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ACQUISITION VALIDATION

An Acquisition Process Area at Maturity Level 3

Purpose

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

Introductory Notes

Validation demonstrates that the acquired product or service, as provided, will fulfill its intended use. In other words, validation ensures that the acquired product or service meets stakeholders' needs and customer requirements.

Validation activities are performed early and incrementally throughout the project lifecycle. These activities can be applied to all aspects of the product and its components in any of their intended environments, such as operations, training, manufacturing, maintenance, and support services. (Throughout the process areas, where we use the phrase product and product component, the intended meaning encompasses services and their components.)

The product or product components that are selected to be validated by the acquirer vary depending on project attributes. Methods used to conduct validation also can be applied to selected acquirer work products (e.g., customer requirements) and supplier deliverables (e.g., prototypes, simulations, and demonstrations). Method selection is based on which methods best predict how well the acquired product or service will satisfy stakeholder needs.

Whenever possible, validation should be conducted using the product or product component operating in its intended environment. Either the entire environment or part of it can be used.

When validation issues are identified, these issues are referred to processes associated with the Acquisition Requirements Development or Project Monitoring and Control process areas for resolution.

The specific practices of this process area build on each other in the following way:

- The Select Products for Validation specific practice enables the identification of the product or product component to be validated and methods to be used to perform the validation.
- The Establish the Validation Environment specific practice enables the determination of the environment to be used to carry out the validation.

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The validation environment should represent the intended environment for the product and product components as well as represent the intended environment suitable (... [1])

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- The Establish Validation Procedures and Criteria specific practice enables the development of validation procedures and criteria that are aligned with the characteristics of selected products, customer constraints on validation, methods, and the validation environment.
- The Perform Validation specific practice enables the performance of validation according to methods, procedures, and criteria.
- The Analyze Validation Results specific practice enables the analysis of validation results against criteria.

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Related Process Areas

Refer to the Acquisition Requirements Development process area for more information about requirements validation.

Refer to the Agreement Management process area for more information about accepting the acquired product or service.

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Refer to the Acquisition Technical Management process area for more information about evaluating supplier work products.

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Specific Goal and Practice Summary

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SG 1 Prepare for Validation

- SP 1.1 Select Products for Validation
- SP 1.2 Establish the Validation Environment
- SP 1.3 Establish Validation Procedures and Criteria

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SG 2 Validate Selected Products and Product Components

- SP 2.1 Perform Validation
- SP 2.2 Analyze Validation Results

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Specific Practices by Goal

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SG 1 Prepare for Validation

Preparation for validation is conducted.

Validation preparation activities include selecting products and product components for validation and establishing and maintaining the validation environment, procedures, and criteria. Items selected for validation may include only the product or it may include appropriate levels of product components used to build the product. Any product or product component may be subject to validation, including replacement, maintenance, and training products, to name a few.

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The environment required to validate the product or product component is prepared. The environment may be purchased or may be specified, designed, and built. Environments used for verification may be considered in collaboration with the validation environment to reduce cost and improve efficiency or productivity.

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Acquisition Validation (AVAL)

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Expectations for validation which are typically included in the supplier agreement include the following:

- List of acquired products to be validated by the acquirer before formal acceptance
- List of products to be validated with customers, users, or other stakeholders by the supplier and applicable validation standards, procedures, methods, tools and criteria, if any
- Measurements to be collected and provided by the supplier with regard to validation activities
- Supplier roles in product and product component validation
- Validation environments to be used by the acquirer
- Validation procedures to be developed and criteria to be used for validation

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SP 1.1 Select Products for Validation

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

Products and product components are selected for validation based on their relationship to user needs. For each product or product component, the scope of the validation (e.g., operational behavior, maintenance, training, and user interface) should be determined.

Examples of products and product components that can be validated include the following:

- Customer requirements and design constraints
- Acquired products and product components (e.g., system, hardware units, software, service documentation)
- User manuals
- Training materials
- Process documentation

Deleted: The requirements and constraints for performing validation are collected. Then, validation methods are selected based on their ability to demonstrate that user needs are satisfied. The validation methods not only define the approach to product validation, but also drive the needs for the facilities, equipment, and environments. This may result in the generation of lower level product component requirements that are handled by the requirements development processes. Derived requirements, such as interface requirements to test sets and test equipment, can be generated. These requirements are also passed to the requirements development processes to ensure that the product or product components can be validated in an environment that supports the methods.¶

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Validation methods should be selected early in the life of the project so they are clearly understood and agreed to by relevant stakeholders.

Validation methods address the development, maintenance, support, and training for the product or product components, as appropriate.

Examples of validation methods include the following:

- Discussions with users, perhaps in the context of a formal review
- Prototype demonstrations
- Functional demonstrations (e.g., system, hardware units, software, service documentation, and user interfaces)
- Pilots of training materials
- Tests of products and product components by end users and other relevant stakeholders

Deleted: <#>Analyses of product and product components (e.g., simulations, modeling, and user analyses)¶

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For Hardware Engineering¶
Hardware validation activities include modeling to validate form, fit, and function of mechanical designs; thermal modeling; maintainability and reliability analysis; timeline demonstrations; and electrical design simulations of electronic or mechanical product components.¶

Typical Work Products

1. Lists of products and product components selected for validation
2. Validation methods for each product or product component
3. Requirements for performing validation for each product or product component
4. Validation constraints for each product or product component

Subpractices

1. Identify the key principles, features, and phases for product or product component validation throughout the life of the project.

2. Determine the customer requirements to be validated.

The product or product component must be maintainable and supportable in its intended operational environment. This specific practice also addresses the actual maintenance, training, and support services that may be delivered with the product.

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3. Select the product and product components to be validated.

4. Select the evaluation methods for product or product component validation.

5. Review the validation selection, constraints, and methods with relevant stakeholders.

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SP 1.2 Establish the Validation Environment

Establish and maintain the environment needed to support validation.

The requirements for the validation environment are driven by the product or service selected, type of work products (e.g., design, prototype, and final version), and validation methods. These selections may yield requirements for the purchase or development of equipment, software, or other resources. The validation environment may include the reuse of existing resources. In this case, arrangements for the use of these resources must be made.

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Example types of elements in a validation environment include the following:

- Test tools interfaced with the product being validated (e.g., scope, electronic devices, and probes)
- Temporary embedded test software
- Recording tools for dump or further analysis and replay
- Simulated subsystems or components (e.g., software, electronics, or mechanics)
- Simulated interfaced systems (e.g., a dummy warship for testing a naval radar)
- Real interfaced systems (e.g., aircraft for testing a radar with trajectory tracking facilities)
- Facilities and customer-supplied products
- Skilled people to operate or use all the preceding elements
- Dedicated computing or network test environment (e.g., pseudo-operational telecommunications-network test bed or facility with actual trunks, switches, and systems established for realistic integration and validation trials)

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Early selection of products or product components to be validated, work products to be used in validation, and validation methods is needed to ensure that the validation environment will be available when necessary.

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The validation environment should be carefully controlled to provide for replication, results analysis, and revalidation of problem areas.

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Typical Work Products

1. Validation environment

Subpractices

1. Identify requirements for the validation environment.
2. Identify customer-supplied products.
3. Identify reuse items.
4. Identify validation equipment and tools.
5. Identify validation resources that are available for reuse and modification.
6. Plan the availability of resources in detail.

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SP 1.3 Establish Validation Procedures and Criteria

Establish and maintain procedures and criteria for validation.

Validation procedures and criteria are defined to ensure the product or product component will fulfill its intended use when placed in its intended environment. Acceptance test cases and procedures may be used for validation procedures.

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The validation procedures and criteria include validation of maintenance, training, and support services.

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These 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.

The validation procedures and criteria applicable to the supplier are typically referenced in the solicitation package and supplier agreement.

Examples of sources for validation criteria include the following:

- Business process descriptions
- Customer requirements
- Customer acceptance criteria
- Standards

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<#>Thresholds of performance deviation¶

Typical Work Products

1. Validation procedures
2. Validation criteria
3. Test and evaluation procedures for maintenance, training, and support

Subpractices

1. Review the requirements to ensure that issues affecting validation of the acquired product or service are identified and resolved.
2. Document the environment, operational scenario, procedures, inputs, outputs, and criteria for the validation of the acquired product or service.
3. Assess the product or service as it matures in the context of the validation environment to identify validation issues.

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SG 2 Validate Selected Products and Product Components

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

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The validation methods, procedures, criteria, and the environment are used to validate the selected products and product components and associated maintenance, training, and support services. Validation activities are performed throughout the project lifecycle.

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Validation activities are performed by the acquirer, the supplier, or both parties in accordance with the supplier agreement.

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SP 2.1 Perform Validation

Perform validation on selected products and product components.

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To be acceptable to stakeholders, a product or product component must perform as expected in its intended operational environment.

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Validation activities are performed and the resulting data are collected according to established methods, procedures, and criteria.

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The as-run validation procedures should be documented and the deviations occurring during the execution should be noted, as appropriate.

Typical Work Products

- 1. Validation reports
- 2. Validation results
- 3. Validation cross-reference matrix
- 4. As-run procedures log
- 5. Operational demonstrations

SP 2.2 Analyze Validation Results

Analyze results of validation activities.

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The data resulting from validation tests, inspections, demonstrations, or evaluations are analyzed against defined validation criteria. Analysis reports indicate whether needs were met. In the case of deficiencies, these reports document the degree of success or failure and categorize probable causes of failure. The collected test, inspection, or review results are compared with established acceptance criteria to determine whether to proceed or to address requirements or design issues with the supplier.

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Analysis reports or as-run validation documentation may also indicate that bad test results are due to a validation procedure problem or a validation environment problem.

Typical Work Products

- 1. Validation deficiency reports
- 2. Validation issues
- 3. Procedure change request

Subpractices

- 1. Compare actual results to expected results.
- 2. Based on the established validation criteria, identify products and product components that do not perform suitably in their intended operating environments, or identify problems with methods, criteria, or the environment.
- 3. Analyze validation data for defects.
- 4. Record results of the analysis and identify issues.
- 5. Use validation results to compare actual measurements and performance to the intended use or operational need.

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6. Identify, document, and track action items to closure for work products that do not pass their validation.

Refer to the Project Monitoring and Control process area for more information about tracking action items.

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Deleted: Manage Configurations

Deleted: Place designated work products of the validation process under appropriate levels of control.

Elaboration:
Examples of work products placed under control include the following:
<#>Lists of products and product components selected for validation
<#>Validation methods, procedures, and criteria
<#>Validation reports

GP 2.7 Identify and Involve Relevant Stakeholders

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

Elaboration:
Select relevant stakeholders from customers, end users, developers, producers, testers, suppliers, marketers, maintainers, disposal personnel, and others who may be affected by, or may affect, the product as well as the process.

Examples of activities for stakeholder involvement include the following:
<#>Selecting the products and product components to be validated
<#>Establishing the validation methods, procedures, and criteria
<#>Reviewing results of product and product component validation and resolving issues
<#>Resolving issues with the customers or end users

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Monitor and control the validation

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Deleted: performing the process and take appropriate corrective action.

Elaboration:
Examples of measures and work products used in monitoring and controlling include the following:

Deleted: derived from planning and performing the validation process to support the future use and improvement of the organization's processes and process assets

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Examples of work products, measures, measurement results, and improvement information include the following:
<#>Product component prototype
<#>Percent of time the validation environment is available

Validation activities can be applied to all aspects of the product 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. (Throughout the process areas, where we use the terms product and product component, their intended meanings also encompass services and their components.) The work products (e.g., requirements, designs, and prototypes) should be selected on the basis of which are the best predictors of how well the product and product component will satisfy user needs and thus validation is performed early and incrementally throughout the product lifecycle.

The validation environment should represent the intended environment for the product and product components as well as represent the intended environment suitable for validation activities with work products.

; whereas, verification addresses whether the work product properly reflects the specified requirements

“you built the right thing.” Validation activities use approaches similar to verification (e.g., test, analysis, inspection, demonstration,

other relevant stakeholders are involved in the validation activities. Both validation and verification activities often run concurrently and may use portions of the same environment

or only part of it. However, validation issues can be discovered early in the life of the project using work products by involving relevant stakeholders. Validation activities for services can be applied to work products such as proposals, service catalogs, statements of work, and service records

Generic Practices by Goal

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GG 1 Achieve Specific Goals

The process supports and enables achievement of the specific goals of the process area by transforming identifiable input work products to produce identifiable output work products.

GP 1.1 Perform Specific Practices

Perform the specific practices of the validation process to develop work products and provide services to achieve the specific goals of the process area.

GG 2 Institutionalize a Managed Process

The process is institutionalized as a managed process.

Staged Only

GG 3 Institutionalize a Defined Process

The process is institutionalized as a defined process.

This generic goal's appearance here reflects its location in the staged representation.

GP 2.1 Establish an Organizational Policy

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

Elaboration:

This policy establishes organizational expectations for selecting products and product components for validation; for selecting validation methods; and for establishing and maintaining validation procedures, criteria, and environments that ensure the products and product components satisfy user needs in their intended operating environment.

GP 2.2 Plan the Process

Establish and maintain the plan for performing the validation process.

Elaboration:

This plan for performing the validation process can be included in (or referenced by) the project plan, which is described in the Project Planning process area.

GP 2.3 Provide Resources

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

Elaboration:

Special facilities may be required for validating the product or product components. When necessary, the facilities required for validation are developed or purchased.

Examples of other resources provided include the following tools:

- Test-management tools
- Test-case generators
- Test-coverage analyzers
- Simulators
- Load, stress, and performance tools

GP 2.4 Assign Responsibility

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

GP 2.5 Train People

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

Elaboration:

Examples of training topics include the following:

- Application domain
- Validation principles, standards, and methods
- Intended-use environment

GP 2.

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

Elaboration:

Examples of work products placed under control include the following:

- Lists of products and product components selected for validation
- Validation methods, procedures, and criteria
- Validation reports

GP 2.7 Identify and Involve Relevant Stakeholders

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

Elaboration:

Select relevant stakeholders from customers, end users, developers, producers, testers, suppliers, marketers, maintainers, disposal personnel, and others who may be affected by, or may affect, the product as well as the process.

Examples of activities for stakeholder involvement include the following:

- Selecting the products and product components to be validated
- Establishing the validation methods, procedures, and criteria
- Reviewing results of product and product component validation and resolving issues
- Resolving issues with the customers or end users

Issues with the customers or end users are resolved particularly when there are significant deviations from their baseline needs for the following:

- Waivers on the contract or agreement (what, when, and for which products)
- Additional in-depth studies, trials, tests, or evaluations
- Possible changes in the contracts or agreements

GP 2.8 Monitor

performing the process and take appropriate corrective action.

Elaboration:

Examples of measures and work products used in monitoring and controlling include the following:

- Number of validation activities completed (planned versus actual)
- Validation problem report trends (e.g., number written and number closed)
- Validation problem report aging (i.e., how long each problem report has been open)
- Schedule for a specific validation activity

GP 2.9 Objectively Evaluate Adherence

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

Elaboration:

Examples of activities reviewed include the following:

- Selecting the products and product components to be validated
- Establishing and maintaining validation methods, procedures, and criteria
- Validating products or product components

Examples of work products reviewed include the following:

- Validation methods, procedures, and criteria

GP 2.10 Review Status with Higher Level Management

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

Continuous Only

GG 3 Institutionalize a Defined Process

The process is institutionalized as a defined process.

This generic goal's appearance here reflects its location in the continuous representation.

GP 3.1 Establish a Defined Process

Establish and maintain the description of a defined validation process.

GP 3.2 Collect Improvement Information

Collect work products, measures, measurement results, and improvement

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Elaboration:

Examples of work products, measures, measurement results, and improvement information include the following:

Product component prototype

Percent of time the validation environment is available

Number of product defects found through validation per development phase

Validation analysis report

Continuous Only

GG 4 Institutionalize a Quantitatively Managed Process

The process is institutionalized as a quantitatively managed process.

GP 4.1 Establish Quantitative Objectives for the Process

Establish and maintain quantitative objectives for the validation process, which address quality and process performance, based on customer needs and business objectives.

GP 4.2 Stabilize Subprocess Performance

Stabilize the performance of one or more subprocesses to determine the ability of the validation process to achieve the established quantitative quality and process-performance objectives.

GG 5 Institutionalize an Optimizing Process

The process is institutionalized as an optimizing process.

GP 5.1 Ensure Continuous Process Improvement

Ensure continuous improvement of the validation process in fulfilling the relevant business objectives of the organization.

GP 5.2 Correct Root Causes of Problems

Identify and correct the root causes of defects and other problems in the validation process.