. Process areas to use when improving organizational capability include Organizational Process Focus, Organizational Process Definition, and Organizational Training. The CMMI-ACQ model is available at <http://www.sei.cmu.edu/publications/documents/07.reports/07tr017.html> .

2 Process Areas

The process areas in this section are from the CMMI-ACQ model. They represent a minimal set of processes that cover the best practices needed to successfully address the entire acquisition lifecycle. Each acquisition project operates within a unique environment that influences the definition of its lifecycle. The acquisition lifecycle, especially as it applies to upgrades and modifications, may restart after a cycle is initiated and partially completed. For example, acquisition of a major upgrade may be initiated for a product or service that has already been developed, fielded, and placed into operation. In these cases, the deployment of CMMI-ACQ could result in the upgrade acquisition being considered a new acquisition lifecycle, with complex implementation requirements of its own that may impact another acquisition lifecycle already underway. Or, in other cases, the acquisition lifecycle may continue throughout the product's lifecycle, including disposal.

In the process areas listed in this section, goals are shown in bold-faced text. Below each goal are numbered statements that reflect the recommended practices. For more extensive treatment of these goals and practices, see the CMMI-ACQ model, which also includes subpractices, typical work products, typical supplier deliverables, and references to other related process areas.

2.1 PROJECT MANAGEMENT PROCESS AREAS

Project Management process areas cover project management activities related to planning, monitoring, and controlling projects. In addition, they include activities that ensure the products or services acquired can be transitioned into operational use and maintained during the operational life of the product or service.

Project Planning (PP)

The purpose of Project Planning is to establish and maintain plans that define project activities.

Project planning starts by setting the acquisition strategy and follows with planning the acquisition process in ever-increasing levels of detail. The resulting plans should be reviewed for consistency with the overall acquisition plans. The acquirer's and supplier's project planning processes are continuously conducted, as the plans evolve to meet the project's needs.

If an existing product is to be replaced as part of the acquisition, the acquirer may be required to consider transition from operation and the disposal of the existing product as part of the planning for executing the new product. Any such transition activities should be included in the project plan as well as provisions for accommodating such specialized requirements.

1. Estimates of project planning parameters are established and maintained.

1.1 Establish and maintain the acquisition strategy.

The acquisition strategy relates the acquisition objectives, constraints, availability of assets and technologies, consideration of acquisition methods, potential supplier agreement types and terms, accommodation of end user considerations, consideration of risk, and support for the project over its lifecycle.

1.2 Establish a top-level work breakdown structure (WBS) to estimate the scope of the project.

The WBS should list the tasks for the entire project, including activities performed by the acquisition project as well as suppliers and other stakeholders (e.g., test community, operational users). Include all these parties to ensure the planning effort includes the scope for the entire acquisition.

1.3 Establish and maintain estimates of work product and task attributes.

Estimates of the attributes of the work products and tasks are used to bound the budget and schedule.

1.4 Define project lifecycle phases upon which to scope the planning effort.

Typical lifecycle choices include single-step or evolutionary incremental. Include in planning the entire known lifecycle from user needs through initial and subsequent upgrades. The acquisition organization should consider the full collection of supplier agreements within a project context to ensure an integrated approach rather than an approach that deals with activities individually. An integrated approach supports project planning activities on occasions when some elements of the acquisition or lifecycle may be out of the control of the acquisition organization.

1.5 Estimate the project's effort and cost for work products and tasks.

In addition to creating an estimate of project work products, the acquisition organization should have its estimate independently reviewed by those external to the project to validate the project estimate. Be sure to include the effort and cost supporting execution of the acquisition processes as well as the effort and cost supporting development of the product or service. Estimates of the effort and cost of work products and tasks are used to establish the overall project budget and schedule.

2. A project plan is established and maintained as the basis for managing the project.

2.1 Establish and maintain the project's budget and schedule.

The acquisition project's budget and schedule should be created and maintained for the duration of the project. The budget and schedule should include lifecycle-related activities of the acquisition organization itself, the supplier, supporting organizations, suppliers that support the acquisition organization, and other stakeholders.

2.2 Identify and analyze project risks.

Identify risks from multiple perspectives (e.g., acquisition, technical, management, operational, supplier, support, and user) to ensure all project risks are considered in planning activities.

2.3 Plan for the management of project data.

Consider how data will be shared across all relevant stakeholders, including informal data as well as formal project data and plans. Create plans for managing data within integrated teams and the infrastructure required to manage data among the supplier, operational users, and other relevant stakeholders. Decide which project data and plans require version control or more stringent configuration control and establish mechanisms to ensure project data is controlled. Consider the implications of controlling access to classified information and sensitive but unclassified information (e.g., proprietary, export controlled, and source selection sensitive information) and other access-controlled data.

2.4 Plan for necessary resources to perform the project.

Plan the resources required for the acquisition project as well as tools and infrastructure required during the life of the project. Include resource planning for integration and test facilities.

2.5 Plan for knowledge and skills needed to perform the project.

Plan for knowledge and skills required by the project team to perform their tasks. Knowledge and skill requirements can be derived from project risks. For example, if the project team is acquiring a software-intensive product, ensure expertise in systems and software engineering exists on the project team or provide training for the project team in these areas. Include orientation and training for the project team and stakeholders in acquisition practices and the domain knowledge required to execute the project.

2.6 Plan the involvement of identified stakeholders.

Stakeholders can include operational users and project participants from test or other support communities as well as potential suppliers. When acquiring products or services that must interoperate with other products or services, plan for the involvement of stakeholders from other projects or communities to ensure the delivered product or service can perform as required in its intended environment.

2.7 Plan transition to operations and support.

The acquisition project is responsible for ensuring the acquired products not only meet specified requirements (see the Acquisition Technical Management process area) and can be used in the intended environment (see the Acquisition Validation process area) but also that they can be transitioned into operational use to achieve the users' desired mission capabilities and can be maintained and sustained over their intended lifecycles. The acquisition project is responsible for ensuring reasonable planning for transition into operations is conducted, clear transition criteria exist and are agreed to by relevant stakeholders, and planning is completed for product maintenance and support of products after they become operational. These plans include reasonable accommodation for known and potential evolution of products and their eventual removal from operational use.

Planning for transition includes establishing the strategy for support (e.g., source of repair) through organic support infrastructures, supplier logistics support, or other sources. It can also include defining the levels of support to be established (e.g., organization, intermediate, and depot). The strategy is important because it drives most of the other transition planning activities as well as product design considerations.

Planning includes identifying and providing for initial spares, operational and support training capabilities, facilities, etc. Eventual disposal of the product should also be considered as well as disposal of existing products to be replaced.

The roles and responsibilities of the acquirer, supplier, and user should be defined for lifecycle support of the product. Explicitly identifying organizational responsibility for support (i.e., level 1 maintenance) and for enhancements (i.e., level 2 maintenance) ensures that relevant stakeholders are involved early in the acquisition project's planning processes.

Responsibility for capability enhancements during the support phase should be assigned. Criteria used to support the assignment of responsibilities should include the magnitude and complexity of the envisioned change, the domain knowledge and experience required, and the acquisition expertise required.

2.8 Establish and maintain the overall project plan.

The overall project plan can take on many forms and may even be found in multiple plans, such as the acquisition strategy, single acquisition management plan, program management plan, lifecycle management plan, and systems engineering plan.

Regardless of its form, the plan or plans should address the acquisition strategy as well as the cradle-to-grave considerations for the project and product to be acquired.

3. Commitments to the project plan are established and maintained.

3.1 Review all plans that affect the project to understand project commitments.

The project may have a hierarchy of plans (e.g., risk management plan, systems engineering plan, and requirements management plan). In addition, stakeholder plans (e.g., operational, test, support, and supplier plans) should be reviewed to ensure consistency among all project participants.

3.2 Adjust the project plan to reconcile available and estimated resources.

When available resources (e.g., personnel, facilities, stakeholders, schedule, and funding) are inadequate to accomplish the project, consider de-scoping the effort to match available resources. When de-scoping is not feasible, identify and mitigate these risks.

3.3 Obtain commitment from relevant stakeholders responsible for performing and supporting plan execution.

Major project planning should be coordinated with stakeholders and the resulting plans should be approved by them.

Project Monitoring and Control (PMC)

The purpose of Project Monitoring and Control is to provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan.

Project monitoring and control functions are directed within the acquisition project early in the process as acquisition planning is performed and the strategy is defined. As the acquisition project unfolds, monitoring and controlling are essential to ensuring that appropriate resources are being applied and that acquisition activities are progressing according to plan. The Project Monitoring and Control process area involves establishing the planned internal activities and schedule for completion and then monitoring the status of these activities and work product completions through measurement and analysis (i.e., metrics). It is important that the acquisition project has internal processes, plans, and work products that are monitored for satisfactory completion and progress.

Included in those internal items monitored should be work product completion (e.g., specifications, plans, and request for proposal components), staffing levels and qualifications applied, project performance objectives and thresholds, infrastructure readiness (e.g., tools and networks) and other activities and products included in project planning. Project risk identification and mitigation should also be monitored for status.

After one or more suppliers are selected and agreements are established, the role of monitoring and control becomes twofold: (1) the acquirer continues to monitor and control its activities and work products, (2) at the same time, the acquirer monitors and controls the progress and performance of supplier activities that affect the overall project plan.

1. Actual performance and progress of the project are monitored against the project plan.

1.1 Monitor actual values of project planning parameters against the project plan.

Monitoring schedule, budget, and acquisition activity progress should begin as soon as a project plan is established.

1.2 Monitor commitments against those identified in the project plan.

Commitments for resources that result in expenditures (e.g., issued purchase orders and completed deliverables that have been accepted) should be tracked when incurred, even prior to formal payment, to ensure that future financial and legal obligations are accounted for as soon as they are incurred.

1.3 Monitor risks against those identified in the project plan.

The acquisition project should manage risks independent of the supplier's risk management procedures. Many risks are the responsibility of the acquisition project and may include sensitive information that should not be shared with the supplier (e.g., source selection sensitive, re-competition, and internal staffing information).

1.4 Monitor the management of project data against the project plan.

1.5 Monitor stakeholder involvement against the project plan.

1.6 Periodically review the project's progress, performance, and issues.

1.7 Review the project's accomplishments and results at selected project milestones.

1.8 Monitor transition to operations and support.

The acquirer monitors and controls the transition of the accepted product or service against the plan for transition to operations and support. Readiness is evaluated throughout the acquisition lifecycle based on transition criteria. Using the previously defined transition criteria, objectively evaluate the products' readiness for transition. As a result of analysis, transition activities and actions may be required of the acquisition project, supplier, user, or support organization. The analysis may also identify areas for improvement in future transition activities.

2. **Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan.**

2.1 Collect and analyze issues and determine corrective actions necessary to address them.

Corrective action is taken for both acquirer deviations and when supplier execution does not align with project planning (e.g., milestones and work product date slippages). Many issues and corrective actions are the sole responsibility of the acquirer and may include information that should not be shared with the supplier (e.g., source selection sensitive, re-competition, and internal staffing information).

2.2 Take corrective action on identified issues.

Corrective action should be applied when execution does not match project planning (e.g., internal staffing, project plan completion dates, draft and final solicitation, and supplier agreement award milestone dates).

2.3 Manage corrective actions to closure.

If a corrective action is required to resolve variances from project plans, these actions should be defined and tracked to closure.

Integrated Project Management (IPM)

The purpose of Integrated Project Management is to establish and manage the project and the involvement of the relevant stakeholders according to an integrated and defined process that is tailored from the organization's set of standard processes.

Integrated Project Management involves establishing project management processes consistent with and tailored from the organization's standard processes. It includes higher level acquisition guidance, regulations, instructions, and local practices established to be used across various projects in the local organization. Establishing an integrated project management process that incorporates and involves relevant stakeholders (e.g., executive level acquisition offices, users, test organizations, developers, and associated government support organizations) is critical to the success of the project. This defined project management process is typically defined in an overall project management plan or equivalent document.

The integrated project management process needs to involve and integrate all relevant acquisition, development, support, and operational activities. Depending on the size of the project, the size of the coordination efforts can be significant.

Formal interfaces among project stakeholders take the form of memorandums of understanding (MOUs), memorandums of agreements (MOAs), contractual commitments, associate supplier agreements, and similar documents, depending on the nature of the interfaces and involved stakeholders.

1. The project is conducted using a defined process tailored from the organization's set of standard processes.

It is possible that the organization has not established a standard set of processes. If so, the project should define its own processes appropriate to its needs.

1.1 Establish and maintain the project's defined process from project startup through the life of the project.

Often, the defined process for a project is developed by tailoring and integrating higher level organizational guidance. For example, guidance in the Defense Acquisition Guidebook (<http://akss.dau.mil/dag/>) in conjunction with lower level guidance at the service, component, or other level, would be used by a project to establish the process to be used to acquire the project's unique product or service. Where no organizational process exists, the project develops the defined processes itself.

The project's defined process is driven by the acquisition strategy. The acquirer's defined process is affected, for example, by whether the acquisition strategy includes introducing a new technology to the organization or consolidating acquired products or services currently in use by the acquirer.

1.2 Use organizational process assets and the measurement repository for estimating and planning project's activities.

When available, use the results of previous planning and execution activities as predictors of the relative scope and size of the effort being estimated for the acquisition.

1.3 Establish and maintain the project's work environment based on the organization's work environment standards.

The supplier's work environment should be compatible with the acquirer's work environment to enable efficient and effective transfer of work products.

- 1.4 Integrate the project plan and other plans that affect the project to describe the project's defined process.

Tiered plans are often effective for large projects.

- 1.5 Manage the project using the project plan, other plans that affect the project, and the project's defined process.
- 1.6 Establish and maintain integrated teams.

One of the best ways to ensure coordination and collaboration with relevant stakeholders (specific goal 2 of this process area) is to include them on an integrated team. For projects within a system of systems framework, the most important integrated team may include stakeholders representing other systems as members.

- 1.7 Contribute work products, measures, and documented experiences to organizational process assets.

If a repository of information from previous similar projects exists at the start of the project, consider retaining the project's estimates and actual results for use in estimating future projects.

2. Coordination and collaboration between the project and relevant stakeholders are conducted.

- 2.1 Manage the involvement of relevant stakeholders in the project.

The supplier agreement provides the basis for managing supplier involvement in the project. Supplier agreements (e.g., interagency and intercompany agreements, memorandums of understanding, and memorandums of agreement) that the acquirer makes with stakeholder organizations, which may be product or service providers or recipients, provide the basis for their involvement. These agreements are particularly important when the acquirer's project produces a system that must be integrated into a larger system of systems.

- 2.2 Participate with relevant stakeholders to identify, negotiate, and track critical dependencies.

Stakeholder activities that include dependencies critical to the project should be negotiated with the stakeholders to obtain commitment to perform. The critical dependencies should be identified in the project plan so those activities can be monitored and controlled relative to their dependent activities.

- 2.3 Resolve issues with relevant stakeholders.

Requirements Management (REQM)

The purpose of Requirements Management is to manage the requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.

Requirements management processes manage all requirements received or generated by the project, including both technical and nontechnical requirements as well as requirements levied on the project by the organization. Requirements management is applied to the requirements that are received from the acquisition requirements development process. Requirements management includes the direct management of acquirer-controlled customer and contractual requirements (see the Acquisition Requirements Development process area) and oversight of supplier requirements management. Requirements are managed and maintained with discipline so that changes are not executed without recognizing the impact to the project.

Requirements management does not end with the selection of a supplier and an award. The acquisition project continues to manage high-level requirements, including changes, while the selected supplier manages the lower level product and product component requirements.

1. Requirements are managed and inconsistencies with project plans and work products are identified.

- 1.1 Develop an understanding with requirements providers on the meaning of requirements.

The acquirer should identify “authorized” requirements providers and an approved path by which requirements are provided to the supplier. This identification prevents suppliers from receiving requirements changes from unauthorized sources that are outside the flow of the acquirer’s established requirements management process.

- 1.2 Obtain commitment to requirements from project participants.

Commitment to the requirements by project participants includes having coordinated and approved documents that define requirements. Changes to requirements may lead to changes in supplier agreements. These changes must be agreed on by the acquirer and supplier after appropriate negotiations.

- 1.3 Manage changes to requirements as they evolve during the project.

Each change to a controlled requirement should be assessed for impact to the project’s performance, cost, and schedule baselines and to project risk. The existing cost, schedule, and performance baselines should be changed, as required, to accommodate the requirements change. If contractual requirements defined in the supplier agreement are affected by the changes, the supplier agreement also must be aligned with these changes.

- 1.4 Maintain bidirectional traceability among requirements and work products.

When requirements are managed well, traceability can be established from a source requirement to its lower level requirements and from those lower level requirements back to their source requirements. Such bidirectional traceability helps determine whether all source requirements have been completely addressed and whether all lower level requirements can be traced to a valid source.

Requirements traceability can also cover relationships to other entities, such as intermediate and final work products, changes in design documentation, and test plans. Traceability can cover horizontal relationships (such as across interfaces) as well as vertical relationships. Traceability is particularly needed in conducting the impact assessment of requirements changes on project activities and work products. The supplier maintains comprehensive bidirectional traceability to requirements defined in the supplier agreement by the acquirer, and the acquirer verifies that traceability. The acquirer maintains bidirectional traceability between customer requirements and contractual requirements.

- 1.5 Identify inconsistencies between project plans and work products and requirements.

Risk Management (RSKM)

The purpose of Risk Management is to identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives.

Risk identification and estimation of probability of occurrence and impact, particularly for those risks involved in meeting performance requirements, schedules, and cost targets, largely determine the acquisition strategy. The acquirer has a dual role: (1) Assess and manage overall project risks for the duration of the project, and (2) Assess and manage risks associated with the performance of the supplier. As the acquisition progresses to the selection of a supplier, the risk specific to the supplier's technical and management approach then becomes important to the success of the acquisition.

The particular risks associated with integrated teams should be considered, such as risks associated with loss of inter- or intra-team coordination.

1. Preparation for risk management is conducted.

1.1 Determine risk sources and categories.

Acquisition organizations should initially identify and categorize risks and risk sources for the project and refine those risks and categories over time (e.g., schedule, cost, supplier execution, technology readiness, and issues outside control of acquisition organization).

1.2 Define parameters used to analyze and categorize risks and to control the risk management effort.

Acquisition organizations should document the parameters used to analyze and categorize risks so that they are available throughout the project for reference when circumstances change over time. In this way, risks can easily be re-categorized and analyzed relative to the original information when changes occur.

1.3 Establish and maintain the strategy to be used for risk management.

2. Risks are identified and analyzed to determine their relative importance.

2.1 Identify and document risks.

2.2 Evaluate and categorize each identified risk using defined risk categories and parameters, and determine its relative priority.

3. Risks are handled and mitigated, where appropriate, to reduce adverse impacts on achieving objectives.

3.1 Develop a risk mitigation plan for the most important risks to the project as defined by the risk management strategy.

3.2 Monitor the status of each risk periodically and implement the risk mitigation plan, as appropriate.

Risks should be continually monitored and, when warranted, the mitigation plan should be adjusted to adapt for change. When the situation requires action, mitigation actions should be executed promptly based on the mitigation plan.

2.2 ACQUISITION PROCESS AREAS

The acquisition process areas establish a consistent set of requirements and agreements that are derived from stakeholder needs and operational capability statements so that work products developed internally by the acquirer and work products and delivered products and services from the suppliers are proven to successfully satisfy end user needs and provide operational capabilities.

Solicitation and Supplier Agreement Development (SSAD)

The purpose of Solicitation and Supplier Agreement Development (SSAD) is to prepare a solicitation package, select one or more suppliers to deliver the product or service, and establish and maintain the supplier agreement.

The solicitation must comply with applicable federal, departmental, and service acquisition regulations and policies. The solicitation should address activities appropriate to the product domain or acquisition environment (e.g., supplier process evaluations; operational safety, suitability, and effectiveness; certifications; architecture evaluations; and interoperability). The representatives responsible for these activities within the project or stakeholder organizations should be consulted for proper inclusion of those activities into the solicitation and supplier agreement development process. The solicitation practices apply equally to initial supplier agreement actions and subsequent change orders, task orders, etc.

The Solicitation and Supplier Agreement Development process area creates a proactive environment that enables the acquirer to initialize the relationship with the supplier for the successful execution of the project. It encourages creation of a supplier agreement that allows the acquirer to execute its management of supplier activities using other process areas, such as Agreement Management and Acquisition Technical Management. This encouragement may include levying a requirement on the supplier to create a project plan that will successfully execute the supplier agreement, to define and execute the processes needed to achieve success, and to commit to executing the plan as it evolves during supplier agreement execution.

The Solicitation and Supplier Agreement Development process area involves planning for and performing the practices necessary to develop and issue a solicitation package, preparing for the evaluation of responses, conducting an evaluation, conducting supporting negotiations, and establishing and maintaining the supplier agreement.

1. Preparation for solicitation and supplier agreement development is performed.

- 1.1 Identify and qualify potential suppliers.
- 1.2 Establish and maintain a solicitation package that includes the requirements and proposal evaluation criteria.

For task orders or changes against an existing supplier agreement, ensure the acquisition project has documented evaluation criteria against which to evaluate the proposed changes from the supplier.

Define the proposal content that the suppliers must submit with their response.

Examples include:

Evidence of existing organizational processes upon which the project's processes will be based and the commitment to execute those processes from project inception

Descriptions in the proposed documents such as the statement of work (SOW), integrated master plan (IMP), integrated master schedule (IMS), and software development plan (SDP) of the processes, tasks, and activities characteristic of the proposed development approach

Description of how the proposed approach (e.g., SOW, IMP, IMS, SDP or other documents) demonstrates a commitment to execute the project using the processes and methods proposed from project inception. Require suppliers to provide evidence of a mechanism to encourage and monitor execution of organizational processes at project start up. Require suppliers to describe measurements that provide project team visibility into the supplier's process adherence

Description of how the proposed approach demonstrates high confidence that the size and complexity of the development and integration effort is understood, the effort and schedule necessary to develop the required products are estimated with high confidence, and that the proposed development effort is compatible with and can be completed within the proposed funding and schedule

Plans appropriate to the scope and content of the project (e.g., integrated management plan, systems engineering plan, software development plan, and risk management plan)

Identification of the measurements, including development progress measures, to be used in the project and made available to the project office

A description of the supplier's planned use of COTS or re-use of previously developed hardware or software components, including non-deliverable components (This description should identify any limitations of data rights and rationale for the supplier's confidence that the levels of COTS and re-use can be achieved.)

An approach that provides visibility of development task progress and costs at a level appropriate for the type of supplier agreement and commensurate with the degree of risk related to the acquisition

Identification of the work to be performed by lower-level suppliers

Proposed tasks and activities to support product verification, validation, and transition to operations and support

Technical, non-technical, and product verification requirements to be satisfied by the supplier

Deliverables that provide the acquisition project sufficient data to evaluate and analyze the acquired products

Requirements to ensure that the supplier supports each of the acquisition project's technical review and validation activities

Requirements for the supplier to establish a corrective action system that includes a change control process for rework and reevaluation

The acquisition organization should request evidence of adherence to the supplier organization's mechanism for project start up in accordance with their defined processes.

- 1.3 Review the solicitation package with stakeholders to ensure that the approach is realistic and can reasonably lead to the acquisition of a usable product.

To ensure objectivity and realism, cost and schedule estimates should be reviewed by individuals independent of the acquisition project team and supplier's team. Representatives from the functional or "home office" organizations within the acquisition organization, such as finance and engineering, can support these efforts.

- 1.4 Distribute the solicitation package to potential suppliers for their response and maintain the package throughout the solicitation.

In a competitive environment, ensure all potential suppliers have equal access and opportunity to provide feedback on the solicitation package. Provide the opportunity for the selected suppliers and end users to clarify points of ambiguity in the set of required capabilities as well as any disconnects or concerns with the proposed solution. In a sole source or change order environment, make sure relevant stakeholders understand the intent of the new effort or the changes before placing additional work on the supplier agreement.

2. Suppliers are selected using a formal evaluation.

2.1 Evaluate proposed solutions according to documented proposal evaluation criteria.

The criteria are used to evaluate the suppliers' technical approach as well as their management practices, sufficiency of plans, process capability in key project risk areas, relevant domain experience, cost, schedule, and past performance.

2.2 Establish and maintain negotiation plans to use in completing a supplier agreement.

2.3 Select suppliers based on an evaluation of their ability to meet specified requirements and established criteria

3. Supplier agreements are established and maintained.

3.1 Establish and maintain a mutual understanding of the agreement with selected suppliers and end users based on acquisition needs and the suppliers' proposed approaches.

As points of clarification and ambiguities continue to arise after supplier agreement award, ensure the mutual understanding is revised and maintained through the life of the project. Ensure that the supplier makes a commitment in the supplier agreement to execute its proposed processes.

3.2 Establish and maintain the supplier agreement.

The acquisition project is responsible for establishing and maintaining the ground rules for supplier communication, documenting decisions, and conflict resolution through the life of the project. The acquisition project facilitates these activities with relevant project stakeholders. Specific roles and responsibilities of relevant project stakeholders for interaction with or direction of the suppliers need to be defined, coordinated, and adhered to.

After the supplier agreement is awarded, the acquisition project should verify that the supplier is effectively executing its organization's processes.

After establishing the supplier agreement, the acquirer may find requirements that are no longer optimal or applicable based on the supplier's progress or environment changes. Examples include the availability of new technology, overly burdensome documentation, and reporting requirements. Changes to supplier agreements may also occur when the supplier's processes or products fail to meet agreed-to criteria.

Agreement Management (AM)

The purpose of Agreement Management (AM) is to ensure that the supplier and the acquirer perform according to the terms of the supplier agreement.

The supplier agreement is the basis for managing the relationship with the supplier, including resolving issues. It defines the mechanisms that allow the acquirer to oversee the supplier's activities and evolving products and to verify compliance with supplier agreement requirements. It is also the vehicle for a mutual understanding between the acquirer and supplier. When the supplier's performance, processes, or products fail to satisfy established criteria as outlined in the supplier agreement, the acquirer may take corrective action.

1. The terms of the supplier agreement are met by both the acquirer and the supplier.

1.1 Perform activities with the supplier as specified in the supplier agreement.

The acquirer and supplier establish and maintain a mutual understanding through effective, timely, and appropriate communication. The acquirer should clearly identify and prioritize its needs and expectations, as well as its suppliers' capabilities. The acquirer works closely with suppliers to achieve a mutual understanding of product requirements, responsibilities, and processes that are applied to achieve project objectives.

1.2 Select, monitor, and analyze supplier processes.

The supplier's plans and processes are used as the basis for monitoring its activities. The acquisition project is responsible for ensuring the supplier's "as implemented" processes address the needs of the project. The acquisition project should verify that the supplier's processes are executed from project inception.

If not performed with adequate care, monitoring can at one extreme be invasive and burdensome, or at the other extreme be uninformative and ineffective. The acquirer decides on the necessary level of monitoring depending on the level of risk if the supplier's process is not performed correctly. Monitoring activities can range from reviewing supplier-supplied process data to on-site appraisals of the supplier's processes.²

1.2 Ensure that the supplier agreement is satisfied before accepting the acquired product.

This practice involves ensuring that the acquired product meets all requirements and that customers concur before the product is accepted. The acquirer ensures that all acceptance criteria have been satisfied and that all discrepancies have been corrected. Requirements for formal deliverable acceptance and how to address non-conforming deliverables are usually defined in the supplier agreement. The acquirer should be prepared to exercise all remedies if the supplier fails to perform.

1.3 Manage invoices submitted by the supplier.

² For more information on monitoring supplier's processes, see *Understanding and Leveraging a Supplier's CMMI Efforts: A Guidebook for Acquirers* (CMU/SEI-2007-TR-004). Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, March 2007.
<http://www.sei.cmu.edu/publications/documents/07.reports/07tr004.html>.

The intent of this practice is to ensure that payment terms defined in the supplier agreement are met and that supplier compensation is linked to supplier progress, as defined in the supplier agreement. This practice covers invoices for any type of charge (e.g., one-time, monthly, deliverable-based, pass-through). It covers invoice errors or issues, changes to invoices, billing errors, and withholding disputed charges consistent with the terms and conditions of the supplier agreement. The acquirer must also ensure that appropriate financial and invoice management controls are in place.

Acquisition Requirements Development (ARD)

The purpose of Acquisition Requirements Development (ARD) is to develop and analyze customer and contractual requirements.

Acquisition Requirements Development has two contexts. The first context is the amalgamation and coordination of stakeholder requirements into a set of customer requirements that defines the scope and direction of the acquisition. The second context is the refining and elaboration of the customer requirements into contractual requirements that become the basis of the product and product component requirements derived and developed by the supplier.

The requirements included in the solicitation package form the basis for evaluating proposals by suppliers and for further negotiations with suppliers and communication with the customer. The contractual requirements for the supplier are baselined in the supplier agreement.

When acquiring services instead of products, the same requirements process is used to define high-level operational needs and to allocate those needs to lower level components of the service to ensure the resulting service meets the original intent.

1. Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements.

- 1.1 Elicit stakeholder needs, expectations, constraints, and interfaces for all phases of the product lifecycle.

This practice includes review, coordination, and formalization of top-level operational needs and requirements with the user.

- 1.2 Transform stakeholder needs, expectations, constraints, and interfaces into prioritized customer requirements.

This practice includes the transformation of top level user requirements into engineering-oriented requirements that are typically included in a solicitation. Requirements also include non-functional requirements and other attributes such as evolvability, maintainability, and re-usability, which can drive the definition of the product requirements and architecture.

This practice also includes defining high-level interface requirements in a system of systems.

2. Customer requirements are refined and elaborated into contractual requirements.

- 2.1 Establish and maintain contractual requirements that are based on customer requirements.

Requirements include not only the classical functional and performance requirements, but also interface requirements, whether they are contained in separate interface specifications or within the requirements specifications.

The acquirer's level of involvement in allocating system-level requirements to lower level subsystems and components varies depending on the acquisition environment.

- 2.2 Allocate contractual requirements to supplier deliverables.

As each level of requirements is defined, there is an iterative process of allocation, high-level design, and requirements definition (for the next-lower level). Beyond the level of the architecture at which this responsibility has been assigned to the supplier, it is the acquirer's role to oversee the adequacy of the supplier's process and the resultant flow-down and definition of lower level requirements.

3. Requirements are analyzed and validated.

3.1 Establish and maintain operational concepts and associated scenarios.

Concepts of operations documents or similar documents that define the intended usage concepts and environments are useful in developing requirements and designs that ultimately satisfy the user's operational needs.

3.2 Analyze requirements to ensure that they are necessary and sufficient.

3.3 Analyze requirements to balance stakeholder needs and constraints.

Balance stakeholder needs against constraints such as development cost and schedule or operational and support considerations.

3.4 Validate requirements to ensure the resulting product performs as intended in the user's environment.

Acquisition Technical Management (ATM)

The purpose of Acquisition Technical Management (ATM) is to evaluate the supplier's technical solution and to manage selected interfaces of that solution.

Acquisition technical management activities involve measuring technical progress and the effectiveness of plans and requirements. Activities include those associated with technical performance measurement and the conduct of technical reviews. A structured review process should demonstrate and confirm completion of required accomplishments and exit criteria as defined in project planning and technical plans (e.g., the systems engineering management plan). Acquisition technical management activities discover deficiencies or anomalies that often result in corrective action.

1. Supplier technical solutions are evaluated to confirm that contractual requirements continue to be met.

1.1 Select supplier technical solutions to be analyzed and analysis methods to be used.

Depending on where in the acquisition lifecycle the highest risks occur, the acquirer selects supplier technical solutions for analysis to reduce those risks. Analysis methods are selected based on the type of technical solution being analyzed.

1.2 Analyze selected supplier technical solutions.

The acquirer should select a supplier's design to analyze. The acquirer explores the adequacy and completeness of a design by reviewing product representations (e.g., prototypes, simulations, models, scenarios, and storyboards) and obtaining feedback about them from relevant stakeholders.

The acquirer may require delivery of verification results from the supplier of the technical solution, as applicable. The suppliers may conduct verifications in an iterative fashion, concurrently with the acquirer's technical analyses, or the supplier may be required to conduct follow-on verifications of technical solutions.

1.3 Conduct technical reviews with the supplier as defined in the supplier agreement.

Technical reviews (i.e., architectural evaluations) are performed throughout the project lifecycle to gain confidence that the requirements, architecture, and supplier technical solutions are capable of guiding a development that results in a product or service that provides the required capability. This activity should be integrated with risk management activities. Mature organizations typically perform technical reviews using different proven techniques depending on the type of review. These organizations broaden the basis of the review to include other stakeholder needs, expectations, and constraints.

2. Selected interfaces are managed.

2.1 Select interfaces to manage.

The interfaces considered for selection include all interfaces with other products and services in the operations and support environments as well as environments for verification and validation and services that support those environments. The acquirer should review all supplier interface data for completeness to substantiate the complete coverage of all interfaces when making the selection.

2.2 Manage selected interfaces.

Managing interfaces includes the maintenance of the consistency of the interfaces throughout the life of the product and the resolution of conflict, noncompliance, and change issues. In a system-of-systems environment, the management of interfaces between products or services acquired from suppliers and other systems within the system of systems is critical to the success of the project.

Acquisition Verification (AVER)

The purpose of Acquisition Verification is to ensure that selected work products meet their specified requirements.

Acquisition verification involves ensuring that the evolving work products of the acquisition project meet their specified requirements. The acquisition project should ensure that a proper verification environment exists and that it selects work products to evaluate based on documented criteria. Peer reviews are used to evaluate work products developed by the acquisition project.

The acquisition project is also responsible for ensuring that the supplier uses appropriate methods to verify its work products. In this context, the test community is a major stakeholder, including participation in up-front planning through final-product acceptance. The supplier and/or the test community may perform many of these practices with the acquisition project facilitating the correction of deficiencies or enhancements by the supplier or follow-on maintenance organization. It is important that the acquirer define at the outset the degree to which verification is required both early in the definition of the project and later when the products are received.

Verifications of the evolving products by the supplier are routinely conducted throughout the entire supplier agreement performance period and results are analyzed to determine acceptability of the products (see the Acquisition Technical management and Agreement Management process areas). Acquisition project verification activities should be designed to reduce interference with activities performed by the supplier and test communities and to reduce duplication of the verification efforts.

1. Preparation for verification is conducted.

1.1 Select work products to be verified and verification methods to be used.

Acquirer work products are selected based on their contribution to meeting project objectives and requirements, and to addressing project risks. Peer reviews are one of the methods used to verify work products produced by the acquisition project. Other methods should be selected when verifying work products from the supplier. Examples of these other methods include demonstration, inspection, and actual testing.

1.2 Establish and maintain the environment needed to support verification.

The acquisition project should provide an adequate environment to carry out its verification activities.

1.3 Establish and maintain verification procedures and criteria for the selected work products.

2. Peer reviews are performed on selected work products.

A peer review is a method for conducting verification of work products that has had great success in detecting defects, especially in documents for requirements and design. The acquisition project uses peer reviews on selected products (e.g., solicitation documents, system engineering plans, and test plans) they produce internally to find and remove defects and to ensure compliance to acquisition standards. Many work products produced by the acquisition project set the stage for the project success and are critical to the supplier's performance. The supplier typically uses peer reviews internally on selected interim work products during development, but the acquirer should not rely solely on these results.

- 2.1 Prepare for peer reviews of selected work products.
- 2.2 Conduct peer reviews of selected work products and identify issues resulting from these reviews.
- 2.3 Analyze data about the preparation, conduct, and results of the peer reviews.
- 3. Selected work products are verified against their specified requirements.**
 - 3.1 Perform verification on selected work products.
 - 3.2 Analyze results of all verification activities.

Acquisition Validation (AVAL)

The purpose of Acquisition Validation is to demonstrate that an acquired product or service fulfills its intended use when placed in its intended environment.

Acquisition Validation activities can be applied to all aspects of the product or service in any of its intended environments such as operation, training, manufacturing, maintenance, and support services. The methods employed to accomplish validation can be applied to work products as well as to the product and product components. Work products (e.g., requirements, designs, and prototypes) should be selected for validation based on which are the best predictors of how well the delivered end product and product components will satisfy user needs.

Validation involves ensuring that the evolving acquisition work products (e.g., RFPs, SOWs, and plans) meet the acquisition project's needs. Validation activities are normally performed early and continuously throughout the acquisition lifecycle. The acquirer also uses validation processes to ensure that the product or service received from the supplier will fulfill its intended use. In this context, the test community is a major stakeholder, participating in up-front planning through final-product acceptance. The supplier and/or the test community may perform many of the validation practices with the acquisition project facilitating the correction of deficiencies or enhancements by the supplier or follow-on maintenance organization.

Validation involves the development of requirements for the validation approach, including acceptance criteria, which are incorporated into both the solicitation package and the supplier agreement. Validations of the evolving products by both the supplier and project are routinely conducted throughout the entire supplier agreement performance period and results are analyzed to determine acceptability of the products. Project validation activities should be designed to reduce interference with supplier and test community-performed activities and to reduce the duplication of validation efforts. Validation processes support establishing and validating requirements. See the Acquisition Requirements Development process area for more information.

1. Preparation for validation is conducted.

- 1.1 Select products and product components to be validated and validation methods to be used.

It is important that the acquirer define at the outset the degree to which validation is required both early in the project (e.g., requirements validation activities) and later when the end products are received.

- 1.2 Establish and maintain the environment needed to support validation.

Plans should identify adequate resources to execute validation activities.

- 1.3 Establish and maintain procedures and criteria for validation.

Validation procedures also address the validation of requirements and the acquired product or service throughout the project lifecycle. Typically, formal acceptance testing procedures and criteria are established to ensure the delivered product or service meets stakeholder needs before it is deployed in the intended environment.

2. Selected products and product components are validated to ensure they are suitable for use in their intended operating environment.

- 2.1 Perform validation on selected products and product components.

Validation activities are performed by the acquirer, the supplier, or both parties according to the supplier agreement.

2.2 Analyze results of validation activities.

2.3 SUPPORT PROCESS AREAS

The support process areas include the processes and tools required to allow projects to effectively apply measurement, control, and decision techniques to manage the project.

Configuration Management (CM)

The purpose of Configuration Management is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits.

Acquired products may need to be placed under configuration management by both the supplier and the acquirer. Provisions for conducting configuration management should be established in supplier agreements. Methods to ensure that data are complete and consistent should be established and maintained.

1. Baselines of identified work products are established.

- 1.1 Identify configuration items, components, and related work products to be placed under configuration management.

Acquisition organizations should identify and categorize risks and risk sources for the project initially and refine those risks and categories over time (e.g., schedule, cost, supplier execution, technology readiness, and issues outside control of acquisition organization).

- 1.2 Establish and maintain a configuration management and change management system for controlling work products.

The acquirer considers how configuration items are shared between the acquirer and supplier as well as among relevant stakeholders. If the use of an acquirer's configuration management system is extended to a supplier, the acquirer must exercise security and access control procedures. In many cases, leaving acquired configuration items in the physical possession of the supplier and having access to supplier deliverables is a viable alternative. The supplier agreement specifies appropriate acquirer rights to supplier deliverables in addition to requirements for delivery or access. Supplier work products, whenever they are delivered to the acquirer, are presented in accordance with accepted standards to ensure usability by the acquirer.

- 1.3 Create or release baselines for internal use and for delivery to the customer.

The acquirer reviews and approves the release of product baselines created by the supplier. The acquirer creates baselines for acquirer work products that describe the project, requirements, funding, schedule, and performance measures and makes a commitment to manage the project to those baselines.

2. Changes to the work products under configuration management are tracked and controlled.

- 2.1 Track change requests for configuration items.

Change requests can be initiated either by the acquirer or supplier. Changes that impact acquirer work products and supplier deliverables as defined in the supplier agreement are handled through the acquirer's configuration management process.

- 2.2 Control changes to configuration items.

The acquirer decides which configuration items require version control or more stringent levels of configuration control and establishes mechanisms to ensure configuration items are controlled. Although the supplier may manage configuration items on the acquirer's behalf, the acquirer is responsible for approval and control of changes to these configuration items.

3. Integrity of baselines is established and maintained.

- 3.1 Establish and maintain records describing configuration items.
- 3.2 Perform configuration audits to maintain the integrity of configuration baselines.

Decision Analysis and Resolution (DAR)

The purpose of Decision Analysis and Resolution is to analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria.

A repeatable, criteria-based decision-making process is especially important both while making the critical decisions that define and guide the acquisition process itself and later when critical decisions are made with the selected supplier. The establishment of a formal process for decision making provides the acquisition project with documentation of the decision rationale. Such documentation allows the criteria for critical decisions to be revisited when changes impact project requirements or other critical project parameters.

1. Decisions are based on an evaluation of alternatives using established criteria.

- 1.1 Establish and maintain guidelines to determine which issues are subject to a formal evaluation process.

Not every decision is significant enough to require a formal evaluation process. The choice between the trivial and the truly important may be unclear without explicit guidance. The significance of a particular decision is dependent on the project and circumstances and is determined by the established guidelines.

- 1.2 Establish and maintain criteria for evaluating alternatives, and the relative ranking of these criteria.

Regular use of decision-making criteria, even for less significant decisions, can be extremely helpful in creating a practice for disciplined decision making. Practiced evaluators have demonstrated that defined criteria and weighting can be a significant contributor to the speed and consensus level of a decision.

- 1.3 Identify alternative solutions to address issues.

A wider range of alternatives can surface by soliciting as many stakeholders as is practical for input. Input from stakeholders with diverse skills and backgrounds can help teams identify and address assumptions, constraints, and biases. Brainstorming sessions with support from the stakeholder may stimulate innovative alternatives through rapid interaction and feedback.

- 1.4 Select evaluation methods.

Suppliers competing to develop a technical solution for the acquirer may be directly evaluated in a final competition that involves a performance or functional demonstration of proposed solutions.

- 1.5 Evaluate alternative solutions using established criteria and methods.

- 1.6 Select solutions from alternatives based on evaluation criteria.

Document the results of the evaluation for future reference.

Measurement and Analysis (MA)

The purpose of Measurement and Analysis is to develop and sustain a measurement capability used to support management information needs.

The acquisition project has needs for information to help determine the status of its activities throughout the acquisition lifecycle, the supplier's activities per requirements in the supplier agreement, and the status of the evolving products acquired. In acquisition projects in which multiple products are acquired to deliver a capability to the end user, or in which there are teaming relationships with other acquisition projects to acquire joint capabilities, additional information needs may be identified to ensure programmatic, technical, and operational interoperability objectives for the product are identified, measured, and achieved.

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

Not all measurements are valuable. Those measurements that address the needs and objectives of the acquisition project are the most valuable. It is best to identify the measures that focus on the objectives, rather than measures that are easily obtained but have questionable value.

1.1 Establish and maintain measurement objectives derived from identified information needs and objectives.

Identify the information needed to keep the acquisition on track to a successful conclusion. Establish measurement objectives and measurement criteria needed to provide this information.

1.2 Specify measures to address measurement objectives.

In most cases, supplier measures are the primary source of data, especially with regard to the development of the acquired product or service. For instance, measurement and analysis of the product or product components provided by a supplier through technical performance measures is essential for effective management. Technical performance measures are precisely defined measures based on a product requirement, product capability, or some combination of requirements and capabilities.

1.3 Specify how measurement data is obtained and stored.

The supplier agreement specifies the measurement data the supplier must provide to the acquirer, the format in which data must be provided to the acquirer, how the data must be collected and stored by the supplier (e.g., retention period of data), how and how often data must be transferred to the acquirer, and who has access to data. Some supplier data may be considered proprietary by the supplier and may need to be protected as such by the acquirer. Some acquirer measurement data (e.g., total project cost data) may be proprietary and should not be shared with suppliers. An acquirer must plan for the collection, storage, and access control of sensitive data.

1.4 Specify how measurement data are analyzed and communicated.

The supplier agreement defines the data analysis and the definition and examples of measures the supplier must provide to the acquirer.

2. Measurement results, which address identified information needs and objectives, are provided.

- 2.1 Obtain specified measurement data.
- 2.2 Analyze and interpret measurement data.
- 2.3 Manage and store measurement data, measurement specifications, and analysis results.
- 2.4 Communicate results of measurement and analysis activities to all relevant stakeholders.

Process and Product Quality Assurance (PPQA)

The purpose of Process and Product Quality Assurance (PPQA) is to provide staff and management with objective insight into processes and associated work products.

The acquirer evaluates critical acquirer work products, acquirer processes, results of supplier process quality assurance, and supplier deliverables. For example, process and product quality assurance process ensures that the solicitation package was developed using standard processes agreed on by the acquirer and supplier and that the package conforms to all applicable policies. The acquirer may review results of supplier quality assurance activities for selected supplier processes to ensure that the supplier is following its own processes.

1. Adherence of the performed process and associated work products and services to applicable process descriptions, standards, and procedures is objectively evaluated.

- 1.1 Objectively evaluate designated performed processes against applicable process descriptions, standards, and procedures.
- 1.2 Objectively evaluate designated work products and services against applicable process descriptions, standards, and procedures.

In addition to objectively evaluating critical acquirer work products, the acquirer uses objective acceptance criteria to evaluate supplier deliverables throughout the project lifecycle. The acquirer's acceptance criteria for supplier deliverables are consistent with project objectives and sufficient to allow the supplier to satisfactorily demonstrate that the product conforms to requirements in the supplier agreement.

2. Noncompliance issues are objectively tracked and communicated, and resolution is ensured.

- 2.1 Communicate quality issues and ensure the resolution of noncompliance issues with the staff and managers.
- 2.2 Establish and maintain records of quality assurance activities.

3 Generic Practices

Generic practices are practices that should be included in every process area, in addition to the specific practices that appear in each process area description. Generic practices improve the power of a process by ensuring that the specific practices are executed and that there is appropriate planning of the process to ensure that it is feasible and well supported and that stakeholders are properly involved.

In this section, practices are denoted by bold-faced text and followed by a brief explanation. The last two generic practices documented in this section ensure that the performance of each process and the lessons learned are saved and that this knowledge is used to establish new projects or to improve the performance of an existing project. The 12 generic practices listed here correspond to the 10 generic practices under generic goal 2 and the two generic practices under generic goal 3 in the CMMI-ACQ model.

1. Establish and maintain an organizational policy for planning and performing the process.

This generic practice defines the organizational expectations for the process and makes these expectations visible to those in the organization who are affected. In general, senior management is responsible for establishing and communicating guiding principles, direction, and expectations for the organization.

Not all direction from senior management will bear the label “policy.” The existence of appropriate organizational direction is the expectation of this generic practice, regardless of what it is called or how it is imparted.

This policy establishes organizational expectations for planning and performing the process, including not only the elements of the process addressed directly by the acquirer, but also the interactions of the acquirer with suppliers.

2. Establish and maintain the plan for performing the process.

The purpose of this generic practice is to determine what is needed to perform the process and achieve the established objectives, to prepare a plan for performing the process, to prepare a process description, and to get agreement on the plan from relevant stakeholders.

Planning a process applies to all process areas including Project Planning. The process for planning the project requires planning (e.g., resource, duration) just like any other activity.

The objectives for the process may be derived from other plans (e.g., project plans). Included are objectives for the specific situation, including quality, cost, and schedule objectives. For example, an objective might be to reduce the cost of performing a process for an implementation over its previous implementation.

Establishing a plan includes documenting the plan and a process description. Maintaining the plan includes updating it as necessary in response to either corrective actions or to changes in process requirements and objectives.

The plan for performing the process typically includes the following elements:

- Process description
- Standards and requirements for the work products and services of the process
- Objectives for the performance of the process (e.g., quality, time scale, cycle time, and resource usage)
- Dependencies among activities, work products, and services of the process
- Resources (including funding, people, and tools) needed to perform the process
- Assignment of responsibility and authority
- Training needed for performing and supporting the process
- Work products to be controlled and the level of control for each item
- Measurement requirements to provide insight into the performance of the process, its work products, and its services
- Involvement of identified stakeholders
- Activities for monitoring and controlling the process
- Objective evaluation activities for the process
- Management review activities for the process and the work products

3. Provide adequate resources for performing the process, developing the work products, and providing the services of the process.

This generic practice ensures that resources necessary to perform the process as defined by the plan are available when they are needed. Resources include adequate funding, appropriate physical facilities, skilled people, and appropriate tools.

The interpretation of the term *adequate* depends on many factors and can change over time. Inadequate resources may be addressed by increasing resources or by removing requirements, constraints, and commitments.

4. Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process.

This generic practice ensures that there is accountability for performing the process and achieving the specified results throughout the life of the process. The people assigned must have the appropriate authority to perform their assigned responsibilities.

Responsibility can be assigned using detailed job descriptions or in living documents, such as the plan for performing the process. Dynamic assignment of responsibility is another legitimate way to perform this generic practice, as long as the assignment and acceptance of responsibility are ensured throughout the life of the process.

5. Train the people performing or supporting the process as needed.

This generic practice ensures that the people have the necessary skills and expertise to perform or support the process.

Training supports the successful performance of the process by establishing a common understanding of the process and by imparting the skills and knowledge needed to perform the process.

6. Place designated work products of the process under appropriate levels of control.

This generic practice establishes and maintains the integrity of the designated work products of the process (or their descriptions) throughout their useful life.

Designated work products are identified in the plan for performing the process, along with a specification of the appropriate level of control.

7. Identify and involve the relevant stakeholders of the process as planned.

This generic practice establishes and maintains the expected involvement of stakeholders during the execution of the process.

To plan stakeholder involvement, ensure that sufficient stakeholder interaction necessary to accomplish the process occurs, while avoiding excessive numbers of stakeholders that could impede process execution.

8. Monitor and control the process against the plan for performing the process and take appropriate corrective action.

The purpose of this generic practice is to perform the direct day-to-day monitoring and controlling of the process. Appropriate visibility into the process is maintained so that appropriate corrective action can be taken when necessary. Monitoring and controlling the process involves measuring appropriate attributes of the process or work products produced by the process.

9. Objectively evaluate adherence of the process against its process description, standards, and procedures, and address noncompliance.

This generic practice provides credible assurance that the process is implemented as planned and adheres to its process description, standards, and procedures. This generic practice is implemented, in part, by evaluating selected work products of the process.

10. Review the activities, status, and results of the process with higher level management and resolve issues.

This generic practice provides higher level management with the appropriate visibility into the process.

Higher level management includes those levels of management in the organization above the immediate level of management responsible for the process. In particular, higher level management includes senior management. These reviews are for managers who provide the policy and overall guidance for the process, and not for those who perform the direct day-to-day monitoring and controlling of the process.

The following two generic practices form the basis for propagating good practice to future acquisition projects. These practices facilitate process definition and identify process benefits that encourage adoption of best practices on new projects.

A defined process is tailored from the organization's set of standard processes according to the organization's tailoring guidelines and contributes work products, measures, and other process-improvement information to the organizational process assets.

These two generic practices activate a process improvement cycle. The organization maintains a process asset library and standard process that can be drawn upon by a project to create its processes. In turn, the project provides information about the performance of its process to the organization's process asset library, which is used to improve and extend the standard processes.

The organization's set of standard processes, which are the basis of the defined process, are established and improved over time. Standard processes describe the fundamental process elements that are expected in the defined processes. Standard processes also describe the relationships (e.g., the ordering and interfaces) between these process elements. The organization-level infrastructure to support current and future use of the organization's set of standard processes is established and improved over time.

11. Establish and maintain the description of a defined process.

The purpose of this generic practice is to establish and maintain a description of the process that is tailored from the organization's set of standard processes to address the needs of a specific situation. The organization should have standard processes that cover the process area and have guidelines for tailoring these standard processes to meet the needs of a project or organizational function. With a defined process, variability in how the processes are performed across the organization is reduced and process assets, data, and learning can be effectively shared.

12. Collect work products, measures, measurement results, and improvement information derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets.

This generic practice collects information and artifacts derived from planning and performing the process. This generic practice is performed so that the information and artifacts can be included in organizational process assets and made available to those who are (or who will be) planning and performing the same or similar processes. The information and artifacts are stored in the organization's measurement repository and the organization's process asset library.

Appendix: Implementation Questions

The questions included in this appendix will help you, as an acquisition project manager, implement your processes. The questions help you verify that best practices are being employed and provide a means of gathering background information necessary to determine if the products or services being acquired will meet the operational needs of your organization.

The questions in the tables below were designed to facilitate review and improvement of the processes in your acquisition organization. They address whether or not strategy development, planning, and estimating activities occur. In large part, these early activities determine the success of an acquisition process from the outset. The questions also focus on risk identification, management practices, capabilities definition and requirements generation, and the existence of repeatable processes that enable organizations to institutionalize best practices. For each question in the left-hand column, the relevant process areas, described in detail in Section 2, are listed in the right-hand column.

1. Processes in General	
Questions	CMMI-ACQ Process Areas
a. What are the content and source of your acquisition processes?	Project Planning, Integrated Project Management
b. What mechanisms do you use to monitor, control, and improve your acquisition processes?	Project Monitoring and Control, Measurement and Analysis, Process and Product Quality Assurance
c. How do you know that your project is adhering to your acquisition processes?	Project Monitoring and Control, Process and Product Quality Assurance
2. User Requirements	
Questions	CMMI-ACQ Process Areas
a. Is there a process in place to define, verify, and validate customer and contractual requirements?	Acquisition Requirements Development
b. How do you manage users' involvement in the requirements process?	Project Planning, Integrated Project Management, Requirements Management, Acquisition Requirements Development
c. How do you ensure a clear understanding of user needs by relevant stakeholders?	Requirements Management, Acquisition Requirements Development, Integrated Project Management
d. What role does your organization play in establishing the project requirements?	Acquisition Requirements Development, Requirements Management,

e. What is your strategy for keeping up with the evolving operational environment (e.g., threat, concept of operations, and technology readiness)?	Integrated Project Management, Requirements Management
3. Acquisition Strategy	
Questions	CMMI-ACQ Process Areas
a. How did you determine the most appropriate acquisition strategy for this acquisition?	Project Planning, Decision Analysis and Resolution, Risk Management
b. How does your selected acquisition strategy mitigate the risks you have identified?	Project Planning, Risk Management
c. Which stakeholders were involved in establishing the acquisition strategy?	Project Planning, Integrated Project Management
4. Acquisition Planning	
Questions	CMMI-ACQ Process Areas
a. How do your acquisition plans reflect and implement the acquisition strategy?	Project Planning, Integrated Project Management, Decision Analysis and Resolution
b. How do you determine and document the scope of the project, including acquisition project activities, supplier activities, and other related activities (operational testing, user activities, etc.)?	Project Planning, Solicitation and Supplier Agreement Development
c. How do you determine the magnitude of the development effort?	Project Planning
d. How do you determine resource needs for each element of the project?	Project Planning
e. How do you determine the critical path?	Project Planning, Integrated Project Management
f. How are plans coordinated with relevant stakeholders at both the management and working levels?	Project Planning, Integrated Project Management
g. How do you ensure that you have adequate staff with the necessary experience and training to execute your plans?	Project Planning
h. How do you ensure that the supplier has the resources and tools needed to complete the project?	Project Planning, Solicitation and Supplier Agreement Development, Agreement Management

i. How do you ensure that the supplier has the domain experience and process capability needed to complete the project?	Project Planning, Solicitation and Supplier Agreement Development, Agreement Management
5. Cost, Schedule, and Performance Baselines	
Questions	CMMI-ACQ Process Areas
a. How do you ensure that the cost, schedule, and performance baselines are integrated, realistic and executable?	Project Planning, Integrated Project Management
b. What provisions do you make for independent reviews of your cost, schedule, and performance baselines?	Project Planning, Integrated Project Management, Acquisition Requirements Development, Requirements Management
c. How do you ensure that all the lifecycle costs are included in the baselines (e.g., testing, training, sustainment, and support)?	Project Planning, Integrated Project Management,
d. How do you plan to track cost, schedule, and performance of the project throughout its lifecycle?	Project Monitoring and Control, Measurement and Analysis
e. How do you accommodate risks and engineering changes in your baselines?	Project Planning, Risk Management, Requirements Management
f. How do you manage changes to baselines?	Configuration Management, Project Monitoring and Control, Requirements Management
g. How do you evaluate the impact of changes in cost and schedule on supplier's development efforts?	Project Monitoring and Control, Solicitation and Supplier Agreement Development, Requirements Management
6. Risk Identification and Management	
Questions	CMMI-ACQ Process Areas
a. How do you identify project risks?	Project Planning, Risk Management
b. How do you identify risks related to your acquisition strategy and plans?	Project Planning, Risk Management
c. How do you identify risks associated with cost and schedule?	Project Planning, Integrated Project Management, Risk Management
d. How do you ensure that you understand the cost risk of obtaining the required capability?	Project Planning, Risk Management, Requirements Development

e. How do you identify risks related to supplier execution?	Project Planning, Risk Management, Solicitation and Supplier Agreement Development
f. How do you identify risks that are outside your control?	Project Planning, Integrated Project Management, Risk Management
g. How do you assess the likelihood and consequence of project risks?	Risk Management
h. How do you monitor mitigation efforts for identified risks?	Risk Management
i. Which risk management tool(s) do you employ?	Project Planning, Risk Management
j. Who is involved in project risk assessment (e.g., users, the supplier, and independent subject matter experts)?	Integrated Project Management, Risk Management
k. How do you build in sufficient reserves for risk mitigation and absorbing the impact of realized risks?	Project Planning, Risk Management
7. Supplier Monitoring	
Questions	CMMI-ACQ Process Areas
a. How do you assess the mechanisms the supplier uses to encourage execution of their organization's processes from the beginning of the project?	Agreement Management, Acquisition Technical Management, Risk Management
b. Is there a process in place to define, verify, and validate requirements and architectures for the product?	Acquisition Requirements Development, Acquisition Technical Management
c. How will the status of development be monitored?	Project Monitoring and Control, Measurement and Analysis, Agreement Management
d. How will the supplier demonstrate the performance and stability of their development environment and tools?	Agreement Management

8. Nondevelopmental Items	
Questions	CMMI-ACQ Process Areas
a. What is your strategy for incorporating nondevelopmental products (e.g., commercial off-the-shelf [COTS], government off-the-shelf [GOTS], reuse, and product lines) into the project?	Project Planning, Decision Analysis and Resolution, Acquisition Requirements Development
b. What percentage of the software is planned to be nondevelopmental?	Project Planning, Measurement and Analysis
c. How do you determine that you can achieve the planned percentage of nondevelopmental software use on this project?	Project Planning, Risk Management, Verification, Validation, Decision Analysis and Resolution
d. How do you determine that the planned nondevelopmental products will provide the required functionality and performance?	Measurement and Analysis, Requirements Development, Verification, Validation, Decision Analysis and Resolution
e. How do you determine that the interfaces for nondevelopmental products are defined and agreed to by relevant stakeholders?	Acquisition Technical Management
f. How do you account for the effort required to test and integrate nondevelopmental products?	Acquisition Requirements Development, Acquisition Technical Management, Validation

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13. ABSTRACT (MAXIMUM 200 WORDS) Using relevant best practices from the CMMI® (Capability Maturity Model® Integration) for Acquisition (CMMI-ACQ) model, this primer defines effective and efficient practices for acquisition projects. These best practices address activities that include monitoring and controlling contractors and suppliers that develop products and services and deliver services. The practices in this primer provide a foundation for acquisition process discipline and rigor that enables product and service development and service delivery to be repeatedly executed for ultimate acquisition success. This primer can be used by projects that acquire products or services in government and non-government organizations to improve acquisition processes. Selected content of the CMMI-ACQ model is used in this primer as a basis for helping readers unfamiliar with CMMI to begin their process improvement journey. After using this primer, most organizations will want to implement the CMMI-ACQ model. This primer can also be used by acquisition organizations that manage several related acquisition projects (e.g., product centers, acquisition commands) to establish an acquisition process improvement program. However, organizations at that level should consider using the CMMI-ACQ model instead because it includes organizational process management practices.				
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