

SCOPE MANAGEMENT DEFINITION AND PROCESS STEPS

NOTE:

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WisDOT changes to the PMBOK language are shown in italics.

Scope Management includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. Managing the project scope is primarily concerned with defining and controlling what is and is not included in the project.

The processes used to manage project scope, as well as the supporting tools and techniques, can vary by project. The scope baseline for the project is the approved version of the project scope statement, work breakdown structure (WBS), and its associated WBS dictionary. A baseline can be changed only through formal *change management process* and is used as a basis for comparison while performing Validate Scope and Control Scope processes as well as other controlling processes.

The processes in scope management are:

- Plan Scope Management
- Collect Requirements
- Define Scope
- Use WisDOT's WBS
- Validate Scope
- Control Scope

Plan Scope Management

Plan Scope Management is the process of creating a scope management plan that documents how the project scope will be defined, validated, and controlled. The key benefit of this process is that it provides guidance and direction on how scope will be managed throughout the project.

Inputs

Project Management Plan

Approved subsidiary plans of the project management plan are used to create the scope management plan and influence the approach taken for planning scope and managing project scope.

Project Overview

The project *overview* is used to provide the project context needed to plan the scope management processes. It provides the high-level project description and product characteristics from the project statement of work.

Tools/Techniques

Expert Judgment

Expert judgment refers to input received from knowledgeable and experienced parties. Expertise may be provided by any group or person with specialized education, knowledge, skill, experience, or training in developing scope management plans.

Meetings

Project teams may attend project meetings to develop the scope management plan. Attendees at these meetings may include the project manager, the project sponsor, selected project team members, elected stakeholders, anyone with responsibility for any of the scope management processes, and others as needed.

Outputs

Scope Management Plan

The scope management plan is a component of the project or program management plan that describes how the scope will be defined, developed, monitored, controlled, and verified. The scope management plan is a major input into the Develop Project Management Plan process, and the other scope management processes. The components of a scope management plan include:

- Process for preparing a detailed project scope statement
- Process that enables the creation of the WBS from the detailed project scope statement
- Process that establishes how the WBS will be maintained and approved
- Process that specifies how formal acceptance of the completed project deliverables will be obtained
- Process to control how requests for changes to the detailed project scope statement will be processed

Requirements Management Plan

The requirements management plan is a component of the project management plan that describes how requirements will be analyzed, documented, and managed. The phase-to-phase relationship strongly influences how requirements are managed. The project manager chooses the most effective relationship for the project and documents this approach in the requirements management plan. Many of the requirements management plan components are based on that relationship.

Collect Requirements

Collect Requirements is the process of determining, documenting, and managing stakeholder needs and requirements to meet project objectives. The key benefit of this process is that it provides the basis for defining and managing the project scope.

Inputs

Scope Management Plan

The scope management plan provides clarity as to how project teams will determine which type of requirements need to be collected for the project.

Requirements Management Plan

The requirements management plan provides the processes that will be used throughout the Collect Requirements process to define and document the stakeholder needs.

Stakeholder Management Plan

The stakeholder management plan is used to understand stakeholder communication requirements and the level of stakeholder engagement in order to assess and adapt to the level of stakeholder participation for requirements activities.

Project Overview

The project *overview* is used to provide the high-level project requirements so that detailed project requirements can be developed.

Stakeholder Input

The stakeholder register is used to identify stakeholders who can provide information on the requirements. The stakeholder register also captures major requirements and main expectations stakeholders may have for the project. *FDM 6-5-10 discusses the Public Involvement Plan. One of the key components of the Public Involvement Plan Template is "Identify stakeholders and target audiences". The register is shown in the Public Involvement Plan Template (FDM 6-5, Attachment 10.1).*

WisDOT Inputs

Inputs used by WisDOT are the existing Wisconsin State Highway Plan 2020 (SHP) and more recently the State's long-range, multi-modal transportation plan, Connections 2030; information in Meta Manager (WisDOT's

system for predicting highway deterioration over time and identifying potential improvement needs); program guidelines (providing policy guidance and emphasis areas for program development); photo logs; and field trips. (See, for example, Section 03-05-05 of the Program Management Manual for a discussion of Needs Identification for the State Highway Rehabilitation, State 3R/SHR Bridges Program.)

Tools/Techniques

Interviews

An interview is a formal or informal approach to discover information from stakeholders by talking to them directly.

Focus groups

Focus groups bring together prequalified stakeholders and subject matter experts to learn about their expectations and attitudes about a proposed *project*.

Facilitated Workshops

Requirements workshops are focused sessions that bring key cross-functional stakeholders together to define *project* requirements.

Group Creativity Techniques

Several group activities can be organized to identify *project* requirements. Some of the group creativity techniques that can be used are:

- Brainstorming
- Nominal group technique
- Idea/mind mapping
- Affinity diagram
- Multicriteria decision analysis

Group Decision Making Techniques

Group decision making is an assessment process of multiple alternatives with an expected outcome in the form of future actions. These techniques can be used to generate, classify, and prioritize product requirements.

Questionnaires and Surveys

Questionnaires and surveys are written sets of questions designed to quickly accumulate information from a large number of respondents.

Outputs

Needs Identification

Needs identification describes how individual requirements meet the need for the project. *Needs* may start out at a high level and become progressively more detailed as more is known.

Requirements Traceability Matrix

The requirements traceability matrix is a grid that links requirements from their origin to the deliverables that satisfy them.

Define Scope

Define Scope is the process of developing a detailed description of the project and product. The key benefit of this process is that it describes the product, service, or result boundaries by defining which of the requirements collected will be included in and excluded from the project scope.

Inputs

Scope Management Plan

The scope management plan provides clarity as to how project teams will determine which type of requirements need to be collected for the project.

Project Overview

The project *overview* is used to provide the high-level project requirements so that detailed project requirements can be developed.

Needs Identification

Needs identification describes how individual requirements meet the need for the project. *Needs* may start out at a high level and become progressively more detailed as more is known.

WisDOT Inputs

*Inputs used by WisDOT are the existing Wisconsin State Highway Plan 2020 (SHP) and more recently the State's long-range, multi-modal transportation plan, Connections 2030; information in *Meta Manager*; program guidelines; photo logs; and field trips. (See, for example, Section 03-05-05 of the *Program Management Manual*.)*

Tools/Techniques

Expert Judgment

Expert judgment is often used to analyze the information needed to develop the scope statement. Such judgment and expertise is applied to any technical detail.

Alternatives Identification/NEPA Process

Alternatives identification is a technique used to develop as many potential options as possible in order to identify different approaches to execute and perform the work of the project.

Facilitated Workshops

Requirements workshops are focused sessions that bring key cross-functional stakeholders together to define *project* requirements.

Outputs

Project Scope

The project scope is the description of major deliverables, assumptions, and constraints. It describes, in detail, the project's deliverables and the work required to create those deliverables.

Project Document Updates

Project documents that may be updated include, but are not limited to:

- Stakeholder register,
- Needs identification, and
- Requirements traceability matrix.

Use WisDOT's WBS

The process of subdividing project deliverables and project work into smaller, more manageable components *is simplified since the department already has a work breakdown structure (WBS)*. The key benefit of this process is that it provides a structured vision of what has to be delivered.

Inputs

Scope Management Plan

The scope management plan provides clarity as to how project teams will determine which type of requirements need to be collected for the project.

Project Scope

The project scope is the description of major deliverables, assumptions, and constraints. It describes, in detail, the project's deliverables and the work required to create those deliverables.

Needs Identification

Needs identification describes how individual requirements meet the need for the project. *Needs* may start out at a high level and become progressively more detailed as more is known.

Tools/Techniques

Decomposition

Decomposition is a technique used for dividing and subdividing the project scope and project deliverables into smaller, more manageable parts. The work package is the work defined at the lowest level of the WBS for which cost and duration can be estimated and managed.

Expert Judgment

Expert judgment is often used to analyze the information needed to develop the scope *baseline*. Such judgment and expertise is applied to any technical detail.

Outputs

Scope *Baseline*

The scope management plan contains the scope baseline. Components of the scope baseline include:

- Project scope statement. The project scope statement includes the description of the project scope, major deliverables, assumptions, and constraints.
- WBS. The WBS defines each deliverable and the decomposition of the deliverables into work packages.
- WBS dictionary. The WBS dictionary has a detailed description of work and technical documentation for each WBS element.

Project Document Updates

Project documents that may be updated include, but are not limited to, *needs identification*, which may need to be updated to include approved changes. If approved change requests result from the *Use WisDOT's* WBS process, then the *needs identification* may need to be updated to include approved changes.

Validate Scope

Validate Scope is the process of formalizing acceptance of the completed project deliverables. The key benefit of this process is that it brings objectivity to the acceptance process and increases the chance of final *project* acceptance by validating each deliverable.

Inputs

Scope Management Plan

The scope *management plan* contains the scope baseline.

Needs Identification

Needs identification describes how individual requirements meet the need for the project. *Needs* may start out at a high level and become progressively more detailed as more is known.

Tools/Techniques

Inspection

Inspection includes activities such as measuring, examining, and validating to determine whether work and deliverables meet requirements and acceptance criteria.

Outputs

Accepted Deliverables

Deliverables that meet the acceptance criteria are formally signed off and approved.

Change Requests

The deliverables that have not been formally accepted are documented, along with the reasons for non-acceptance. Those deliverables may require a change request. The change requests are processed for review and disposition through the *Change Management* process.

Project Document Updates

Project documents that may be updated as a result of the Validate Scope *sub-process* include any documents that define the *project* or report status on *project* completion.

Control Scope

Control Scope is the process of monitoring the status of the project scope and managing changes to the scope baseline. The key benefit of this process is that it allows the scope baseline to be maintained throughout the project.

Inputs

Project Management Plan

The following information from the project management plan is used to control scope:

- Scope baseline. The scope baseline is compared to actual results to determine if a change, corrective action, or preventive action is necessary.
- Scope management plan. Sections from the scope management plan describe how the project scope will be monitored and controlled.
- Change management plan. The change management plan defines the process for managing change on the project.”¹
- Changes to other knowledge area plans, such as schedule, budget, communication, quality and risk.

Status Reports/Status Meetings

This includes information about project progress, such as which deliverables have started, their progress and which deliverables have finished.

Needs Identification

Needs identification describes how individual requirements meet the need for the project. *Needs* may start out at a high level and become progressively more detailed as more is known.

Accepted Deliverables

Deliverables that meet the acceptance criteria are formally signed off and approved by the sponsor.

Approved Change Requests

These are requests for changes that have been approved through the Change Management Process.

Tools/Techniques

Change Management Meetings

Project performance measurements are used to assess variation from the original **base scope**. Important aspects of project scope control include determining the cause and degree of variance relative to the **base scope** and deciding whether corrective or preventive action is required.

Production Meetings

Production meetings during the life of the project are vital to track possible changes in the scope. *These include in particular the 30, 60, and 90 reviews.*

Outputs

Performance Measurements

Measurements can include planned vs. actual technical performance or other scope performance measurements. This information is documented and communicated to stakeholders.

Change Requests

Analysis of scope performance can result in a change request to the scope baseline or other components of the project management plan. Change requests can include preventive or corrective actions, defect repairs, or enhancement requests. Change requests are processed for review and disposition according to the *Change Management* process.

Project Management Plan Updates

- **Base Scope Updates.** If the approved change requests have an effect upon the project scope, then the scope statement, the WBS, and the WBS dictionary are revised and reissued to reflect the approved changes
- **Other Baseline Updates.** If the approved change requests have an effect on the project scope, then the corresponding Budget baseline and schedule baselines are revised and reissued to reflect the approved changes

Project Document Updates

Project documents that may be updated include, but are not limited to:

- *Needs identification*
- Requirements traceability matrix

SCHEDULE MANAGEMENT DEFINITION AND PROCESS STEPS

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Schedule Management includes the processes required to manage the timely completion of the project.

On some projects, especially those of smaller scope, defining activities, sequencing activities, estimating activity resources, estimating activity durations, and developing the schedule model are so tightly linked that they are viewed as a single process that can be performed by a person over a relatively short period of time. These processes are presented here as distinct elements because the tools and techniques for each process are different.

The *Schedule* Management processes are documented in the schedule management plan. The schedule management plan is a subsidiary plan of, and integrated with, the project management plan.

The schedule management plan includes seven processes:

- Plan Schedule Management
- Define Activities
- Sequence Activities
- Estimate Activity Resources
- Estimate Activity Durations
- Develop Schedule
- Control Schedule

Plan Schedule Management

Plan Schedule Management is the process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule. The key benefit of this process is that it provides guidance and direction on how the project schedule will be managed throughout the project.

Inputs

Project Management Plan

The project management plan contains information used to develop the schedule management plan which includes, but is not limited to:

- **Scope baseline.** The scope baseline includes the project scope statement and the work breakdown structure (WBS) detail used for defining activities, duration estimation, and schedule management; and
- **Other information.** Other scheduling related cost, risk, and communications decisions from the project management plan are used to develop the schedule.

Project Overview

The project *overview* defines the summary milestone schedule and project approval requirements that will influence the management of the project schedule.

Tools/Techniques

Expert Judgment

Expert judgment, guided by historical information, provides valuable insight about the environment and information from prior similar projects.

Analytical Techniques

The Plan Schedule Management process may involve choosing strategic options to estimate and schedule the project such as: scheduling methodology, scheduling tools and techniques, estimating approaches, formats, and project management software.

Meetings

Project teams may hold planning meetings to develop the schedule management plan.

Outputs

Schedule Management Plan

The schedule management plan is a component of the project management plan that establishes the criteria and the activities for developing, monitoring, and controlling the schedule. The schedule management plan may be formal or informal, highly detailed or broadly framed, based upon the needs of the project, and includes appropriate control thresholds.

Select Activities

Select Activities is the process of identifying and documenting the specific actions to be performed to produce the project deliverables. The key benefit of this process is to break down work packages into activities that provide a basis for estimating, scheduling, executing, monitoring, and controlling the project work.

Inputs

Project Management Plan

The project management plan contains information used to develop the schedule management plan which includes, but is not limited to:

- **Scope baseline.** The scope baseline includes the project scope statement and the work breakdown structure (WBS) detail used for defining activities, duration estimation, and schedule management; and
- **Other information.** Other scheduling related cost, risk, and communications decisions from the project management plan are used to develop the schedule.

Schedule Management Plan

A key input from the schedule management plan is the prescribed level of detail necessary to manage the work.

Scope Baseline

The project WBS, deliverables, constraints, and assumptions documented in the scope baseline are considered explicitly while defining activities.

Tools/Techniques

Decomposition

Decomposition is a technique used for dividing and subdividing the project scope and project deliverables into smaller, more manageable parts. Activities represent the effort needed to complete a work package.

Templates

A standard activity list or a portion of an activity list from a previous project is often usable as a template for a new project. At WisDOT, templates exist for almost all of the potential improvement projects.

Rolling Wave Planning

Rolling wave planning is an iterative planning technique in which the work to be accomplished in the near term is planned in detail, while the work in the future is planned at a higher level. It is a form of progressive elaboration.

Expert Judgment

Project team members or other experts who are experienced and skilled in developing detailed project scope statements, the WBS, and project schedules, can provide expertise in defining activities.

Outputs

Activities

The activity list is a comprehensive list that includes all schedule activities required on the project. *At WisDOT, activity lists exist for almost all of the potential improvement projects.*

Activity Attributes

Activities, distinct from milestones, have durations, during which the work of that activity is performed, and may have resources and costs associated with that work. Activity attributes extend the description of the activity by identifying the multiple components associated with each activity. The components for each activity evolve over time.

Milestones

A milestone is a significant point or event in a project. A milestone list is a list identifying all project milestones and indicates whether the milestone is mandatory, such as those required by contract, or optional, such as those based upon historical information. *At WisDOT, milestones are automatically generated for almost all of the potential improvement projects.*

Sequence Activities

Sequence Activities is the process of identifying and documenting relationships among the project activities. The key benefit of this process is that it defines the logical sequence of work to obtain the greatest efficiency given all project constraints.

Inputs

Schedule Management Plan

The schedule management plan identifies the scheduling method and tool to be used for the project, which will guide how the activities may be sequenced.

Activities

The activity list contains all schedule activities required on the project, which are to be sequenced. Dependencies and other constraints for these activities can influence the sequencing of the activities.

Activity Attributes

Activity attributes may describe a necessary sequence of events or defined predecessor or successor relationships.

Milestones

The milestones may have scheduled dates for specific milestones, which may influence the way activities are sequenced.

Project Scope Statement

The project scope statement contains the *project* description, which includes *project* characteristics that may affect activity sequencing. Other information from the project scope statement including project deliverables, project constraints, and project assumptions may also affect activity sequencing.

Tools/Techniques

Critical Path Methodology (CPM)

Critical path methodology (CPM) is a technique used for constructing a schedule model in which activities are represented by nodes and are graphically linked by one or more logical relationships to show the sequence in which the activities are to be performed.

Dependency Determination

Dependencies may be characterized by the following attributes: mandatory or discretionary, internal or external, as described below. Dependency has four attributes, but two can be applicable at the same time in following ways: mandatory external dependencies, mandatory internal dependencies, discretionary external dependencies, or discretionary internal dependencies.

Leads and Lags

A lead is the amount of time whereby a successor activity can be advanced with respect to a predecessor activity. A lag is the amount of time whereby a successor activity will be delayed with respect to a predecessor activity.

Schedule Network Templates / WBS

A standard activity list or a portion of an activity list from a previous project is often usable as a template for a new project. At WisDOT, templates exist for almost all of the potential improvement projects.

Outputs

Activity Sequencing (P6)

A project schedule network diagram is a graphical representation of the logical relationships, also referred to as dependencies, among the project schedule activities. A project schedule network diagram is produced manually or by using project management software. *At WisDOT, the displays are produced using project management software.*

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Activity lists
- Activity attributes
- Milestones
- *Issue/risk tracking log*

Estimate Activity Resources

Estimate Activity Resources is the process of estimating the type and quantities of material, resources, equipment, or supplies required to perform each activity. The key benefit of this process is that it identifies the type, quantity, and characteristics of resources required to complete the activity which allows more accurate cost and duration estimates.

Inputs

Schedule Management Plan

The schedule management plan identifies the level of accuracy and the units of measure for the resources to be estimated.

Activities

The activity list identifies the activities which will need resources.

Activity Descriptions

The activity attributes provide the primary data input for use in estimating those resources required for each activity in the activity list.

Staff Availability

Information on which resources (such as people, equipment, and material) are potentially available during planned activity period is used for estimating staff availability. Information on the capability of the expected resources is also part of the estimating.

Issue/Risk Tracking Log

Risk events may impact resource selection and availability. Updates to the *log* are included with project documents updates from Plan Risk Responses.

Activity Cost Estimates

The cost of resources may impact resource selection.

Tools/Techniques

Expert Judgment

Expert judgment is often required to assess the resource-related inputs to this process. Any group or person with specialized knowledge in resource planning and estimating can provide such expertise.

Past Project Historical Data

Data from previous similar projects is used as a basis for estimating what resources are needed for the current project.

Alternative Analysis

Many schedule activities have alternative methods of accomplishment. They include using various levels of resource capability or skills, different size or type of machines, different tools (hand versus automated), and make-rent-or-buy decisions regarding the resource.

Published Estimating Data

Several organizations routinely publish updated production rates and unit costs of resources for an extensive array of labor trades, material, and equipment for different countries and geographical locations within countries.

Bottom-Up Estimating

Bottom-up estimating is a method of estimating project duration or cost by aggregating the estimates of the lower-level components of the WBS. When an activity cannot be estimated with a reasonable degree of confidence, the work within the activity is decomposed into more detail.

Project Management Software

Project management software, such as a scheduling software tool, has the capability to help plan, organize, and manage resource pools and develop resource estimates.

Outputs

Resources to Complete Activities

Activity resource requirements identify the types and quantities of resources required for each activity in a work package. These requirements then can be aggregated to determine the estimated resources for each work package and each work period.

Staff Skill Sets

The *staff skills sets* are a hierarchical representation of resources by category and type. Examples of resource categories include labor, material, equipment, and supplies. Resource types may include the skill level, grade level, or other information as appropriate to the project.

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Activity list

- Activity attributes
- Resource calendars

Estimate Activity Durations

Estimate Activity Durations is the process of estimating the number of work periods needed to complete individual activities with estimated resources. The key benefit of this process is that it provides the amount of time each activity will take to complete, which is a major input into the Develop Schedule process.

Inputs

Schedule Management Plan

The schedule management plan defines the method used and the level of accuracy along with other criteria required to estimate activity durations including the project update cycle.

Activities

The activity list identifies the activities that will need duration estimates.

Activity Descriptions

The activity attributes provide the primary data input for use in estimating durations required for each activity in the activity list.

Resources to Complete Activities

The estimated activity resource requirements will have an effect on the duration of the activity, since the level to which the resources assigned to the activity meet the requirements will significantly influence the duration of most activities.

Staff Availability

The resource calendars influence the duration of schedule activities due to the availability of specific resources, type of resources, and resources with specific attributes.

Project Scope Statement

The assumptions and constraints from the project scope statement are considered when estimating the activity durations. Examples of assumptions include, but are not limited to:

- Existing conditions,
- Availability of information, and
- Length of the reporting periods.

Examples of constraints include, but are not limited to:

- Available skilled resources, and
- Contract terms and requirements.

Issue/Risk Tracking Log

The *log* provides the list of risks, along with the results of risk analysis and risk response planning. Updates to the *log* are included with project document updates.

Staff Skill Sets

The *staff skill sets* provide a hierarchical structure of the identified resources by resource category and resource type.

Tools/Techniques

Expert Judgment

Expert judgment, guided by historical information, can provide duration estimate information or recommended maximum activity durations from prior similar projects.

Analogous Estimating

Analogous estimating is a technique for estimating the duration or cost of an activity or a project using historical data from a similar activity or project. Analogous estimating uses parameters from a previous, similar project, such as duration, budget, size, weight, and complexity, as the basis for estimating the same parameter or measure for a future project.

Parametric Estimating

Parametric estimating is an estimating technique in which an algorithm is used to calculate cost or duration based on historical data and project parameters. Parametric estimating uses a statistical relationship between historical data and other variables (e.g., square footage in construction) to calculate an estimate for activity parameters, such as cost, budget, and duration.

Three-Point Estimating

The accuracy of single-point activity duration estimates may be improved by considering estimation uncertainty and risk. This concept originated with the program evaluation and review technique (PERT). PERT uses three estimates to define an approximate range for an activity's duration:

- **Most likely** (*tM*).
- **Optimistic** (*tO*).
- **Pessimistic** (*tP*).

Depending on the assumed distribution of values within the range of the three estimates the expected duration, *tE*, can be calculated using a formula. Two commonly used formulas are triangular and beta distributions. The formulas are:

- **Triangular Distribution.** $tE = (tO + tM + tP) / 3$
- **Beta Distribution** (from the traditional PERT technique). $tE = (tO + 4tM + tP) / 6$

Group Decision-Making Techniques

Team-based approaches, such as brainstorming, the Delphi or nominal group techniques, are useful for engaging team members to improve estimate accuracy and commitment to the emerging estimates. By involving a structured group of people who are close to the technical execution of work in the estimation process, additional information is gained and more accurate estimates obtained.

Reserve Analysis

Duration estimates may include contingency reserves, sometimes referred to as time reserves or buffers, into the project schedule to account for schedule uncertainty. Contingency reserves are the estimated duration within the schedule baseline, which is allocated for identified risks that are accepted and for which contingent or mitigation responses are developed.

Outputs**Activity Duration Estimating**

Activity duration estimates (*the time to complete activities*) are quantitative assessments of the likely number of time periods that are required to complete an activity.

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Activity attributes; and
- Assumptions made in developing the activity duration estimate, such as skill levels and availability, as well as a basis of estimates for durations.

Develop Schedule

Develop Schedule is the process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model.

Inputs

Schedule Management Plan

The schedule management plan identifies the scheduling method and tool used to create the schedule, and how the schedule is to be calculated.

Activities

The activity list identifies the activities that will be included in the schedule model.

Activity Descriptions

The activity attributes provide the details used to build the schedule model.

Activity Sequencing (P6)

The *activity sequencing* contains the logical relationships of predecessors and successors that will be used to calculate the schedule.

Resources to Complete Activities

The activity resource requirements identify the types and quantities of resources required for each activity used to create the schedule model.

Staff Availability

The resource calendars contain information on the availability of resources during the project.

Activity Duration Estimating

The activity duration estimates contain the quantitative assessments of the likely number of work periods that will be required to complete an activity that will be used to calculate the schedule.

Project Scope Statement

The project scope statement contains assumptions and constraints that can impact the development of the project schedule.

Issue/Risk Tracking Log

The *log* provides the details of all identified risks and their characteristics that affect the schedule model.

Staff Assignments

The staff assignments specify which resources are assigned to each activity.

Staff Skill Sets

The *staff skill sets* provide the details by which resource analysis and organizational reporting can be done.

Tools/Techniques

Schedule Network Analysis

Schedule network analysis is a technique that generates the project schedule model. It employs various analytical techniques, such as critical path method, critical chain method, what-if analysis, and resource optimization techniques to calculate the early and late start and finish dates for the uncompleted portions of project activities. Some network paths may have points of path convergence or path divergence that can be identified and used in schedule compression analysis or other analyses.

At WisDOT, tools such as Schedule Analyzer Pro and Claim Digger are available for this activity.

Critical Path Method

The critical path method, which is a method used to estimate the minimum project duration and determine the amount of scheduling flexibility on the logical network paths within the schedule model. This schedule network analysis technique calculates the early start, early finish, late start, and late finish dates for all

activities without regard for any resource limitations by performing a forward and backward pass analysis through the schedule network.

At WisDOT, the P6 software performs this task automatically.

Critical Chain Method

The critical chain method (CCM) is a schedule method that allows the project team to place buffers on any project schedule path to account for limited resources and project uncertainties. It is developed from the critical path method approach and considers the effects of resource allocation, resource optimization, resource leveling, and activity duration uncertainty on the critical path determined using the critical path method.

At WisDOT, the P6 software performs this task automatically.

Resource Optimization Techniques

Examples of resource optimization techniques that can be used to adjust the schedule model due to demand and supply of resources include, but are not limited to:

- **Resource leveling.** A technique in which start and finish dates are adjusted based on resource constraints with the goal of balancing demand for resources with the available supply.
- **Resource Smoothing.** A technique that adjusts the activities of a schedule model such that the requirements for resources on the project do not exceed certain predefined resource limits.

Modeling Techniques

Examples of modeling techniques include, but are not limited to:

- **What-If Scenario Analysis.** What-if scenario analysis is the process of evaluating scenarios in order to predict their effect, positively or negatively, on project objectives.
- **Simulation.** Simulation involves calculating multiple project durations with different sets of activity assumptions, usually using probability distributions constructed from the three-point estimates to account for uncertainty.

Leads and Lags

Leads and lags are refinements applied during network analysis to develop a viable schedule by adjusting the start time of the successor activities. Leads are used in limited circumstances to advance a successor activity with respect to the predecessor activity, and lags are used in limited circumstances where processes require a set period of time to elapse between the predecessors and successors without work or resource impact.

At WisDOT, the P6 software performs this task automatically.

Schedule Compression

Schedule compression techniques are used to shorten the schedule duration without reducing the project scope, in order to meet schedule constraints, imposed dates, or other schedule objectives. Schedule compression techniques include, but are not limited to:

- **Crashing.** A technique used to shorten the schedule duration for the least incremental cost by adding resources.
- **Fast tracking.** A schedule compression technique in which activities or phases normally done in sequence are performed in parallel for at least a portion of their duration.

At WisDOT, the P6 software performs this task automatically.

Scheduling Tool

Automated scheduling tools contain the schedule model and expedite the scheduling process by generating start and finish dates based on the inputs of activities, network diagrams, resources and activity durations using schedule network analysis.

At WisDOT, the P6 software performs this task automatically.

Outputs

Schedule Baseline

A schedule baseline is the approved version of a schedule model that can be changed only through formal change control procedures and is used as a basis for comparison to actual results. It is accepted and approved by the appropriate stakeholders as the schedule baseline with baseline start dates and baseline finish dates.

Schedule Data

The schedule data for the project schedule model is the collection of information for describing and controlling the schedule. The schedule data includes at least the schedule milestones, schedule activities, activity attributes, and documentation of all identified assumptions and constraints.

Project Schedule

The outputs from a schedule model are schedule presentations. The project schedule is an output of a schedule model that presents linked activities with planned dates, durations, milestones, and resources. Although a project schedule model can be presented in tabular form, it is more often presented graphically.

Project Calendars

A project calendar identifies working days and shifts that are available for scheduled activities. It distinguishes time periods in days or parts of days that are available to complete scheduled activities from time periods that are not available.

Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to:

- Schedule baseline
- Schedule management plan

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Resources to Complete Activities
- Activity attributes
- Calendars
- *Issue/risk tracking log*

Control Schedule

Control Schedule is the process of monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan. The key benefit of this process is that it provides the means to recognize deviation from the plan and take corrective and preventive actions and thus minimize risk.

Inputs

Project Management Plan

The project management plan contains the schedule management plan and the schedule baseline. The schedule management plan describes how the schedule will be managed and controlled. The schedule baseline is used as a reference to compare with actual results to determine if a change, corrective action, or preventive action is necessary.

Project Schedule

Project schedule refers to the most recent version with notations to indicate updates, completed activities, and started activities as of the indicated data date.

Status Reports

Status reports refers to information about project progress such as which activities have started, their progress, and which activities have finished.

Project Calendars

A schedule model may require more than one project calendar to allow for different work periods for some activities to calculate the schedule forecasts.

Schedule Data

Schedule data will be reviewed and updated in the Control Schedule process.

Tools/Techniques

Performance Reviews

Performance reviews measure, compare, and analyze schedule performance such as actual start and finish dates, percent complete, and remaining duration for work in progress.

Project Management Software

Project management software for scheduling provides the ability to track planned dates versus actual dates, to report variances to and progress made against the schedule baseline, and to forecast the effects of changes to the project schedule model.

Resource Optimization Techniques

Resource optimization techniques involve the scheduling of activities and the resources required by those activities while taking into consideration both the resource availability and the project time.

Modeling Techniques

Modeling techniques are used to review various scenarios guided by risk monitoring to bring the schedule model into alignment with the project management plan and approved baseline.

Leads and Lags

Adjusting leads and lags is applied during network analysis to find ways to bring project activities that are behind into alignment with the plan.

Schedule Compression

Schedule compression techniques are used to find ways to bring project activities that are behind into alignment with the plan by fast tracking or crashing schedule for the remaining work.

Scheduling Tool

Schedule data is updated and compiled into the schedule model to reflect actual progress of the project and remaining work to be completed. The scheduling tool and the supporting schedule data are used in conjunction with manual methods or other project management software to perform schedule network analysis to generate an updated project schedule.

Outputs

Work Performance Information

The calculated time performance indicators for WBS components, in particular the work packages and control accounts, are documented and communicated to stakeholders.

Schedule Forecasts

Schedule forecasts are estimates or predictions of conditions and events in the project's future based on information and knowledge available at the time of the forecast. Forecasts are updated and reissued based on work performance information provided as the project is executed.

Change Requests

Schedule variance analysis, along with review of progress reports, results of performance measures, and modifications to the project scope or project schedule may result in change requests to the schedule baseline, scope baseline, and/or other components of the project management plan. Change requests are processed for review and disposition through the *Change Management* process.

Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to:

- Schedule baseline
- Schedule management plan
- Budget baseline

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Schedule Data
- Project Schedule
- Issue/Risk Tracking Log

BUDGET MANAGEMENT DEFINITION AND PROCESS STEPS

NOTE:

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WisDOT changes to the PMBOK language are shown in italics.

Budget Management includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.

Budget Management should consider the stakeholder requirements for managing costs. Different stakeholders will measure project costs in different ways and at different times. For example, the cost of an acquired item may be measured when the acquisition decision is made or committed, the order is placed, the item is delivered, or the actual cost is incurred or recorded for project accounting purposes.

Budget Management is primarily concerned with the cost of the resources needed to complete project activities. *Budget Management* should also consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting the product, service, or result of the project. For example, limiting the number of design reviews can reduce the cost of the project but could increase the resulting product's operating costs.

The *budget* management planning effort occurs early in project planning and sets the framework for each of the cost management processes so that performance of the processes will be efficient and coordinated.

The schedule management plan includes seven processes:

- Plan *Budget Management*
- Estimate Costs
- Determine Budget
- Control Costs

Plan Budget Management

Plan *Budget Management* is the process that establishes the policies, procedures, and documentation for planning, managing, expending, and controlling project costs. The key benefit of this process is that it provides guidance and direction on how the project costs will be managed throughout the project.

Inputs

Project Management Plan

The project management plan contains information used to develop the *budget* management plan, which contains, but is not limited to:

- **Scope baseline.** The scope baseline includes the project scope statement and WBS details for cost estimation and management.
- **Schedule baseline.** The schedule baseline defines when the project costs will be incurred.
- **Other information.** Other cost-related scheduling, risk, and communications decisions from the project management plan.

Project Overview

The project *overview* provides the summary budget from which the detailed project costs are developed. The project *overview* also defines the project approval requirements that will influence the management of the project costs.

Tools/Techniques

Expert Judgment

Expert judgment, guided by historical information, provides valuable insight about the environment and information from prior similar projects.

Analytical Techniques

Developing the *budget* management plan may involve choosing strategic options to fund the project. These decisions, like other financial decisions affecting the project, may affect project schedule and/or risks.

Meetings

Project teams may hold planning meetings to develop the *budget* management plan. Attendees at these meetings may include the project manager, the project sponsor, selected project team members, selected stakeholders, anyone with responsibility for project costs, and others as needed.

Outputs

Budget Management Plan

The *budget* management plan is a component of the project management plan and describes how the project costs will be planned, structured, and controlled. The *budget* management processes and their associated tools and techniques are documented in the *budget* management plan.

Estimate Costs

Estimate Costs is the process of developing an approximation of the monetary resources needed to complete project activities. The key benefit of this process is that it determines the amount of cost required to complete project work.

Inputs

Budget Management Plan

The *budget* management plan defines how project costs will be managed and controlled. It includes the method used and the level of accuracy required to estimate activity cost.

Resource Management Plan

The resource management plan provides project staffing attributes, personnel rates, and related rewards/recognition, which are necessary components for developing the project cost estimates.

Scope Baseline

The scope baseline is comprised of the following:

- **Project scope statement.** The project scope statement provides the product description, acceptance criteria, key deliverables, project boundaries, assumptions, and constraints about the project.
- **Work breakdown structure.** The WBS provides the relationships among all the components of the project and the project deliverables.
- **WBS dictionary.** The WBS dictionary provides detailed information about the deliverables and a description of the work for each component in the WBS required to produce each deliverable.

Project Schedule

The type and quantity of resources (*in-house and/or consultant staff*) and the amount of time which those resources are applied to complete the work of the project are major factors in determining the *delivery* cost. Schedule activity resources and their respective durations are used as key inputs to this process.

Issue/Risk Tracking Log

The *log* should be reviewed to consider risk response costs. Risks, which can be either threats or opportunities, typically have an impact on both activity and overall project costs.

Tools/Techniques

Expert Judgment

Expert judgment, guided by historical information, provides valuable insight about the environment and information from prior similar projects. Expert judgment can also be used to determine whether to combine methods of estimating and how to reconcile differences between them.

Analogous Estimating

Analogous cost estimating uses the values such as scope, cost, budget, and duration or measures of scale such as size, weight, and complexity from a previous, similar project as the basis for estimating the same parameter or measurement for a current project.

Parametric Estimating

Parametric estimating uses a statistical relationship between relevant historical data and other variables (e.g., square footage in construction) to calculate a cost estimate for project work.

Bottom-Up Estimating

Bottom-up estimating is a method of estimating a component of work. The cost of individual work packages or activities is estimated to the greatest level of specified detail. The detailed cost is then summarized or "rolled up" to higher levels for subsequent reporting and tracking purposes.

Three-Point Estimating

The accuracy of single-point activity cost estimates may be improved by considering estimation uncertainty and risk and using three estimates to define an approximate range for an activity's cost:

- **Most likely** (*cM*).
- **Optimistic** (*cO*).
- **Pessimistic** (*cP*).

Depending on the assumed distribution of values within the range of the three estimates the expected cost, *cE*, can be calculated using a formula. Two commonly used formulas are triangular and beta distributions. The formulas are:

- **Triangular Distribution.** $cE = (cO + cM + cP) / 3$
- **Beta Distribution.** $cE = (cO + 4cM + cP) / 6$

Reserve Analysis

Cost estimates may include contingency reserves (sometimes called contingency allowances) to account for cost uncertainty. Contingency reserves are the budget within the *budget* baseline that is allocated for identified risks, which are accepted and for which contingent or mitigating responses are developed.

Cost of Quality (COQ)

Assumptions about costs of quality may be used to prepare the activity cost estimate.

Project Management Software

Project management software applications, computerized spreadsheets, simulation, and statistical tools are used to assist with cost estimating.

Group Decision-Making Techniques

Team-based approaches, such as brainstorming, the Delphi or nominal group techniques, are useful for engaging team members to improve estimate accuracy and commitment to the emerging estimates.

Outputs

Component Estimates

As noted above, expert judgment (cost-per-mile for similar past projects) is used to generate initial construction cost estimates. The construction cost estimate is used to generate design delivery costs (e.g., estimated cost for design delivery on a recondition project is 10% of the construction estimate (See PMM 05-05-15, page 3) and the construction administration costs (e.g., estimated 12% of the construction estimate for a project with an estimated construction cost of between \$2 and \$4 million (See PMM 05-05-15, page 12). Other component costs are estimated by the functional area responsible for the activity – Real Estate for land acquisition, Rails and Harbors for compensable railroad adjustments, and Utilities for compensable utility adjustments and Traffic for mitigating user delay costs.

Estimate Documentation / Justification

The amount and type of additional details supporting the cost estimate vary by application area. Regardless of the level of detail, the supporting documentation should provide a clear and complete understanding of how the cost estimate was derived.

Project Documents Updates

Project documents that may be updated include, but are not limited to, the issue/risk tracking log.

Determine Budget

Determine Budget is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized Budget baseline. The key benefit of this process is that it determines the *budget* baseline against which project performance can be monitored and controlled.

Inputs

Budget Management Plan

The *budget* management plan describes how the project costs will be managed and controlled.

Scope Baseline

- **Project scope statement.** Formal limitations by period for the expenditure of project funds can be mandated by the organization, by agreement, or by other entities such as government agencies. These funding constraints are reflected in the project scope statement.
- **Work breakdown structure.** The WBS provides the relationships among all the project deliverables and their various components.
- **WBS dictionary.** The WBS dictionary and related detailed statements of work provide an identification of the deliverables and a description of the work in each WBS component required to produce each deliverable.

Activity Cost Estimates

Cost estimates for each activity within a work package are aggregated to obtain a cost estimate for each work package.

Estimate Documentation / Justification

Supporting detail for cost estimates contained in the basis for estimates should specify any basic assumptions dealing with the inclusion or exclusion of indirect or other costs in the project budget.

Project Schedule

The project schedule includes planned start and finish dates for the project's activities, milestones, work packages, and control accounts. This information can be used to aggregate costs to the calendar periods in which the costs are planned to be incurred.

Staff Availability

Resource calendars provide information on which resources are assigned to the project and when they are assigned. This information can be used to indicate resource costs over the duration of the project.

Contracts

Applicable *contract* information and costs relating to products, services, or results that have been or will be purchased are included when determining the budget.

Issue/Risk Tracking Log

The *log* should be reviewed to consider how to aggregate the risk response costs. Updates to the *log* are included with project document updates.

Tools/Techniques

Cost Aggregation

Cost estimates are aggregated by work packages in accordance with the WBS. The work package cost estimates are then aggregated for the higher component levels of the WBS (such as control accounts) and ultimately for the entire project.

Reserve Analysis

Budget reserve analysis can establish both the contingency reserves and the management reserves for the project.

Expert Judgment

Expert judgment, guided by experience in an application area, Knowledge Area, discipline, industry, or similar project, aids in determining the budget. Such expertise may be provided by any group or person with specialized education, knowledge, skill, experience, or training.

Historical Relationships

Any historical relationships that result in parametric estimates or analogous estimates involve the use of project characteristics (parameters) to develop mathematical models to predict total project costs.

Funding Limit Reconciliation

The expenditure of funds should be reconciled with any funding limits on the commitment of funds for the project. A variance between the funding limits and the planned expenditures will sometimes necessitate the rescheduling of work to level out the rate of expenditures. This is accomplished by placing imposed date constraints for work into the project schedule.

Outputs

Budget Baseline

The *budget* baseline is the approved version of the time-phased project budget, excluding any management reserves, which can only be changed through formal change control procedures and is used as a basis for comparison to actual results. It is developed as a summation of the approved budgets for the different schedule activities. *At WisDOT, the budget baseline is part of the Delivery Cost Report.*

Funding

Total funding requirements and periodic funding requirements (e.g., quarterly, annually) are derived from the *budget* baseline. The *budget* baseline will include projected expenditures plus anticipated liabilities. *At WisDOT, the total funding requirements are estimates that are part of the Delivery Cost Report.*

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Issue/risk tracking log
- Activity cost estimates
- Project schedule

Control Costs

Control Costs is the process of monitoring the status of the project to update the project costs and managing changes to the *budget* baseline. The key benefit of this process is that it provides the means to recognize variance from the plan in order to take corrective action and minimize risk.

Inputs

Project Management Plan

The project management plan contains the following information that is used to control cost:

- **Budget baseline.** The Budget baseline is compared with actual results to determine if a change, corrective action, or preventive action is necessary.
- **Budget management plan.** The *budget* management plan describes how the project costs will be managed and controlled.

Funding

The project funding requirements include projected expenditures plus anticipated liabilities.

Status Reports

Status reports include information about project progress, such as which activities have started, their progress, and which deliverables have finished. Information also includes costs that have been authorized and incurred.

Tools/Techniques

Earned Value Management

Earned value management (EVM) is a methodology that combines scope, schedule, and resource measurements to assess project performance and progress. It is a commonly used method of performance measurement for projects.

Forecasting

As the project progresses, the project team may develop a forecast for the estimate at completion (EAC) that may differ from the budget at completion (BAG) based on the project performance. If it becomes obvious that the BAG is no longer viable, the project manager should consider the forecasted EAC. Forecasting the EAC involves making projections of conditions and events in the project's future based on current performance information and other knowledge available at the time of the forecast.

At WisDOT, project managers can use the "To Date Charge Reports" from MIIP.

To-Complete Performance Index (TCPI)

The to-complete performance index (TCPI) is a measure of the cost performance that is required to be achieved with the remaining resources in order to meet a specified management goal, expressed as the ratio of the cost to finish the outstanding work to the remaining budget.

Performance Reviews

Performance reviews compare cost performance over time, schedule activities or work packages overrunning and underrunning the budget, and estimated funds needed to complete work in progress.

Project Management Software

Project management software is often used to monitor the three *earned value management* dimensions, to display graphical trends, and to forecast a range of possible final project results.

Reserve Analysis

During cost control, reserve analysis is used to monitor the status of contingency and management reserves for the project to determine if these reserves are still needed or if additional reserves need to be requested.

Outputs

Work Performance Information

The calculated CV, SV, CPI, SPI, TCPI, and VAG values for WBS components, in particular the work packages and control accounts, are documented and communicated to stakeholders.

Build Out Budget

Either a calculated EAC value or a bottom-up EAC value is documented and communicated to stakeholders.

Change Requests

Analysis of project performance may result in a change request to the Budget baseline or other components of the project management plan. Change requests may include preventive or corrective actions, and are processed for review and disposition through the *Change Management* process.

Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to:

- *Budget* baseline
- *Budget* management plan

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Cost estimates
- Estimate Documentation

QUALITY MANAGEMENT DEFINITION AND PROCESS STEPS

NOTE:

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Quality Management includes the processes and activities that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. Quality Management uses policies and procedures to implement, within the project's context, the organization's quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of the performing organization. Quality Management works to ensure that the project requirements, including product requirements, are met and validated.

The quality management plan includes three processes:

- Plan Quality Management
- Perform Quality Assurance
- Control Quality

Quality Management addresses the management of the project and the deliverables of the project. It applies to all projects, regardless of the nature of their deliverables. Quality measures and techniques are specific to the type of deliverables being produced by the project.

Plan Quality Management

Plan Quality Management is the process of identifying quality requirements and/or standards for the project and its deliverables, and documenting how the project will demonstrate compliance with relevant quality requirements and/or standards. The key benefit of this process is that it provides guidance and direction on how quality will be managed and validated throughout the project.

Inputs

Project Management Plan

The project management plan is used to develop the quality management plan. The information used for the development of the quality management plan includes, but is not limited to:

- Scope baseline
- Schedule baseline
- *Budget* baseline
- Other management plans. These plans contribute to the overall project quality and may highlight actionable areas of concern with regard to the project's quality.

Stakeholder Register

The stakeholder register aids in identifying those stakeholders possessing a particular interest in, or having an impact on, quality.

Issue/Risk Tracking Log

The *log* contains information on threats and opportunities that may impact quality requirements.

Needs Identification

Needs identification captures the requirements that the project shall meet pertaining to stakeholder expectations. The components of the *needs identification* include, but are not limited to, project and quality requirements. The requirements are used by the project team to help plan how quality control will be implemented on the project.

Tools/Techniques

Cost-Benefit Analysis

The primary benefits of meeting quality requirements include less rework, higher productivity, lower costs, increased stakeholder satisfaction, and increased profitability. A cost-benefit analysis for each quality activity compares the cost of the quality step to the expected benefit.

Cost of Quality (COQ)

Cost of quality includes all costs incurred over the life of the product by investment in preventing nonconformance to requirements, appraising the product or service for conformance to requirements, and failing to meet requirements (rework).

Seven Basic Quality Tools

The seven basic quality tools, also known in the industry as 7QC Tools, are used within the context of the PDCA Cycle to solve quality-related problems. The seven basic quality tools are:

- Cause-and-effect diagrams
- Flowcharts
- Checksheets
- Pareto diagrams
- Histograms
- Control charts
- Scatter diagrams

Benchmarking

Benchmarking involves comparing actual or planned project practices to those of comparable projects to identify best practices, generate ideas for improvement, and provide a basis for measuring performance.

Design of Experiments

Design of experiments (DOE) is a statistical method for identifying which factors may influence specific variables of a product or process under development or in production. DOE may be used during the Plan Quality Management process to determine the number and type of tests and their impact on cost of quality. DOE also plays a role in optimizing products or processes. DOE is used to reduce the sensitivity of product performance to sources of variations caused by environmental or manufacturing differences.

Statistical Sampling

Statistical sampling involves choosing part of a population of interest for inspection (for example, selecting ten engineering drawings at random from a list of seventy-five). Sample frequency and sizes should be determined during the Plan Quality Management process so the cost of quality will include the number of tests, expected *waste*, etc.

Additional Quality Planning Tools

Other quality planning tools are used to define the quality requirements and to plan effective quality management activities. These include, but are not limited to:

- Brainstorming
- Force field analysis
- Nominal group technique
- Quality management and control tools

Meetings

Project teams may hold planning meetings to develop the quality management plan. Attendees at these meetings may include the project manager; the project sponsor; selected project team members; selected stakeholders; anyone with responsibility for Project Quality Management activities; and others as needed.

Outputs

Quality Management Plan

The quality management plan is a component of the project management plan that describes how the organization's quality policies will be implemented. It describes how the project management team plans to meet the quality requirements set for the project.

Process Improvement Plan

The process improvement plan is a subsidiary or component of the project management plan that details steps for analyzing project management processes to identify activities to enhance their value.

Quality Metrics

A quality metric specifically describes a project or product attribute and how the control quality process will measure it. A measurement is an actual value. The tolerance defines the allowable variations to the metric.

Quality Checklists

A checklist is a structured tool, usually component-specific, used to verify that a set of required steps has been performed. Based on the project's requirements and practices, checklists may be simple or complex. Many organizations have standardized checklists available to ensure consistency in frequently performed tasks.

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Stakeholder register
- Responsibility assignment matrix
- WBS and WBS Dictionary

Perform Quality Assurance

Perform Quality Assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used. The key benefit of this process is that it facilitates the improvement of quality processes.

Inputs

Quality Management Plan

The quality management plan describes the quality assurance and continuous process improvement approaches for the project.

Process Improvement Plan

The project's quality assurance activities should be supportive of and consistent with the performing organization's process improvement plans.

Quality Metrics

The quality metrics provide the attributes that should be measured and the allowable variations.

Status Reports

Status reports refers to information about project progress such as which activities have started, their progress, and which activities have finished.

Quality Control Measurements

Quality control measurements are the results of control quality activities. They are used to analyze and evaluate the quality of the processes of the project against the standards of the performing organization or the requirements specified.

Project Documents

Project documents may influence quality assurance work and should be monitored within the context of a system for configuration management.

Tools/Techniques

Quality Management and Control Tools

The Perform Quality Assurance process uses the tools and techniques of the Plan Quality Management and Control Quality processes. In addition, other tools that are available include:

- Affinity diagrams
- Process decision program charts (PDPC)
- Interrelationship digraphs
- Tree diagrams
- Prioritization matrices
- Activity network diagrams
- Matrix diagrams

Quality Audits

A quality audit is a structured, independent process to determine if project activities comply with organizational and project policies, processes, and procedures. The objectives of a quality audit may include:

- Identify all good and best practices being implemented
- Identify all nonconformity, gaps, and shortcomings
- Share good practices introduced or implemented in similar projects in the organization and/or industry
- Proactively offer assistance in a positive manner to improve implementation of processes to help the team raise productivity
- Highlight contributions of each audit in the lessons learned repository of the organization.

Process Analysis

Process analysis follows the steps outlined in the process improvement plan to identify needed improvements. This analysis also examines problems experienced, constraints experienced, and non-value-added activities identified during process operation.

Outputs

Change Requests

Change requests are created and used as input into the *Change Management* process to allow full consideration of the recommended improvements. Change requests are used to take corrective action, preventive action, or to perform defect repair.

Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to:

- Quality management plan
- Scope management plan
- Schedule management plan
- *Budget* management plan

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Quality audit reports
- Training plans
- Process documentation

Control Quality

Control Quality is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes. The key benefits of this process include: (1) identifying the causes of poor process or product quality and recommending and/or taking action to eliminate them; and (2) validating that project deliverables and work meet the requirements specified by key stakeholders necessary for final acceptance.

Inputs

Project Management Plan

The project management plan contains the quality management plan, which is used to control quality. The quality management plan describes how quality control will be performed within the project.

Quality Metrics

A quality metric describes a project or product attribute and how it will be measured.

Quality Checklists

Quality checklists are structured lists that help to verify that the work of the project and its deliverables fulfill a set of requirements.

Status Reports

Status reports can include:

- Planned vs. actual technical performance
- Planned vs. actual schedule performance
- Planned vs. actual cost performance

Approved Change Requests

As part of the *Change Management* process, a Change Management Tracking Log update indicates that some changes are approved and some are not. Approved change requests may include modifications such as defect repairs, revised work methods, and revised schedule. The timely implementation of approved changes needs to be verified.

Deliverables

A deliverable is any unique and verifiable product, result, or capability that results in a validated deliverable required by the project.

Tools/Techniques

Seven Basic Quality Tools

The seven basic quality tools *were discussed earlier*.

Statistical Sampling

Samples are selected and tested as defined in the quality management plan.

Inspection

An inspection is the examination of a work product to determine if it conforms to documented standards. The results of an inspection generally include measurements and may be conducted at any level.

Approved Change Requests Review

All approved change requests should be reviewed to verify that they were implemented as approved.

Outputs

Quality Control Measurements

Quality control measurements are the documented results of control quality activities. They should be captured in the format that was specified through the Plan Quality Management process.

Validated Changes

Any changed or repaired items are inspected and will be either accepted or rejected before notification of the decision is provided. Rejected items may require rework.

Verified Deliverables

A goal of the Control Quality process is to determine the correctness of deliverables. The results of performing the Control Quality process are verified deliverables. Verified deliverables are an input to Validate Scope for formalized acceptance.

Work Performance Information

Work performance information is the performance data collected from various controlling processes, analyzed in context and integrated based on relationships across areas.

Change Requests

If the recommended corrective or preventive actions or a defect repair requires a change to the project management plan, a change request should be initiated in accordance with the defined *Change Management* process.

Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to:

- Quality management plan
- Process improvement plan

Project Documents Updates

Project documents that may be updated include, but are not limited to,

- Quality standards
- Awarded Contracts
- Quality audit reports and Change Management Tracking Logs supported with corrective action plans
- Training plans and assessments of effectiveness
- Process documentation, such as information obtained using the seven basic quality tools or the quality management and control tools.

RESOURCE MANAGEMENT DEFINITION AND PROCESS STEPS**NOTE:**

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Resource Management includes the processes that organize, manage, and lead the project team. The project team is comprised of the people with assigned roles and responsibilities for completing the project. Project team members may have varied skill sets, may be assigned full or part-time, and may be added or removed from the team as the project progresses.

The project management team is a subset of the project team and is responsible for the project management and leadership activities such as initiating, planning, executing, monitoring, controlling, and closing the various project phases. This group can also be referred to as the core, executive, or leadership team. For smaller projects, the project management responsibilities may be shared by the entire team or administered solely by the project manager.

The resource management plan includes four processes:

- Plan Resource Management
- Acquire Project Team
- Develop Project Team
- Manage Project Team

Plan Resource Management

Plan Human Resource Management is the process of identifying and documenting project roles, responsibilities, required skills, reporting relationships, and creating a staffing management plan. The key benefit of this process is that it establishes project roles and responsibilities, project organization charts, and the staffing management plan including the timetable for staff acquisition and release.

Inputs**Project Management Plan**

The project management plan is used to develop the resource management plan. The information used for the development of the resource management plan includes, but is not limited to:

- The project life cycle and the processes that will be applied to each phase
- How work will be executed to accomplish the project objectives
- A change management plan that documents how changes will be monitored and controlled
- A configuration management plan that documents how configuration management will be performed
- How integrity of the project baselines will be maintained
- Needs and methods of communication among stakeholders

Resources to Complete Activities

Resource planning uses activity resource requirements to determine the resource needs for the project. The preliminary requirements regarding the required project team members and their competencies are progressively elaborated as part of the Plan Resource Management process.

Tools/Techniques**Organization Charts and Position Descriptions**

Various formats exist to document team member roles and responsibilities. Most of the formats fall into one of three types: hierarchical, matrix, and text-oriented. Additionally, some project assignments are listed in subsidiary plans, such as the risk, quality, or communications management plans.

Networking

Networking is the formal and informal interaction with others in an organization, industry, or professional environment. It is a constructive way to understand political and interpersonal factors that will impact the effectiveness of various staffing management options.

Organizational Theory

Organizational theory provides information regarding the way in which people, teams, and organizational units behave. Effective use of common themes identified in organizational theory can shorten the amount of time, cost, and effort needed to create the Plan Human Resource Management process outputs and improve planning efficiency.

Expert Judgment

When developing the resource management plan, expert judgment is used to:

- List the preliminary requirements for the required skills
- Assess the roles required for the project based on standardized role descriptions within the organization
- Determine the preliminary effort level and number of resources needed to meet project objectives
- Determine reporting relationships needed based on the organizational culture
- Provide guidelines on lead time required for staffing, based on lessons learned and market conditions
- Identify risks associated with staff acquisition, retention, and release plans
- Identify and recommend programs for complying with applicable government and union contracts

Meetings

When planning human resource management of the project, the project management team will hold planning meetings. These meetings leverage a combination of other tools and techniques to allow for all project management team members to reach consensus on the resource management plan.

Outputs

Resource Management Plan

The resource management plan, a part of the project management plan, provides guidance on how project resources should be defined, staffed, managed, and eventually released..

The resource management plan includes, but is not limited to, the following:

- Roles and responsibilities
- Project organization charts
- Staffing management plan

Acquire Project Team

Acquire Project Team is the process of confirming human resource availability and obtaining the team necessary to complete project activities. The key benefit of this process consists of outlining and guiding the team selection and responsibility assignment to obtain a successful team.

Inputs

Resource Management Plan

The resource management plan provides guidance on how project human resources should be identified, staffed, managed, and eventually released. It includes:

- Roles and responsibilities defining the positions, skills, and competencies that the project demands

- Project organization charts indicating the number of people needed for the project
- Staffing management plan delineating the time periods each project team member will be needed and other information important to engage the project team

Tools/Techniques

Pre-assignment

When project team members are selected in advance, they are considered pre-assigned. This situation can occur if the project is the result of specific people being identified as part of a competitive proposal, if the project is dependent upon the expertise of particular persons, or if some staff assignments are defined within the project *overview*.

Negotiation

Staff assignments are negotiated on many projects. For example, the project management team may need to negotiate with:

- Functional managers, to ensure that the project receives appropriately competent staff in the required time frame
- Other project management teams within the performing organization, to appropriately assign scarce or specialized human resources
- External organizations, *especially consulting firms*, for appropriate, scarce, specialized, qualified, certified, or other such resources.

Acquisition

When the performing organization is unable to provide the staff needed to complete a project, the required services may be acquired from outside sources. This can involve hiring individual consultants or subcontracting work to another organization.

Virtual Teams

The use of virtual teams creates new possibilities when acquiring project team members. Virtual teams can be defined as groups of people with a shared goal who fulfill their roles with little or no time spent meeting face to face.

Multi-Criteria Decision Analysis

Selection criteria are often used as a part of acquiring the project team. By use of a multi-criteria decision analysis tool, criteria are developed and used to rate or score potential team members. The criteria are weighted according to the relative importance of the needs within the team.

Outputs

Project Staff Assignments

The project is staffed when appropriate people have been assigned to the team. The documentation of these assignments can include a project team directory, memos to team members, and names inserted into other parts of the project management plan, such as project organization charts and schedules.

Staff Availability

Resource calendars document the time periods that each project team member is available to work on the project.

Project Management Plan Updates

Elements of the project management plan that may be updated include, primarily, the resource management plan.

Develop Project Team

Develop Project Team is the process of improving competencies, team member interaction, and overall team environment to enhance project performance. The key benefit of this process is that it results in improved teamwork, enhanced people skills and competencies, motivated employees, reduced staff turnover rates, and improved overall project performance.

Inputs

Resource Management Plan

The resource management plan provides guidance on how project human resources should be defined, staffed, managed, controlled, and eventually released. It identifies training strategies and plans for developing the project team.

Project Staff Assignments

Team development starts with a list of the project team members. Project staff assignment documents identify the people who are on the team.

Staff Availability

Resource calendars identify times when the project team members can participate in team development activities.

Tools/Techniques

Interpersonal Skills

Interpersonal skills, sometimes known as "soft skills," are behavioral competencies that include proficiencies such as communication skills, emotional intelligence, conflict resolution, negotiation, influence, team building, and group facilitation. These soft skills are valuable assets when developing the project team

Training

Training includes all activities designed to enhance the competencies of the project team members. Training can be formal or informal.

Team-Building Activities

Team-building activities can vary from a 5-minute agenda item in a status review meeting to an off-site, professionally facilitated experience designed to improve interpersonal relationships. The objective of team-building activities is to help individual team members work together effectively.

Ground Rules

Ground rules establish clear expectations regarding acceptable behavior by project team members. Early commitment to clear guidelines decreases misunderstandings and increases productivity.

Co-location

Co-location, also referred to as "tight matrix," involves placing many or all of the most active project team members in the same physical location to enhance their ability to perform as a team. Colocation can be temporary, such as at strategically important times during the project, or for the entire project.

Recognition and Rewards

Part of the team development process involves recognizing and rewarding desirable behavior. The original plans concerning ways in which to reward people are developed during the Plan Human Resource Management process.

Personnel Assessment Tools

Personnel assessment tools give the project manager and the project team insight into areas of strength and weakness. These tools help project managers assess the team preferences, aspirations, how the process and organize information, how they tend to make decisions and how they prefer to interact with people.

Outputs

Performance Appraisals

As project team development efforts such as training, team building, and colocation are implemented, the project management team makes formal or informal assessments of the project team's effectiveness. Effective team development strategies and activities are expected to increase the team's performance, which increases the likelihood of meeting project objectives.

Manage Project Team

Manage Project Team is the process of tracking team member performance, providing feedback, resolving issues, and managing team changes to optimize project performance. The key benefit of this process is that it influences team behavior, manages conflict, resolves issues, and appraises team member performance.

Inputs

Resource Management Plan

The resource management plan provides guidance on how project human resources should be defined, staffed, managed, controlled, and eventually released. It includes, but is not limited to:

- Roles and responsibilities
- Project organization
- Staffing management plan

Project Staff Assignments

Project staff assignments provide documentation, which includes the list of project team members.

Performance Appraisals

The project management team makes ongoing formal or informal assessments of the project team's performance. By continually assessing the project team's performance, actions can be taken to resolve issues, modify communication, address conflict, and improve team interaction.

Issue Log

Issues arise in the course of managing the project team. An issue log can be used to document and monitor who is responsible for resolving specific issues by a target date.

Work Performance Reports

Work performance reports provide documentation about the current project status compared to project forecasts. Performance areas that can help with project team management include results from schedule control, cost control, quality control, and scope validation.

Tools/Techniques

Observation and Conversation

Observation and conversation are used to stay in touch with the work and attitudes of project team members. The project management team monitors progress toward project deliverables, accomplishments that are a source of pride for team members, and interpersonal issues.

Performance Appraisals

Objectives for conducting performance appraisals during the course of a project can include clarification of roles and responsibilities, constructive feedback to team members, discovery of unknown or unresolved issues, development of individual training plans, and the establishment of specific goals for future time periods.

Conflict Management

Conflict is inevitable in a project environment. Sources of conflict include scarce resources; scheduling priorities, and personal work styles. Team ground rules, group norms, and solid project management practices, like communication planning and role definition, reduce the amount of conflict.

Interpersonal Skills

Project managers use a combination of technical, personal, and conceptual skills to analyze situations and interact appropriately with team members. Using appropriate interpersonal skills allows project managers to capitalize on the strengths of all team members.

Outputs

Change Requests

Staffing changes, whether by choice or by uncontrollable events, can affect the rest of the project management plan. When staffing issues disrupt the project team from adhering to the project management plan such as causing the schedule to be extended or the budget to be exceeded, a change request can be processed through the *Change Management* process.

Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to, the resource management plan.

Project Documents Updates

Project documents that may indirectly be updated include, but are not limited to:

- Issue log
- Roles description
- Project staff assignments.

COMMUNICATION MANAGEMENT DEFINITION AND PROCESS STEPS

NOTE:

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Communication Management includes the processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information. Project managers spend most of their time communicating with team members and other project stakeholders, whether they are internal (at all organizational levels) or external to the organization. Effective communication creates a bridge between diverse stakeholders who may have different cultural and organizational backgrounds, different levels of expertise, and different perspectives and interests, which impact or have an influence upon the project execution or outcome.

The communication management plan includes three processes:

- Plan Communication Management
- Manage Communication
- Control Communication

Plan Communication Management

Plan Communications Management is the process of developing an appropriate approach and plan for project communications based on stakeholder's information needs and requirements, and available organizational assets. The key benefit of this process is that it identifies and documents the approach to communicate most effectively and efficiently with stakeholders.

Inputs

Project Management Plan

The project management plan provides information on how the project will be executed, monitored, controlled, and closed.

Stakeholder Register

The stakeholder register provides the information needed to plan the communication with project stakeholders.

Public Involvement Plan

As noted in FDM 6-5-10, 10.1: The Public Involvement Plan is a project-specific sequenced list of anticipated contacts with the public. Preparation of the plan is a crucial task completed early in the project process. A properly developed plan will ensure effective involvement of the affected public in a planned, orderly manner throughout the entire project.

Tools/Techniques

Communication Requirements Analysis

The analysis of the communication requirements determines the information needs of the project stakeholders. These requirements are defined by combining the type and format of information needed with an analysis of the value of that information.

Communication Technology

The methods used to transfer information among project stakeholders may vary significantly. For example, a project team may use techniques from brief conversations to extended meetings, or from simple written

documents to extensive materials (e.g., schedules, databases, and websites), which are accessible online as methods of communication.

Communication Models

The communication models used to facilitate communications and the exchange of information may vary from project to project and also within different stages of the same project.

Communication Methods

There are several communication methods that are used to share information among project stakeholders. These methods are broadly classified as follows:

- **Interactive communication.** Between two or more parties performing a multidirectional exchange of information
- **Push communication.** Sent to specific recipients who need to receive the information. This ensures that the information is distributed but does not ensure that it actually reached or was understood by the intended audience. Push communications include letters, memos, reports, emails, faxes, voice mails, blogs, press releases, etc.
- **Pull communication.** Used for very large volumes of information, or for very large audiences, and requires the recipients to access the communication content at their own discretion. These methods include intranet sites, e-learning, lessons learned databases, knowledge repositories, etc.

Meetings

The Plan Communication Management process requires discussion and dialogue with the project team to determine the most appropriate way to update and communicate project information, and to respond to requests from various stakeholders for that information. These discussions and dialogue are commonly facilitated through meetings, which may be conducted face to face or online and in different locations, such as the project site or the customer's site.

Outputs

Communication Management Plan

The communication management plan is a component of the project management plan that describes how project communications will be planned, structured, monitored, and controlled. The plan contains the following information:

- Stakeholder communication requirements
- Information to be communicated, including language, format, content, and level of detail
- Reason for the distribution of that information
- Time frame and frequency for the distribution of required information and receipt of acknowledgment or response, if applicable
- Person responsible for communicating the information
- Person responsible for authorizing release of confidential information
- Person or groups who will receive the information
- Methods or technologies used to convey the information, such as memos, e-mail, and/or press releases
- Resources allocated for communication activities, including time and budget
- Escalation process identifying time frames and the management chain (names) for escalation of issues that cannot be resolved at a lower staff level
- Method for updating and refining the communications management plan as the project progresses and develops
- Glossary of common terminology

- Flow charts of the information flow in the project, workflows with possible sequence of authorization, list of reports, and meeting plans, etc.
- Communication constraints usually derived from a specific legislation or regulation, technology, and organizational policies, etc.

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Project schedule
- Stakeholder register

Manage Communication

Manage Communication is the process of creating, collecting, distributing, storing, retrieving, and the ultimate disposition of project information in accordance to the communications management plan. The key benefit of this process is that it enables an efficient and effective communications flow between project stakeholders.

Inputs

Communication Management Plan

The communication management plan describes how project communications will be planned, structured, monitored, and controlled.

Performance Reports

Work performance reports are a collection of project performance and status information that may be used to facilitate discussion and to create communications. To optimize this process, it is important that reports be comprehensive, accurate, and available in a timely manner.

Tools/Techniques

Communication Technology

The choice of communication technology is an important consideration in the Manage Communication process. As this can vary significantly from project to project and also throughout the life of a project, the focus is to ensure that the choice is appropriate for the information that is being communicated.

Communication Models

The choice of communication models is an important consideration in this process. As the components in the communications all contribute toward an effective and efficient communications process, the focus is to ensure that the choice of the communication model is appropriate for the project that is undertaken and that any barriers (noise) are identified and managed.

Communication Methods

The choice of communication methods is an important consideration in this process. As there can be many potential barriers and challenges during this process, the focus is to ensure that the information that has been created and distributed has been received and understood to enable response and feedback.

Information Management Systems

Project information is managed and distributed using a variety of tools, including:

- Hard-copy document management: letters, memos, reports, and press releases
- Electronic communications management: e-mail, fax, voice mail, telephone, video and web conferencing, websites, and web publishing
- Electronic project management tools: web interfaces to scheduling and project management software, meeting and virtual office support software, portals, and collaborative work management tools.

Performance Reporting

Performance reporting is the act of collecting and distributing performance information, including status reports, progress measurements, and forecasts. Performance reporting involves the periodic collection and analysis of baseline versus actual data to understand and communicate the project progress and performance as well as to forecast the project results.

Outputs

Project Communications

The Manage Communication process involves the activities that are required for information to be created, distributed, received, acknowledged, and understood. Project communications may include but are not limited to: performance reports, deliverables status, schedule progress, and cost incurred. Project communications can vary significantly and are influenced by factors such as, but not limited to, the urgency and impact of the message, its method of delivery, and level of confidentiality.

Project Management Plan Updates

The project management plan provides information on project baselines, communications management, and stakeholder management. Each of these areas may require updates based upon the current performance of the project against the performance measurement baseline (PMB). The performance measurement baseline is an approved plan for the project work to which the project execution is compared, and deviations are measured for management control.

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- Issue log
- Project schedule
- Funding

Control Communication

Control Communication is the process of monitoring and controlling communication throughout the entire project life cycle to ensure the information needs of the project stakeholders are met. The key benefit of this process is that it ensures an optimal information flow among all communication participants, at any moment in time.

Inputs

Project Management Plan

The project management plan describes how the project will be executed, monitored, controlled, and closed. It provides valuable information for the Control Communication process such as, but not limited to:

- Stakeholder communication requirements
- Reason for the distribution of the information
- Timeframe and frequency for the distribution of required information
- Individual or group responsible for communication of the information
- Individual or group receiving the information

Project Communications

The Control Communication process involves the activities that are required for information and communications to be monitored, acted upon, and released to stakeholders. Project communications come from multiple sources and may vary significantly in their format, level of detail, degree of formality and confidentiality. Project communications may include but are not limited to:

- Deliverables status
- Schedule progress
- Costs incurred

Issue Log

An issue log is used to document and monitor the resolution of issues. It may be used to facilitate communication and ensure a common understanding of issues. A written log documents and helps to monitor who is responsible for resolving specific issues by a target date. Issue resolution addresses obstacles that can block the team from achieving its goals. This information is important to the Control Communication process as it provides both a repository for what has already happened in the project and a platform for subsequent communications to be delivered.

Build Out Budget

Budget forecast information from the Control Cost process provides information on the additional funds that are expected to be required for the remaining work, as well as estimates for the completion of the total project work.

Status Reports

Status reports can include details about which communications have actually been distributed, feedback on communications, survey results on communication effectiveness, or other raw observations identified during communication activities.

Tools/Techniques

Information Management Systems

An information management system provides a set of standard tools for the project manager to capture, store, and distribute information to stakeholders about the project's costs, schedule progress, and performance. Some software packages allow the project manager to consolidate reports from several systems and facilitate report distribution to the project stakeholders.

Expert Judgment

Expert judgment is often relied upon by the project team to assess the impact of the project communications, need for action or intervention, actions that should be taken, responsibility for taking such actions, and the timeframe for taking action.

Meetings

The Control Communication process requires discussion and dialogue with the project team to determine the most appropriate way to update and communicate project performance, and to respond to requests from stakeholders for information. These discussions and dialogues are commonly facilitated through meetings, which may be conducted face to face or online and in different locations.

Outputs

Work Performance Information

Work performance information organizes and summarizes the performance data gathered. This performance data typically provides status and progress information on the project at the level of detail required by the various stakeholders. This information is then communicated to the appropriate stakeholders.

Change Requests

The Control Communication process often results in the need for adjustment, action, and intervention. As a result, change requests will be generated as an output. These change requests are processed through the *Change Management* process and may result in:

- New or revised cost estimates, activity sequences, schedule dates, resource requirements, and analysis of risk response alternatives
- Adjustments to the project management plan and documents
- Recommendations of corrective actions that may bring the expected future performance of the project back in line with the project management plan

- Recommendations of preventive actions that may reduce the probability of incurring future negative project performance

Project Management Plan Updates

The Control Communication process may trigger updates to the communications management plan as well as other components of the project management plan (e.g. stakeholders and resource management plans).

Project Documents Updates

Project documents may be updated as a result of the Control Communication process. These updates may include, but are not limited to:

- Forecasts
- Performance reports
- Issue log

RISK MANAGEMENT DEFINITION AND PROCESS STEPS**NOTE:**

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Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project. The objectives of project risk management are to increase the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project.

Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost, and quality. A risk may have one or more causes and, if it occurs, it may have one or more impacts. A cause may be a given or potential requirement, assumption, constraint, or condition that creates the possibility of negative or positive outcomes.

The risk management plan includes six processes:

- Plan Risk Management
- Identify Risks
- Perform Qualitative Risk Analysis
- Perform Quantitative Risk Analysis
- Plan Risk Responses
- Control Risks

Plan Risk Management

Plan Risk Management is the process of defining how to conduct risk management activities for a project. The key benefit of this process is it ensures that the degree, type, and visibility of risk management are commensurate with both the risks and the importance of the project to the organization. The risk management plan is vital to communicate with and obtain agreement and support from all stakeholders to ensure the risk management process is supported and performed effectively over the project life cycle.

Inputs**Project Management Plan**

In planning risk management, all approved subsidiary management plans and baselines should be taken into consideration in order to make the risk management plan consistent with them. The risk management plan is also a component of the project management plan. The project management plan provides baseline or current state of risk-affected areas including scope, schedule, and cost.

Project Overview

The project *overview* can provide various inputs such as high-level risks, high-level project descriptions, and high-level requirements.

Stakeholder Register

The stakeholder register, which contains all details related to the project's stakeholders, provides an overview of their roles.

Tools/Techniques**Analytical Techniques**

Analytical techniques are used to understand and define the overall risk management context of the project. Risk management context is a combination of stakeholder risk attitudes and the strategic risk exposure of a given project based on the overall project context.

Expert Judgment

To ensure a comprehensive establishment of the risk management plan, judgment, and expertise should be considered from groups or individuals with specialized training or knowledge on the subject area.

Meetings

Project teams hold planning meetings to develop the risk management plan. Attendees at these meetings may include the project manager, selected project team members and stakeholders, anyone in the organization with responsibility to manage the risk planning and execution activities, and others, as needed.

Outputs

Risk Management Plan

The risk management plan is a component of the project management plan and describes how risk management activities will be structured and performed. The risk management plan includes the following:

- **Methodology.** Defines the approaches, tools, and data sources that will be used to perform risk management on the project.
- **Roles and responsibilities.** Defines the lead, support, and risk management team members for each type of activity in the risk management plan, and clarifies their responsibilities.
- **Budgeting.** Estimates funds needed, based on assigned resources, for inclusion in the Budget baseline and establishes protocols for application of contingency and management reserves.
- **Timing.** Defines when and how often the risk management processes will be performed throughout the project life cycle, establishes protocols for application of schedule contingency reserves, and establishes risk management activities for inclusion in the project schedule.
- **Risk categories.** Provide a means for grouping potential causes of risk. Several approaches can be used, for example, a structure based on project objectives by category. A risk breakdown structure (RBS) helps the project team to look at many sources from which project risk may arise in a risk identification exercise.
- **Definitions of risk probability and impact.** The quality and credibility of the risk analysis requires that different levels of risk probability and impact be defined that are specific to the project context. General definitions of probability levels and impact levels are tailored to the individual project during the Plan
- **Risk Management process for use in subsequent processes.**
- **Probability and impact matrix.** A probability and impact matrix is a grid for mapping the probability of each risk occurrence and its impact on project objectives if that risk occurs. Risks are prioritized according to their potential implications for having an effect on the project's objectives. A typical approach to prioritizing risks is to use a look-up table or a probability and impact matrix. The specific combinations of probability and impact that lead to a risk being rated as "high," "moderate," or "low" importance are usually set by the organization.
- **Revised stakeholders' tolerances.** Stakeholders' tolerances, as they apply to the specific project, may be revised in the Plan Risk Management process.
- **Reporting formats.** Reporting formats define how the outcomes of the risk management process will be documented, analyzed, and communicated. It describes the content and format of the *issue/risk tracking log* as well as any other risk reports required.
- **Tracking.** Tracking documents how risk activities will be recorded for the benefit of the current project and how risk management processes will be audited.

Identify Risks

Identify Risks is the process of determining which risks may affect the project and documenting their characteristics. The key benefit of this process is the documentation of existing risks and the knowledge and ability it provides to the project team to anticipate events.

Inputs

Risk Management Plan

Key elements of the risk management plan that contribute to the Identify Risks process are the assignments of roles and responsibilities, provision for risk management activities in the budget and schedule, and categories of risk, which are sometimes expressed as a risk breakdown structure.

Budget Management Plan

The *budget* management plan provides processes and controls that can be used to help identify risks across the project.

Schedule Management Plan

The schedule management plan provides insight to project time/schedule objectives and expectations which may be impacted by risks (known and unknown).

Quality Management Plan

The quality management plan provides a baseline of quality measures and metrics for use in identifying risks.

Resource Management Plan

The resource management plan provides guidance on how project human resources should be defined, staffed, managed, and eventually released. It can also contain roles and responsibilities, project organization charts, and the staffing management plan, which form a key input to identify risk process.

Scope Baseline

Project assumptions are found in the project scope statement. Uncertainty in project assumptions should be evaluated as potential causes of project risk. The WBS is a critical input to identifying risks as it facilitates an understanding of the potential risks at both the micro and macro levels. Risks can be identified and subsequently tracked at summary, control account, and/or work package levels.

Activity Cost Estimates

Activity cost estimate reviews are useful in identifying risks as they provide a quantitative assessment of the likely cost to complete scheduled activities and ideally are expressed as a range, with the width of the range indicating the degree(s) of risk. The review may result in projections indicating the estimate is either sufficient or insufficient to complete the activity (i.e., pose a risk to the project).

Activity Duration Estimates

Activity duration estimate reviews are useful in identifying risks related to the time allowances for the activities or project as a whole, again with the width of the range of such estimates indicating the relative degree(s) of risk.

Stakeholder Register

Information about the stakeholders is useful for soliciting inputs to identify risks, as this will ensure that key stakeholders, especially the stakeholder, sponsor, and customer are interviewed or otherwise participate during the Identify Risks process.

Project Documents

Project documents provide the project team with information about decisions that help better identify project risks. Project documents improve cross-team and stakeholder communications and include, but are not limited to:

- Project *overview*
- Project schedule
- Schedule network diagrams
- Issue log
- Quality checklist

Solicitation

If the project requires external procurement of resources, the solicitation becomes a key input to the Identify Risks process. The complexity and the level of detail of the solicitation should be consistent with the value of, and risks associated with, planned procurement.

Tools/Techniques

Documentation Review

A structured review of the project documentation may be performed, including plans, assumptions, previous project files, Awarded Contracts, and other information. The quality of the plans, as well as consistency between those plans and the project requirements and assumptions, may be indicators of risk in the project.

Information Gathering Techniques

Examples of information gathering techniques used in identifying risks can include:

- Brainstorming
- Delphi technique
- Interviewing
- Root cause analysis

Checklist Analysis

Risk identification checklists are developed based on historical information and knowledge that has been accumulated from previous similar projects and from other sources of information.

Assumptions Analysis

Every project and its plan is conceived and developed based on a set of hypotheses, scenarios, or assumptions. Assumptions analysis explores the validity of assumptions as they apply to the project. It identifies risks to the project from inaccuracy, instability, inconsistency, or incompleteness of assumptions.

Diagramming Techniques

Risk diagramming techniques may include:

- Cause and effect diagrams
- System or process flow charts
- Influence diagrams

SWOT Analysis

This technique examines the project from each of the strengths, weaknesses, opportunities, and threats (SWOT) perspectives to increase the breadth of identified risks by including internally generated risks.

Expert Judgment

Risks may be identified directly by experts with relevant experience with similar projects. Such experts should be identified by the project manager and invited to consider all aspects of the projects and suggest possible risks based on their previous experience and areas of expertise.

Outputs

Issue/Risk Tracking Log

The primary output from Identify Risks is the initial entry into the *log*. The *log* is a document in which the results of risk analysis and risk response planning are recorded. It contains the outcomes of the other risk management processes as they are conducted, resulting in an increase in the level and type of information contained in the *log* over time. The preparation of the *log* begins in the Identify Risks process with the following information, and then becomes available to other project management and risk management processes:

- List of identified risks. The identified risks are described in as much detail as is reasonable.
- List of potential responses. Potential responses to a risk may sometimes be identified during the Identify Risks process. These responses, if identified in this process, should be used as inputs to the Plan Risk Responses process.

Perform Qualitative Risk Analysis

Perform Qualitative Risk Analysis is the process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact. The key benefit of this process is that it enables project managers to reduce the level of uncertainty and to focus on high-priority risks.

Inputs

Risk Management Plan

Key elements of the risk management plan used in the Perform Qualitative Risk Analysis process include roles and responsibilities for conducting risk management, budgets, schedule activities for risk management, risk categories, definitions of probability and impact, the probability and impact matrix, and revised stakeholders' risk tolerances. These inputs are usually tailored to the project during the Plan Risk Management process. If they are not available, they may be developed during the Perform Qualitative Risk Analysis process.

Scope Baseline

Projects of a common or recurrent type tend to have more well-understood risks. Projects using state-of-the-art or first-of-its-kind technology, and highly complex projects, tend to have more uncertainty. This can be evaluated by examining the scope baseline.

Issue/Risk Tracking Log

The *log* contains the information that will be used to assess and prioritize risks.

Tools/Techniques

Risk Probability and Impact Assessment

Risk probability assessment investigates the likelihood that each specific risk will occur. Risk impact assessment investigates the potential effect on a project objective such as schedule, cost, quality, or performance, including both negative effects for threats and positive effects for opportunities.

Probability and Impact Matrix

Risks can be prioritized for further quantitative analysis and planning risk responses based on their risk rating. Ratings are assigned to risks based on their assessed probability and impact.

Risk Data Quality Assessment

Risk data quality assessment is a technique to evaluate the degree to which the data about risks is useful for risk management. It involves examining the degree to which the risk is understood and the accuracy, quality, reliability, and integrity of the data about the risk.

Risk Categorization

Risks to the project can be categorized by sources of risk (e.g., using the RBS), the area of the project affected (e.g., using the WBS), or other useful categories (e.g., project phase) to determine the areas of the project most exposed to the effects of uncertainty. Risks can also be categorized by common root causes.

Risk Urgency Assessment

Risks requiring near-term responses may be considered more urgent to address. Indicators of priority may include probability of detecting the risk, time to affect a risk response, symptoms and warning signs, and the risk rating.

Expert Judgment

Expert judgment is required to assess the probability and impact of each risk to determine its location in the matrix. Experts generally are those having experience with similar, recent projects. Gathering expert judgment is often accomplished with the use of risk facilitation workshops or interviews.

Outputs

Project Documents Updates

Project documents that may be updated include, but are not limited to:

- *Issue/risk tracking log* updates. As new information becomes available through the qualitative risk assessment, the *log* is updated. Updates to the *log* may include assessments of probability and impacts for each risk, risk ranking or scores, risk urgency information or risk categorization, and a watch list for low probability risks or risks requiring further analysis.
- Assumptions log updates. As new information becomes available through the qualitative risk assessment, assumptions could change. The assumptions log needs to be revisited to accommodate this new information. Assumptions may be incorporated into the project scope statement or in a separate assumptions log.

Perform Quantitative Risk Analysis

Perform Quantitative Risk Analysis is the process of numerically analyzing the effect of identified risks on overall project objectives. The key benefit of this process is that it produces quantitative risk information to support decision making in order to reduce project uncertainty.

Inputs

Risk Management Plan

The risk management plan provides guidelines, methods, and tools to be used in quantitative risk analysis.

Budget Management Plan

The budget management plan provides guidelines on establishing and managing risk reserves.

Schedule Management Plan

The schedule management plan provides guidelines on establishing and managing risk reserves.

Issue/Risk Tracking Log

The *log* is used as a reference point for performing quantitative risk analysis.

Tools/Techniques

Data Gathering and Representation Techniques

- Interviewing. Interviewing techniques draw on experience and historical data to quantify the probability and impact of risks on project objectives.
- Probability distributions. Continuous probability distributions, which are used extensively in modeling and simulation, represent the uncertainty in values such as durations of schedule activities and costs of project components.

Quantitative Risk Analysis and Modeling Techniques

Commonly used techniques use both event-oriented and project-oriented analysis approaches, including:

- Sensitivity analysis. Sensitivity analysis helps to determine which risks have the most potential impact on the project.
- Expected monetary value analysis. Expected monetary value (EMV) analysis is a statistical concept that calculates the average outcome when the future includes scenarios that may or may not happen.
- Modeling and simulation. A project simulation uses a model that translates the specified detailed uncertainties of the project into their potential impact on project objectives.

Expert Judgment

Expert judgment is required to identify potential cost and schedule impacts, to evaluate probability, and to define inputs such as probability distributions into the tools. Expert judgment also comes into play in the interpretation of the data.

Outputs

Project Documents Updates

Project documents are updated with information resulting from quantitative risk analysis. For example, *issue/risk tracking log* updates could include:

- Probabilistic analysis of the project. Estimates are made of potential project schedule and cost outcomes listing the possible completion dates and costs with their associated confidence levels.
- Probability of achieving cost and time objectives. With the risks facing the project, the probability of achieving project objectives under the current plan can be estimated using quantitative risk analysis results.
- Prioritized list of quantified risks. This list includes those risks that pose the greatest threat or present the greatest opportunity to the project.
- Trends in quantitative risk analysis results. As the analysis is repeated, a trend may become apparent that leads to conclusions affecting risk responses.

Plan Risk Responses

Plan Risk Responses is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives. The key benefit of this process is that it addresses the risks by their priority, inserting resources and activities into the budget, schedule and project management plan as needed.

Inputs

Risk Management Plan

Important components of the risk management plan include roles and responsibilities, risk analysis definitions, timing for reviews (and for eliminating risks from review), and risk thresholds for low, moderate, and high risks. Risk thresholds help identify those risks for which specific responses are needed.

Issue/Risk Tracking Log

The *log* refers to identified risks, root causes of risks, lists of potential responses, risk owners, symptoms and warning signs, the relative rating or priority list of project risks, risks requiring responses in the near term, risks for additional analysis and response, trends in qualitative analysis results, and a watch list, which is a list of low priority risks within the *log*.

Tools/Techniques

Several risk response strategies are available. The strategy or mix of strategies most likely to be effective should be selected for each risk.

- **Strategies for Negative Risks or Threats**

- Three strategies, which typically deal with threats or risks that may have negative impacts on project objectives if they occur, are: avoid, transfer, and mitigate. The fourth strategy, accept, can be used for negative risks or threats as well as positive risks or opportunities.
- **Strategies for Positive Risks or Opportunities**
 - Three of the four responses are suggested to deal with risks with potentially positive impacts on project objectives. The fourth strategy, accept, can be used for negative risks or threats as well as positive risks or opportunities. These strategies, described below, are to exploit, share, enhance, and accept.

Contingent Response Strategies

Some responses are designed for use only if certain events occur. For some risks, it is appropriate for the project team to make a response plan that will only be executed under certain predefined conditions, if it is believed that there will be sufficient warning to implement the plan.

Expert Judgment

Expert judgment is input from knowledgeable parties pertaining to the actions to be taken on a specific and defined risk. Expertise may be provided by any group or person with specialized education, knowledge, skill, experience, or training in establishing risk responses.

Outputs

Project Management Plan Updates

Elements of the project management plan that may be updated as a result of carrying out this process include, but are not limited to:

- Schedule management plan
- *Budget* management plan
- Quality management plan
- Procurement management plan
- Resource management plan
- Scope baseline
- Schedule baseline
- *Budget* baseline

Project Documents Updates

In the Plan Risk Responses process, several project documents are updated as needed. For example, when appropriate risk responses are chosen and agreed upon, they are included in the *issue/risk tracking log*. The *log* should be written to a level of detail that corresponds with the priority ranking and the planned response.

Updates to the issue/risk tracking log can include, but are not limited to:

- Risk owners and assigned responsibilities;
- Agreed-upon response strategies;
- Specific actions to implement the chosen response strategy;
- Trigger conditions, symptoms, and warning signs of a risk occurrence;
- Budget and schedule activities required to implement the chosen responses;
- Contingency plans and triggers that call for their execution;
- Fallback plans for use as a reaction to a risk that has occurred and the primary response proves to be inadequate;
- Residual risks that are expected to remain after planned responses have been taken, as well as those that have been deliberately accepted;

- Secondary risks that arise as a direct outcome of implementing a risk response; and
- Contingency reserves that are calculated based on the quantitative risk analysis of the project and the organization's risk thresholds.

Other project documents updated could include:

- Assumptions log updates. As new information becomes available through the application of risk responses, assumptions could change. The assumptions log needs to be revisited to accommodate this new information.
- Technical documentation updates. As new information becomes available through the application of risk responses, technical approaches and physical deliverables may change. Any supporting documentation needs to be revisited to accommodate this new information.
- Change requests. Planning for possible risk responses can often result in recommendations for changes to the resources, activities, cost estimates, and other items identified during other planning processes.

Control Risks

Control Risks is the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project. The key benefit of this process is that it improves efficiency of the risk approach throughout the project life cycle to continuously optimize risk responses.

Inputs

Project Management Plan

The project management plan, which includes the risk management plan, provides guidance for risk monitoring and controlling.

Issue/Risk Tracking Log

The *log* has key inputs that include identified risks and risk owners, agreed-upon risk responses, control actions for assessing the effectiveness of response plans, risk responses, specific implementation actions, symptoms and warning signs of risk, residual and secondary risks, a watch list of low-priority risks, and the time and cost contingency reserves.

Status Reports

Work performance data related to various performance results possibly impacted by risks includes, but is not limited to:

- Deliverable status
- Schedule progress
- Costs incurred

Performance Reports

Work performance reports take information from performance measurements and analyze it to provide project work performance information including variance analysis, earned value data, and forecasting data. These data points could be impactful in controlling performance related risks.

Tools/Techniques

Risk Reassessment

Control Risks often results in identification of new risks, reassessment of current risks, and the closing of risks that are outdated. Project risk reassessments should be regularly scheduled. The amount and detail of repetition that are appropriate depends on how the project progresses relative to its objectives.

Risk Audits

Risk audits examine and document the effectiveness of risk responses in dealing with identified risks and their root causes, as well as the effectiveness of the risk management process.

Technical Performance Measurement

Technical performance measurement compares technical accomplishments during project execution to the schedule of technical achievement. It requires the definition of objective, quantifiable measures of technical performance, which can be used to compare actual results against targets.

Reserve Analysis

Throughout execution of the project, some risks may occur with positive or negative impacts on budget or schedule contingency reserves. Reserve analysis compares the amount of the contingency reserves remaining to the amount of risk remaining at any time in the project in order to determine if the remaining reserve is adequate.

Meetings

Project risk management should be an agenda item at periodic status meetings. The amount of time required for that item will vary, depending upon the risks that have been identified, their priority, and difficulty of response. The more often risk management is practiced, the easier it becomes. Frequent discussions about risk make it more likely that people will identify risks and opportunities.

Outputs

Issue/Risk Tracking Log Updates

An updated risk register includes, but is not limited to:

- *Outcomes of risk reassessments, risk audits, and periodic risk reviews. These outcomes may include identification of new risk events, updates to probability, impact, priority, response plans, ownership, and other elements of the risk register. Outcomes can also include closing risks that are no longer applicable and releasing their associated reserves.*
- *Actual outcomes of the project's risks and of the risk responses. This information can help project managers to plan for risk throughout their organizations, as well as on future projects.*

Work Performance Information

Work performance information, as a Control Risks output, provides a mechanism to communicate and support project decision making.

Change Requests

Implementing contingency plans or workarounds sometimes results in a change request. Change requests are prepared and submitted to the *Change Management* process. Change requests can include recommended corrective and preventive actions as well.

- Recommended corrective actions. These are activities that realign the performance of the project work with the project management plan. They include contingency plans and workarounds.
- Recommended preventive actions. These are activities that ensure that future performance of the project work is aligned with the project management plan.

Project Management Plan Updates

If the approved change requests have an effect on the risk management processes, the corresponding component documents of the project management plan are revised and reissued to reflect the approved changes. The elements of the project management plan that may be updated are the same as those in the Plan Risk Responses process.

Project Documents Updates

Project documents that may be updated as a result of the Control Risk process include, but are not limited to the *issue/risk tracking log*. Log updates may include:

- Outcomes of risk reassessments, risk audits, and periodic risk reviews. These outcomes may include identification of new risks, updates to probability, impact, priority, response plans, ownership, and other elements of the *log*. Outcomes can also include closing risks that are no longer applicable and releasing their associated reserves.
- Actual outcomes of the project's risks and of the risk responses. This information can help project managers to plan for risk throughout their organizations, as well as on future projects.

PROCUREMENT MANAGEMENT DEFINITION AND PROCESS STEPS

NOTE:

Almost all of the information in this attachment is from:

Project Management Institute (PMI). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* - Fifth Edition. (2013). Copyright and all rights reserved. Material from this publication has been reproduced with the permission of PMI.

WisDOT changes to the PMBOK language are shown in italics.

Procurement Management includes the processes necessary to purchase or acquire services needed from outside the project team.

Procurement Management includes the contract management and change control processes required to develop and administer contracts.

The procurement management plan includes four processes:

- Plan Procurement Management
- Conduct Procurements
- Control Procurements
- Close Procurements

The processes are discussed below but the inputs, tools/techniques, and outputs are just shown as bullet points since the procurement process at WisDOT is well-defined in FDM Chapter 8.

Plan Procurement Management

Plan Procurement Management is the process of documenting project procurement decisions, specifying the approach, and identifying potential sellers. The key benefit of this process is that it determines whether to acquire outside support, and if so, what to acquire, how to acquire it, how much is needed, and when to acquire it.

Inputs

- Project Management Plan
- *Needs Identification*
- *Issue/Risk Tracking Log*
- *Resources to Complete Activities*
- Project Schedule
- Activity Cost Estimates
- Stakeholder Register

Tools/Techniques

- Make-or-Buy Analysis
- Expert Judgment
- Market Research
- Meetings

Outputs

- Procurement Management Plan
- *Scope of Services Narrative (NOI)*
- *Solicitations*
- Selection Criteria
- Make-or-Buy Decisions

- Change Requests
- Change Management Plan Updates
- Project Documents Updates

Conduct Procurements

Conduct Procurements is the process of obtaining seller responses, selecting a seller, and awarding a contract. The key benefit of this process is that it provides alignment of internal and external stakeholder expectations through established *contracts*.

Inputs

- Procurement Management Plan
- Solicitation
- Selection Criteria
- *Completed NOI*
- Project Documents
- Make-or-Buy Decisions
- Solicitation

Tools/Techniques

- Bidder Conferences
- Proposal Evaluation Techniques
- Independent Estimates
- Expert Judgment
- Advertising
- Analytical Techniques
- Procurement Negotiations

Outputs

- *Short List*
- Awarded Contracts
- Staff Availability
- Change Requests
- Project Management Plan Updates
- Project Documents Updates

Control Procurements

Control Procurements is the process of managing procurement relationships, monitoring contract performance, and making changes and corrections to contracts as appropriate. The key benefit of this process is that it ensures that both the seller's and buyer's performance meets procurement requirements according to the terms of the legal agreement.

Inputs

- Project Management Plan
- *Solicitations*
- *Awarded Contract*
- Approved Change Requests
- Work Performance Reports
- *Status Reports*

Tools/Techniques

- Contract Change Control System
- Procurement Performance Reviews
- Inspections and Audits
- Performance Reporting
- Payment Systems
- Claims Administration
- Records Management System

Outputs

- Work Performance Information
- Change Requests
- Project Management Plan Updates
- Project Documents Updates

Close Procurements

Close Procurements is the process of completing each *executed consultant contract*. The key benefit of this process is that it documents *contracts* and related documentation for future reference.

Inputs

- Project Management Plan
- Solicitation

Tools/Techniques

- Procurement Audits
- Procurement Negotiations
- Records Management System

Outputs

- Closed Procurements