

CAUSAL ANALYSIS AND RESOLUTION

A Support Process Area at Maturity Level 5

Purpose

The purpose of Causal Analysis and Resolution (CAR) is to identify causes of defects and other problems and take action to prevent them from occurring in the future.

Introductory Notes

The Causal Analysis and Resolution process area involves the following activities:

- Identifying and analyzing causes of defects and other problems
- Taking actions to remove causes and prevent the occurrence of those types of defects and problems in the future

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Causal analysis and resolution improves quality and productivity by preventing the introduction of defects into a product. Reliance on detecting defects after they have been introduced is not cost effective. It is more effective to prevent defects from being introduced by integrating causal analysis and resolution activities into each phase of the project.

Since similar defects and problems may have been previously encountered on other projects or in earlier phases or tasks of the current project, causal analysis and resolution activities are a mechanism for communicating lessons learned among projects.

Types of defects and other problems encountered are analyzed to identify trends. Based on an understanding of the defined process and how it is implemented, root causes of defects and future implications of defects are determined.

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Causal analysis may also be performed on problems unrelated to defects. For example, causal analysis may be used to improve coordination and cycle time with one supplier or multiple suppliers.

When it is impractical to perform causal analysis on all defects, defect targets are selected by tradeoffs on estimated investments and estimated returns of quality, productivity, and cycle time.

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A measurement process should already be in place. Already defined measures can be used, though in some instances new measures may be needed to analyze the effects of the process change.

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Refer to the Measurement and Analysis process area for more information about establishing objectives for measurement and analysis, specifying measures and analyses to be performed, obtaining and analyzing measures, and reporting results.

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Causal Analysis and Resolution activities provide a mechanism for projects to evaluate their processes at the local level and look for improvements that can be implemented.

Causal Analysis and Resolution activities also include the evaluation of acquirer processes that interface with supplier processes, as appropriate. A jointly-performed causal analysis may lead to such improvement actions as the supplier improving its processes to more effectively execute in the context of the project or the acquirer improving its supplier interfaces.

When improvements are judged to be effective, the information is extended to the organizational level.

Refer to the Organizational Innovation and Deployment process area for more information about improving organizational level processes through proposed improvements and action proposals.

The informative material in this process area is written assuming that the specific practices are applied to a quantitatively managed process. The specific practices of this process area may be applicable, but with reduced value, if this assumption is not met.

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See the definitions of “stable process” and “common cause of process variation” in the glossary.

Related Process Areas

Refer to the Quantitative Project Management process area for more information about analyzing process performance and determining process capability.

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Refer to the Organizational Innovation and Deployment process area for more information about the selection and deployment of improvements to organizational processes and technologies.

Refer to the Measurement and Analysis process area for more information about establishing objectives for measurement and analysis, specifying the measures and analyses to be performed, obtaining and analyzing measures, and reporting results.

Causal Analysis and Resolution (CAR)

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Specific Goal and Practice Summary

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- SG 1 Determine Causes of Defects
 - SP 1.1 Select Defect Data for Analysis
 - SP 1.2 Analyze Causes
- SG 2 Address Causes of Defects
 - SP 2.1 Implement Action Proposals
 - SP 2.2 Evaluate the Effect of Changes
 - SP 2.3 Record Data

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Specific Practices by Goal

SG 1 Determine Causes of Defects

Root causes of defects and other problems are systematically determined.

A root cause is a source of a defect, such that if it is removed, the defect is decreased or removed.

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SP 1.1 Select Defect Data for Analysis

Select defects and other problems for analysis.

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Typical Work Products

1. Defect and problem data selected for further analysis

Subpractices

1. Gather relevant defect or problem data.

Examples of relevant defect data include the following:

- Defects reported by the customer
- Defects reported by end users
- Defects reported by the supplier

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<#>Defects found in testing¶
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Examples of relevant problem data include the following:

- Project management problem reports requiring corrective action
- Process capability problems
- Process duration measurements
- Earned value measurements by process (e.g., cost performance index)
- Resource throughput, utilization, or response time measurements

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Refer to the Quantitative Project Management process area for more information about statistical management.

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2. Determine the defects and other problems to be analyzed further.

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When determining which defects to analyze further, consider the impact of the defects, their frequency of occurrence, the similarity between defects, the cost of analysis, the time and resources needed, the safety considerations, etc.

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Examples of methods for selecting defects and other problems include the following:

- Pareto analysis
- Histograms
- Process capability analysis

SP 1.2 Analyze Causes

Perform causal analysis of selected defects and other problems and propose actions to address them.

The purpose of this analysis is to develop solutions to identified problems by analyzing relevant data and producing action proposals for implementation.

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Typical Work Products

1. Action proposal
2. Root cause analysis results

Typical Supplier Deliverables

1. Root cause analysis results
2. Recommended action proposals

Subpractices

1. Conduct causal analysis with those responsible for performing the task.

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Causal analysis is performed, typically in meetings, with those who understand the selected defect or problem under study. Those who have the best understanding of the selected defect are typically those responsible for performing the task.

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Examples of when to perform causal analysis include the following:

- When a stable sub process does not meet its specified quality and process-performance objectives
- When more defects than anticipated escape from earlier phases to the current phase
- When a work product exhibits an unexpected deviation from its requirements

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Refer to the Quantitative Project Management process area for more information about achieving the project's quality and process-performance objectives.

2. Analyze selected defects and other problems to determine their root causes.

Depending on the type and number of defects, it may make sense to first group the defects before identifying their root causes.

Causal Analysis and Resolution (CAR)

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Examples of methods to determine root causes include the following:

- Cause-and-effect (fishbone) diagrams
- Check sheets

3. Group selected defects and other problems based on their root causes.

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Examples of cause groups, or categories, include the following:

- Inadequate training and skills
- Inadequate resource allocation
- Breakdown of communication
- Not accounting for all details of a task
- Making mistakes in manual procedures (e.g., typing)
- Process deficiency
- Incomplete, ambiguous, or unclear contractual requirements
- Ineffective management of changes to the supplier agreement

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4. Propose and document actions to be taken to prevent the future occurrence of similar defects or other problems.

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Examples of proposed actions include changes to the following:

- The process in question
- Training
- Tools
- Methods
- Communication
- Work products

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Examples of actions include the following:

- Providing training in common problems and techniques for preventing them
- Changing a process so that error-prone steps do not occur
- Automating all or part of a process
- Reordering process activities
- Adding process steps to prevent defects, such as task kickoff meetings to review common defects and actions to prevent them

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An action proposal usually documents the following:

- Originator of the action proposal
- Description of the problem
- Description of the defect cause
- Defect cause category
- Phase when the problem was introduced
- Phase when the defect was identified
- Description of the action proposal
- Action proposal category

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SG 2 Address Causes of Defects

Root causes of defects and other problems are systematically addressed to prevent their future occurrence.

Projects operating according to a well-defined process systematically analyze **where in** the operation problems still occur and implement process changes to eliminate root causes of selected problems.

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SP 2.1 Implement Action Proposals

Implement selected action proposals developed in causal analysis.

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Action proposals describe tasks necessary to remove root causes of analyzed defects or problems and avoid their reoccurrence.

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Only changes that prove to be of value should be considered for broad implementation.

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Typical Work Products

1. Action proposals selected for implementation
2. Improvement proposals

Typical Supplier Deliverables

1. Improvement proposals

Subpractices

1. Analyze action proposals and determine their priorities.

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Criteria for prioritizing action proposals include the following:

- Implications of not addressing the defects
- Cost to implement process improvements to prevent the defects
- Expected impact on quality

2. Select action proposals to be implemented.

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3. Create action items for implementing the action proposals.

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Causal Analysis and Resolution (CAR)

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- Examples of information provided in an action item include the following:
- Person responsible for implementing it
 - Description of the areas affected by it
 - People who are to be kept informed of its status
 - Next date that status will be reviewed
 - Rationale for key decisions
 - Description of implementation actions
 - Time and cost required to identify the defect and correct it
 - Estimated cost of not fixing the problem

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To implement action proposals, the following tasks must be done:

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- Make assignments
- Coordinate the people doing the work
- Review the results
- Track action items to closure

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Experiments may be conducted for particularly complex changes.

- Examples of experiments include the following:
- Using a temporarily modified process
 - Using a new tool

Action items may be assigned to members of the causal analysis team, members of the project team, or other members of the organization.

4. Identify and remove similar defects that may exist in other processes and work products.
5. Identify and document improvement proposals for the organization's set of standard processes.

Refer to the Organizational Innovation and Deployment process area for more information about the selection and deployment of improvement proposals for the organization's set of standard processes.

SP 2.2 Evaluate the Effect of Changes

Evaluate the effect of changes on process performance.

Refer to the Quantitative Project Management process area for more information about analyzing process performance, stabilizing selected subprocesses, and determining their capability to achieve objectives.

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Once the changed process is deployed across the project, the effect of changes must be evaluated to gather evidence that the process change corrected the problem and improved performance.

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Typical Work Products

1. Measures of performance and performance change

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Typical Supplier Deliverables

1. Base and derived supplier measurements

Subpractices

- 1. Measure the change in performance of the project's defined process or of subprocesses, as appropriate.

This subpractice determines whether the selected change has positively influenced process performance and by how much.

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- 2. Measure the capability of the project's defined process or of subprocesses, as appropriate.

This subpractice determines whether the selected change has positively influenced the ability of the process to meet its quality and process-performance objectives, as determined by relevant stakeholders.

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An example of a change in the capability of the project's defined change management process would be a change in the ability of the process to stay within its process-specification boundaries. This change in capability can be statistically measured by calculating and comparing the range of time taken for processing a change request before and after the improvement has been made.

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SP 2.3 Record Data

Record causal analysis and resolution data for use across the project and organization.

Data are recorded so that other projects and organizations can make appropriate process changes and achieve similar results.

Record the following:

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- Data on defects and other problems that were analyzed
- Rationale for decisions
- Action proposals from causal analysis meetings
- Action items resulting from action proposals
- Cost of analysis and resolution activities
- Measures of changes to the performance of the defined process resulting from resolutions

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Typical Work Products

- 1. Causal analysis and resolution records

Deleted: Generic Practices by Goal

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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 causal 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 causal analysis and resolution process.

Elaboration:

This policy establishes organizational expectations for identifying and systematically addressing root causes of defects and other problems.

GP 2.2 Plan the Process

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

Elaboration:

This plan for performing the causal analysis and resolution process can be included in (or referenced by) the project plan, which is described in the Project Planning process area. This plan differs from the action proposals and associated action items described in several specific practices in this process area. The plan called for in this generic practice would address the project's overall causal analysis and resolution process (perhaps tailored from a standard process maintained by the organization). In contrast, the process action proposals and associated action items address the activities needed to remove a specific root cause under study.

GP 2.3 Provide Resources

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

Elaboration:

Examples of resources provided include the following tools:

- Database systems
- Process modeling tools
- Statistical analysis packages
- Tools, methods, and analysis techniques (e.g., Ishikawa or fishbone diagram, Pareto analysis, histograms, process capability studies, or control charts)

GP 2.4 Assign Responsibility

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

GP 2.5 Train People

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

Elaboration:

Examples of training topics include the following:

- Quality management methods (e.g., root cause analysis)

GP 2.6 Manage Configurations

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

Elaboration:

Examples of work products placed under control include the following:

- Action proposals
- Action proposals selected for implementation
- Causal analysis and resolution records

GP 2.7 Identify and Involve Relevant Stakeholders

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

Elaboration:

Examples of activities for stakeholder involvement include the following:

- Conducting causal analysis
- Assessing the action proposals

GP 2.8 Monitor and Control the Process

Monitor and control the causal 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:

- Number of root causes removed
- Change in quality or process performance per instance of the causal analysis and resolution process
- Schedule of activities for implementing a selected action proposal

GP 2.9 Objectively Evaluate Adherence

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

Elaboration:

Examples of activities reviewed include the following:

- Determining causes of defects
- Addressing causes of defects

Examples of work products reviewed include the following:

Action proposals selected for implementation

Causal analysis and resolution records

GP 2.10 Review Status with Higher Level Management

Review the activities, status, and results of the causal 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 causal 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 causal 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:

Action proposals

Number of action proposals that are open and for how long

Action proposal status reports

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 causal 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 causal 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 causal 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 causal analysis and resolution process.