

DECISION ANALYSIS AND RESOLUTION

A Support Process Area at Maturity Level 3

Purpose

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

Introductory Notes

The Decision Analysis and Resolution process area involves establishing guidelines to determine which issues should be subject to a formal evaluation process and applying formal evaluation processes to these issues.

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A formal evaluation process is a structured approach to evaluating alternative solutions against established criteria to determine a recommended solution.

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A formal evaluation process involves the following actions:

- Establishing the criteria for evaluating alternatives
- Identifying alternative solutions
- Selecting methods for evaluating alternatives
- Evaluating alternative solutions using established criteria and methods
- Selecting recommended solutions from alternatives based on evaluation criteria

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Rather than using the phrase *alternative solutions to address issues*, each time, in this process area, one of two shorter phrases are used: *alternative solutions* or *alternatives*.

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

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A formal evaluation process reduces the subjective nature of a decision and provides a higher probability of selecting a solution that meets multiple demands of relevant stakeholders.

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While the primary application of this process area is to technical concerns, formal evaluation processes can also be applied to many nontechnical issues, particularly when a project is being planned. Issues that have multiple alternative solutions and evaluation criteria lend themselves to a formal evaluation process.

Guidelines are created for deciding when to use formal evaluation processes to address unplanned issues. Guidelines often suggest using formal evaluation processes when issues are associated with medium to high risks or when issues affect the ability to achieve project objectives.

Formal evaluation processes can vary in formality, type of criteria, and methods employed. Less formal decisions can be analyzed in a few hours, use few criteria (e.g., effectiveness and cost to implement), and result in a one- or two-page report. More formal decisions may require separate plans, months of effort, meetings to develop and approve criteria, simulations, prototypes, piloting, and extensive documentation.

Both numeric and non-numeric criteria can be used in a formal evaluation process. Numeric criteria use weights to reflect the relative importance of criteria. Non-numeric criteria use a more subjective ranking scale (e.g., high, medium, or low). More formal decisions may require a full trade study.

A formal evaluation process identifies and evaluates alternative solutions. The eventual selection of a solution may involve iterative activities of identification and evaluation. Portions of identified alternatives may be combined, emerging technologies may change alternatives, and the business situation of suppliers may change during the evaluation period.

A recommended alternative is accompanied by documentation of selected methods, criteria, alternatives, and rationale for the recommendation. The documentation is distributed to relevant stakeholders; it provides a record of the formal evaluation process and rationale, which are useful to other projects that encounter a similar issue.

While some of the decisions made throughout the life of the project involve the use of a formal evaluation process, others do not. As mentioned earlier, guidelines should be established to determine which issues should be subject to a formal evaluation process.

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¶ During planning, specific issues requiring a formal evaluation process are identified. Typical issues include selection among architectural or design alternatives, use of reusable or commercial off-the-shelf (COTS) components, supplier selection, engineering support environments or associated tools, test environments, delivery alternatives, and logistics and production. A formal evaluation process can also be used to address a make-or-buy decision, the development of manufacturing processes, the selection of distribution locations, and other decisions.¶

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Related Process Areas

Refer to the Project Planning process area for more information about general planning for projects.

Refer to the Integrated Project Management process area for more information about establishing the project's defined process. The project's defined process includes a formal evaluation process for each

Decision Analysis and Resolution (DAR)

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selected issue and incorporates the use of guidelines for applying a formal evaluation process to unforeseen issues.

Refer to the Risk Management process area for more information about identifying and mitigating risks. A formal evaluation process is often used to address issues with identified medium or high risks. Selected solutions typically affect risk mitigation plans.

Specific Goal and Practice Summary

SG 1 Evaluate Alternatives

- SP 1.1 Establish Guidelines for Decision Analysis
- SP 1.2 Establish Evaluation Criteria
- SP 1.3 Identify Alternative Solutions
- SP 1.4 Select Evaluation Methods
- SP 1.5 Evaluate Alternatives
- SP 1.6 Select Solutions

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Specific Practices by Goal

SG 1 Evaluate Alternatives

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

Issues requiring a formal evaluation process may be identified at any time. The objective should be to identify issues as early as possible to maximize the time available to resolve them.

SP 1.1 Establish Guidelines for Decision Analysis

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 **are** unclear without explicit guidance. Whether a decision is significant or not is dependent on the project and circumstances, and is determined by established guidelines.

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Typical guidelines for determining when to require a formal evaluation process include the following:

- A decision is directly related to topics that are medium or high risk.
- A decision is related to changing work products under configuration management.
- A decision would cause schedule delays over a certain percentage or amount of time.
- A decision affects the ability of the project to achieve its objectives.
- The costs of the formal evaluation process are reasonable when compared to the decision's impact.
- A legal obligation exists during a solicitation.
- There is a risk that the decision will have a significant adverse effect on cost, quality, resources, or schedule.
- Legal or supplier agreement issues must be resolved.

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Refer to the Risk Management process area for more information about determining which issues are medium or high risk.

Examples of when to use a formal evaluation process include the following:

- On decisions to trade off performance, cost, and schedule requirements during an acquisition
- On selecting, terminating, or renewing suppliers
- On selecting training for project personnel
- On selecting a testing environment to be used for product validation
- On determining the items to be selected for reuse in related projects
- On selecting an approach for ongoing support (e.g., disaster recovery, service levels)

Deleted: <#>On decisions involving the procurement of material when 20 percent of the material parts constitute 80 percent of the total material costs!

<#>On design-implementation decisions when technical performance failure may cause a catastrophic failure (e.g., safety of flight item)!

<#>On decisions with the potential to significantly reduce design risk, engineering changes, cycle time, response time, and production costs (e.g., to use lithography models to assess form and fit capability before releasing engineering drawings and production builds)!

Typical Work Products

1. Guidelines for when to apply a formal evaluation process

Subpractices

1. Establish guidelines for when to use a formal evaluation process.
2. Incorporate the use of guidelines into the defined process as appropriate.

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Refer to the Integrated Project Management process area for more information about establishing the project's defined process.

SP 1.2 Establish Evaluation Criteria

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

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Evaluation criteria provide the basis for evaluating alternative solutions. Criteria are ranked so that the highest ranked criteria exert the most influence on the evaluation.

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Decision Analysis and Resolution (DAR)

This process area is referenced by many other process areas in the model, and there are many contexts in which a formal evaluation process can be used. Therefore, in some situations you may find that criteria have already been defined as part of another process. This specific practice does not suggest that a second development of criteria be conducted.

Document the evaluation criteria to minimize the possibility that decisions will be second-guessed or that the reason for making the decision will be forgotten. Decisions based on criteria that are explicitly defined and established remove barriers to stakeholder buy-in.

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Typical Work Products

1. Documented evaluation criteria
2. Rankings of criteria importance

Subpractices

1. Define the criteria for evaluating alternative solutions.

Criteria should be traceable to requirements, scenarios, business case assumptions, business objectives, or other documented sources.

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Types of criteria to consider include the following:

- Technology limitations
- Environmental impact
- Risks
- Total ownership and lifecycle costs

2. Define the range and scale for ranking the evaluation criteria.

Scales of relative importance for evaluation criteria can be established with non-numeric values or with formulas that relate the evaluation parameter to a numeric weight.

3. Rank the criteria.

4. Assess the criteria and their relative importance.

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5. Evolve the evaluation criteria to improve their validity.

6. Document the rationale for the selection and rejection of evaluation criteria.

SP 1.3 Identify Alternative Solutions

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Identify alternative solutions to address issues.

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

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Sufficient candidate solutions may not be furnished for analysis. As the analysis proceeds, other alternatives should be added to the list of

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potential candidate solutions. The generation and consideration of multiple alternatives early in a decision analysis and resolution process increases the likelihood that an acceptable decision will be made and that consequences of the decision will be understood.

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Typical Work Products

- 1. Identified alternatives

Typical Supplier Deliverables

- 1. Supplier identified alternatives, if any

Subpractices

- 1. Perform a literature search.

A literature search can uncover what others have done both inside and outside the organization. Such a search may provide a deeper understanding of the problem, alternatives to consider, barriers to implementation, existing trade studies, and lessons learned from similar decisions.

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- 2. Identify alternatives for consideration in addition to those that may be provided with the issue.

Evaluation criteria are an effective starting point for identifying alternatives. Evaluation criteria identify priorities of relevant stakeholders and the importance of technical, logistical, or other challenges.

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Combining key attributes of existing alternatives can generate additional and sometimes stronger alternatives.

Solicit alternatives from relevant stakeholders. Brainstorming sessions, interviews, and working groups can be used effectively to uncover alternatives.

- 3. Document proposed alternatives.

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SP 1.4 Select Evaluation Methods

Select evaluation methods.

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Methods for evaluating alternative solutions against established criteria can range from simulations to the use of probabilistic models and decision theory. These methods must be carefully selected. The level of detail of a method should be commensurate with cost, schedule, performance, and risk impacts.

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While many problems may require only one evaluation method, some problems may require multiple methods. For instance, simulations may augment a trade study to determine which design alternative best meets a given criterion.

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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.

Typical Work Products

- 1. Selected evaluation methods

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Subpractices

1. Select methods based on the purpose for analyzing a decision and on the availability of the information used to support the method.

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Typical evaluation methods include the following:

- Benchmarking studies
- Cost studies
- Business opportunity studies
- Surveys
- Extrapolations based on field experience and prototypes
- User review and comment
- Judgment provided by an expert or group of experts (e.g., Delphi Method)

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2. Select evaluation methods based on their ability to focus on the issues at hand without being overly influenced by side issues.
3. Determine the measures needed to support the evaluation method.
Refer to the Measurement and Analysis process area for more information about specifying measures.

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SP 1.5 Evaluate Alternatives

Evaluate alternative solutions using established criteria and methods.

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Evaluating alternative solutions involves analysis, discussion, and review. Iterative cycles of analysis are sometimes necessary. Supporting analyses, experimentation, prototyping, piloting, or simulations may be needed to substantiate scoring and conclusions.

Often, the relative importance of criteria is imprecise and the total effect on a solution is not apparent until after the analysis is performed. In cases where the resulting scores differ by relatively small amounts, the best selection among alternative solutions may not be clear. Challenges to criteria and assumptions should be encouraged.

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Typical Work Products

1. Evaluation results

Subpractices

1. Evaluate proposed alternative solutions using the established evaluation criteria and selected methods.
2. Evaluate assumptions related to the evaluation criteria and the evidence that supports the assumptions.
3. Evaluate whether uncertainty in the values for alternative solutions affects the evaluation and address these uncertainties, as appropriate.

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For instance, if the score can vary between two values, is the difference significant enough to make a difference in the final solution set? Does the variation in score represent a high risk? To address these concerns, simulations may be run, further studies may be performed, or evaluation criteria may be modified, among other things.

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- 4. Perform simulations, modeling, prototypes, and pilots as necessary to exercise the evaluation criteria, methods, and alternative solutions.

Untested criteria, their relative importance, and supporting data or functions may cause the validity of solutions to be questioned. Criteria and their relative priorities and scales can be tested with trial runs against a set of alternatives. These trial runs of a select set of criteria allow for the evaluation of the cumulative impact of criteria on a solution. If trials reveal problems, different criteria or alternatives might be considered to avoid biases.

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- 5. Consider new alternative solutions, criteria, or methods if proposed alternatives do not test well; repeat evaluations until alternatives do test well.

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Document the rationale for the addition of new alternatives or methods and changes to criteria, as well as the results of interim evaluations. Determine the scores for each alternative based on criteria evaluations and scoring methods previously determined.

- 6. Document the results of the evaluation.

SP 1.6 Select Solutions

Select solutions from alternatives based on evaluation criteria.

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Selecting solutions involves weighing results from the evaluation of alternatives. Risks associated with the implementation of solutions must be assessed.

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Typical Work Products

- 1. Recommended solutions to address significant issues

Subpractices

- 1. Assess the risks associated with implementing the recommended solution.

Refer to the Risk Management process area for more information about identifying and managing risks.

- 2. Document the results and rationale for the recommended solution.

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When decisions must be made according to a specific schedule, time and resources may not be available for gathering complete information. Consequently, risky decisions made with incomplete information may require re-analysis later. Identified risks should be monitored.¶

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Generic Practices by Goal¶

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Continuous Only

It is important to record both why a solution is selected and why another solution was rejected.

Generic Practices by Goal

Continuous Only

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 decision analysis and resolution 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 decision analysis and resolution process.

Elaboration:

This policy establishes organizational expectations for selectively analyzing possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria. The policy should also provide guidance on which decisions require a formal evaluation process.

GP 2.2 Plan the Process

Establish and maintain the plan for performing the decision analysis and resolution process.

Elaboration:

This plan for performing the decision analysis and resolution 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 decision analysis and resolution process, developing the work products, and providing the services of the process.

Elaboration:

Examples of resources provided include the following tools:

- Simulators and modeling tools
- Prototyping tools
- Tools for conducting surveys

GP 2.4 Assign Responsibility

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

GP 2.5 Train People

Train the people performing or supporting the decision analysis and resolution process as needed.

Elaboration:

Examples of training topics include the following:

- Formal decision analysis
- Methods for evaluating alternative solutions against criteria

GP 2.6 Manage Configurations

Place designated work products of the decision analysis and resolution process under appropriate levels of control.

Elaboration:

Examples of work products placed under control include the following:

- Guidelines for when to apply a formal evaluation process
- Evaluation reports containing recommended solutions

GP 2.7 Identify and Involve Relevant Stakeholders

Identify and involve the relevant stakeholders of the decision analysis and resolution process as planned.

Elaboration:

Examples of activities for stakeholder involvement include the following:

- Establishing guidelines for which issues are subject to a formal evaluation process
- Establishing evaluation criteria
- Identifying and evaluating alternatives
- Selecting evaluation methods
- Selecting solutions

GP 2.8 Monitor and Control the Process

Monitor and control the decision analysis and resolution process against the plan for performing the process and take appropriate corrective action.

Elaboration:

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

- Cost-to-benefit ratio of using formal evaluation processes
- Schedule for the execution of a trade study

GP 2.9 Objectively Evaluate Adherence

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

Elaboration:

Examples of activities reviewed include the following:

- Evaluating alternatives using established criteria and methods

Examples of work products reviewed include the following:

Guidelines for when to apply a formal evaluation process

Evaluation reports containing recommended solutions

GP 2.10 Review Status with Higher Level Management

Review the activities, status, and results of the decision analysis and resolution 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 decision analysis and resolution process.

GP 3.2 Collect Improvement Information

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

Elaboration:

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

Number of alternatives considered

Evaluation results

Recommended solutions to address significant issues

Continuous Only

GG 4 Institutionalize a Quantitatively Managed Process

The process is institutionalized as a quantitatively managed process.

Continuous Only

GP 4.1 Establish Quantitative Objectives for the Process

Establish and maintain quantitative objectives for the decision analysis and resolution 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 decision analysis and resolution 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 decision analysis and resolution 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 decision analysis and resolution process.