Part 3

Appendices, Glossary, and Index

The information contained in this part is not an American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, the information in this part may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to an ANS standard.

APPENDIX X1
SIXTH EDITION CHANGES

The purpose of this appendix is to provide an overview of the changes made to *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*—Fifth Edition to create the *PMBOK® Guide*—Sixth Edition.

X1.1 SCOPE OF UPDATE

The approved scope for the *PMBOK® Guide*—Sixth Edition includes:

◆ Review the following and determine whether the material will be included or excluded in the new editions, and track the disposition:

■ All material relevant to Sections 1 through 13, Annex A1, and the Glossary that was deferred during the development of *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*—Fifth Edition

■ All comments and feedback relevant to Sections 1 through 13, Annex A1, and the Glossary of *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*—Fifth Edition that have been received by PMI since the initial development and publication.

◆ Review, interpret, and ensure appropriate alignment with ISO 21500 in the development of the standard.

◆ Ensure harmonization with any other relevant PMI foundational standards.

◆ Consider the project manager role delineation study results and other PMI research studies for incorporation as appropriate.

◆ Review, conduct, and analyze research for significant additions, deletions, and changes to the Sixth Edition and possibly for strategic input to future editions.

With that directive in mind, the update team focused on bringing greater consistency and clarity by refining and standardizing the processes, inputs, tools and techniques, and outputs.

X1.2 RULES FOR HARMONIZATION BETWEEN GLOSSARY TERMS AND THE *PMI LEXICON OF PROJECT MANAGEMENT TERMS*

To ensure that terms used in the *PMBOK® Guide* align with the *PMI Lexicon of Project Management Terms*[1] and harmonize with other relevant PMI standards, the Sixth Edition followed these business rules:

◆ For terms found in both the *PMBOK® Guide* and the *PMI Lexicon, the definition* from the *PMI Lexicon* is used.

◆ Where terms used in the *PMBOK® Guide* are not found in the *PMI Lexicon* but are found in other relevant PMI standards, the definitions of the terms should be identical. If the definitions do not align with the respective standards, the term is elevated to the PMI Lexicon team for assistance in creating an acceptable common definition.

X1.3 RULES FOR HANDLING INPUTS AND OUTPUTS

The following business rules were used to provide consistency in the order and information within the inputs and outputs for each project management process:

◆ *Fundamental Rules:*

■ Inputs are any documents that are key to the process.

■ Outputs should become an input to another project management process unless the output is a terminal output or embedded within another input such as project documents.

■ Inputs should come from an output from another project management process unless the input comes from outside the project.

◆ *Project Documents Rules:*

■ When specific project documents are identified the first time, they are listed as a specific output. Subsequently, they are listed as "project documents updates" in the output list, and described in the section narrative.

■ When any project document is an input, the term "project documents" is listed and the specific project documents are described in the section narrative.

◆ *Project Management Plan Rules:*

■ For those planning processes that create a subsidiary plan, the project charter is the first input and the project management plan is the second input.

■ The process that creates a component of the project management plan lists the component specifically. Subsequently, components are listed as "project management plan updates" in the output list, and described in the section narrative.

■ When the project management plan serves as a process input, specific components of the project management plan that may be considered are described in the section narrative.

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[1] Project Management Institute. 2016. *The PMI Lexicon of Project Management Terms.* Available from http://www.pmi.org/Lexiconterms

- *Sequencing Rules:*

  - If the project charter is an input, it is the first input.
  - When the project management plan is an input or output, the subsidiary management plans are listed in the order of the sections in the *PMBOK® Guide* where they are produced as an output, followed by baselines and then any other plans.
  - Project documents are listed in alphabetical order.
  - Enterprise environmental factors and organizational process assets are listed last in that order.
  - When updates are an output they are listed in the following sequence:
    - Project management plan updates,
    - Project documents updates, and
    - Organizational process assets updates.

X1.4 RULES FOR HANDLING TOOLS AND TECHNIQUES

The Sixth Edition endeavored to reduce the number of tools and techniques by focusing on those that are currently used on most projects most of the time. Based on academic and market research a number of tools and techniques were eliminated. In order to reduce repetition a tool or technique is described the first time it is listed and subsequent processes using that tool or technique refer back to the earlier description.

The Sixth Edition grouped some of the commonly used tools and techniques by their intent. Not all tools and techniques fall within a group, but for those tools or techniques that are part of a group, the group is listed and then examples of tools and techniques in that group are described in the narrative. The tools and techniques groups are:

- Data gathering,
- Data analysis,
- Data representation,
- Decision-making,
- Communication skills, and
- Interpersonal and team skills.

Appendix X6 identifies all the tools and techniques in the *PMBOK® Guide* by group, where appropriate, and lists the processes where they are used.

X1.5 PROJECT MANAGEMENT PLAN

Not every component of the project management plan is created in a separate process. Such components are considered to be created in the Develop Project Management Plan process. They include the change management plan, configuration management plan, performance measurement baseline, project life cycle, development approach, and management reviews.

X1.6 SECTION 1—INTRODUCTION

The Introduction section was significantly rewritten. Introductory information about projects, programs, and portfolios that aligns with other PMI foundational standards remains. However, there is new information on project and development life cycles, project phases, and phase gates. This information provides a high-level overview on selecting development approaches from predictive, iterative, incremental and adaptive, based on the nature of the project. New information on business documents includes the business case and the benefits management plan.

X1.7 SECTION 2—THE ENVIRONMENT IN WHICH PROJECTS OPERATE

The content of Section 2 was significantly rewritten. Information on organizational process assets and enterprise environmental factors remains. However, there is new content on governance, management elements, and organizational structure types.

X1.8 SECTION 3—THE ROLE OF THE PROJECT MANAGER

This is a new section that outlines the project manager's role on the team. It includes information on the project manager's sphere of influence and competencies. PMI's Talent Triangle® is discussed with its emphasis on strategic and business management skills, technical project management skills, and leadership skills. Leadership styles and personality are also discussed as part of this section. The final part of this section focuses on the project manager as an integrator.

X1.9 AGILE

Since the Fifth Edition of the *PMBOK® Guide* there has been more adoption of agile and adaptive methodologies in the management of projects. The Sixth Edition has included a subsection called Considerations for Adaptive Environments at the beginning of Sections 4 through 13. Some agile-specific tools and techniques have been introduced into the *PMBOK® Guide*, such as sprint and iteration planning. Appendix X3 describes the use of agile, adaptive, iterative, and hybrid approaches from the perspective of the Project Management Process Groups.

X1.10 KNOWLEDGE AREA FRONT MATERIAL

Each of the Knowledge Area sections includes standardized material prior to introducing the first process. The material is presented in the following subsections:

◆ **Key Concepts.** Collects key concepts associated with the specific knowledge area. This information was presented in earlier editions; in this edition it is consolidated and presented for consistency between knowledge areas. These key concepts are compiled in Appendix X4.

◆ **Trends and Emerging Practices**. The profession of project management continues to evolve. However, the purpose of the *PMBOK® Guide* is not to lead the industry; it is to describe what is considered good practice on most projects most of the time. This subsection identifies some of the trends or emerging practices that are occurring, but that may not be practiced on most projects.

◆ **Tailoring Considerations**. The Sixth Edition emphasizes the importance of tailoring all aspects of the project to meet the needs of the organization, environment, stakeholders and other variables. This subsection identifies areas the project manager can consider when tailoring their project. These tailoring considerations are compiled in Appendix X5.

◆ **Considerations for Agile/Adaptive Environments**. This subsection identifies some of the areas where adaptive approaches may differ from predictive approaches in the particular Knowledge Area.

X1.11 KNOWLEDGE AREA AND PROCESS CHANGES

Two Knowledge Areas names were changed to more closely reflect the work that is done.

◆ Project Time Management was changed to Project Schedule Management to reflect that the project schedule is defined and managed during the project, whereas time is not managed.

◆ Both team resources and physical resources are addressed in the Sixth Edition. Thus, the Knowledge Area Project Human Resource Management was changed to Project Resource Management.

One process was removed and three new processes were added, to reflect changes in the way projects are managed in practice. One process was moved between Knowledge Areas. These changes are summarized below, and discussed in the relevant Knowledge Area section:

◆ Manage Project Knowledge (Section 4.4)—Added.

◆ Estimate Activity Resources (Section 6.4)—Moved to Project Resource Management.

◆ Control Resources (Section 9.6)—Added.

◆ Implement Risk Responses (Section 11.6)—Added.

◆ Close Procurements (Section 12.4)—Eliminated.

Several process names were changed to improve consistency across the processes and to improve clarity. Research indicates that project managers tend to monitor, facilitate, and manage rather than control, particularly in processes that involve interactions with people. Therefore, process names for Control Communications, Control Risks, and Control Stakeholder Engagement were changed to Monitor Communications, Monitor Risks, and Monitor Stakeholder Engagement. The list below summarizes all the process name changes:

◆ Perform Quality Assurance (Section 8.2)—Changed to Manage Quality.

◆ Plan Human Resource Management (Section 9.1)—Changed to Plan Resource Management.

◆ Acquire Project Team (Section 9.2)—Changed to Acquire Resources.

◆ Develop Project Team (Section 9.3)—Changed to Develop Team.

◆ Manage Project Team (Section 9.4)—Changed to Manage Team.

◆ Control Communications (Section 10.3)—Changed to Monitor Communications

◆ Control Risks (Section 11.6)—Changed to Monitor Risks.

◆ Plan Stakeholder Management (Section 13.2)—Changed to Plan Stakeholder Engagement.

◆ Control Stakeholder Engagement (Section 13.4)—Changed to Monitor Stakeholder Engagement.

X1.12 SECTION 4—PROJECT INTEGRATION MANAGEMENT CHANGES

A new process, Manage Project Knowledge, was added. This is a result of many deferred comments from the Fifth Edition indicating the need to address knowledge management in projects. A key output of this process is the lessons learned register. This register is used throughout many of the processes in the Sixth Edition. This emphasizes the need to learn continually throughout the project rather than waiting until the end to reflect.

Business documents are inputs to the Develop Project Charter and Close Project or Phase processes. The introduction of business documents underscores the importance of staying attuned to the business case and benefits management throughout the project. Administrative closure activities for procurements have been absorbed into the Close Project or Phase process.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-1 summarizes the Section 4 processes:

Table X1-1. Section 4 Changes

Fifth Edition Processes	Sixth Edition Processes
4.1 Develop Project Charter	4.1 Develop Project Charter
4.2 Develop Project Management Plan	4.2 Develop Project Management Plan
4.3 Direct and Manage Project Work	4.3 Direct and Manage Project Work
4.4 Monitor and Control Project Work	4.4 Manage Project Knowledge
4.5 Perform Integrated Change Control	4.5 Monitor and Control Project Work
4.6 Close Project or Phase	4.6 Perform Integrated Change Control
	4.7 Close Project or Phase

X1.13 SECTION 5—PROJECT SCOPE MANAGEMENT CHANGES

The Sixth Edition team collaborated with The Standard for Business Analysis to ensure that both foundational standards were aligned, though not duplicative. No changes to process names were necessary.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented.

X1.14 SECTION 6—PROJECT SCHEDULE MANAGEMENT CHANGES

Section 6 was renamed from Project Time Management to Project Schedule Management. Research indicated support for the name change as project managers do not manage time, they define and manage the project schedule. Due to the shift in focus and renaming of Project Human Resource Management to Project Resource Management, the process Estimate Activity Resources was moved from this Knowledge Area to Project Resource Management. Some agile concepts were incorporated into the Develop Schedule process. Figures and associated text were updated to clarify scheduling concepts addressed in the section.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-2 summarizes the Section 6 processes:

Table X1-2. Section 6 Changes

Fifth Edition Processes	Sixth Edition Processes
6.1 Plan Schedule Management	6.1 Plan Schedule Management
6.2 Define Activities	6.2 Define Activities
6.3 Sequence Activities	6.3 Sequence Activities
6.4 Estimate Activity Resources	6.4 Estimate Activity Durations
6.5 Estimate Activity Durations	6.5 Develop Schedule
6.6 Develop Schedule	6.6 Control Schedule
6.7 Control Schedule	

X1.15 SECTION 7—PROJECT COST MANAGEMENT CHANGES

Changes consistent with information described in Sections X1.1 through X1.11 were implemented.

X1.16 SECTION 8—PROJECT QUALITY MANAGEMENT CHANGES

Academic and market research was conducted regarding the Perform Quality Assurance process. Research indicated that many of the quality tools and techniques that were identified previously are not widely used in today's projects. The profession focuses more on managing quality through the quality management plan. Thus, the Perform Quality Assurance process shifted focus and the name was changed to Manage Quality.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-3 summarizes the Section 8 processes:

Table X1-3. Section 8 Changes

Fifth Edition Processes	Sixth Edition Processes
8.1 Plan Quality Management	8.1 Plan Quality Management
8.2 Perform Quality Assurance	8.2 Manage Quality
8.3 Control Quality	8.3 Control Quality

X1.17 SECTION 9—PROJECT RESOURCE MANAGEMENT CHANGES

The Sixth Edition expanded the scope of this section from its previous focus on human resources to include all resources. To distinguish between human resources and other resources, the term team resources is used to refer to human resources and the term physical resources is used to refer to other resources. The Estimate Activity Resources process was transferred into this Knowledge Area from Project Schedule Management, and a new process Control Resources was added. The word "project" was eliminated from Develop Team and Manage Team as it is inferred that the only team the project manager is concerned about developing and managing is the project team.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-4 summarizes the Section 9 processes:

Table X1-4. Section 9 Changes

Fifth Edition Processes	Sixth Edition Processes
9.1 Plan Human Resource Management	9.1 Plan Resource Management
9.2 Acquire Project Team	9.2 Estimate Activity Resources
9.3 Develop Project Team	9.3 Acquire Resources
9.4 Manage Project Team	9.4 Develop Team
	9.5 Manage Team
	9.6 Control Resources

X1.18 SECTION 10—PROJECT COMMUNICATIONS MANAGEMENT CHANGES

A subtle but important distinction was made in this section about project communication. The term "communication" indicates the act of communicating, such as facilitating a meeting, giving information and active listening. The term "communications" indicates the artifacts of communication, such as memos, presentations, and emails. Because it is not possible to control how and when people communicate, the name of the Control Communications process has been changed to Monitor Communications.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-5 summarizes the Section 10 processes:

Table X1-5. Section 10 Changes

Fifth Edition Processes	Sixth Edition Processes
10.1 Plan Communications Management	10.1 Plan Communications Management
10.2 Manage Communications	10.2 Manage Communications
10.3 Control Communications	10.3 Monitor Communications

X1.19 SECTION 11—PROJECT RISK MANAGEMENT CHANGES

An increased emphasis on overall project risk was integrated throughout the risk management processes. A new process, Implement Risk Responses, was added. This process is part of the Executing Process Group. The new process emphasizes the importance of not just planning risk responses, but implementing them as well. A new risk response "escalate" was introduced to indicate that if risks are identified that are outside the scope of the project objectives, they should be passed to the relevant person or part of the organization. Because risks are uncertain future events or conditions, they cannot be controlled; however, they can be monitored. Thus, the process Control Risks was renamed to Monitor Risks.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-6 summarizes the Section 11 processes:

Table X1-6. Section 11 Changes

Fifth Edition Processes	Sixth Edition Processes
11.1 Plan Risk Management	11.1 Plan Risk Management
11.2 Identify Risks	11.2 Identify Risks
11.3 Perform Qualitative Risk Analysis	11.3 Perform Qualitative Risk Analysis
11.4 Perform Quantitative Risk Analysis	11.4 Perform Quantitative Risk Analysis
11.5 Plan Risk Responses	11.5 Plan Risk Responses
11.6 Control Risks	11.6 Implement Risk Responses
	11.7 Monitor Risks

X1.20 SECTION 12—PROJECT PROCUREMENT MANAGEMENT CHANGES

Much of the information in this Knowledge Area was updated to reflect a more global perspective. Many projects are conducted with stakeholders in various countries, or by organizations with offices in multiple countries.

Market research shows that very few project managers actually close out procurements. Someone in contracts, procurement or legal departments usually has that authority. Therefore, information from Close Procurements about evaluating all completed deliverables and comparing them to the contract was absorbed into Control Procurements. Information about administrative, communications, and records was moved to Close Project or Phase.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-7 summarizes the Section 12 processes:

Table X1-7. Section 12 Changes

Fifth Edition Processes	Sixth Edition Processes
12.1 Plan Procurement Management	12.1 Plan Procurement Management
12.2 Conduct Procurements	12.2 Conduct Procurements
12.3 Administer Procurements	12.3 Control Procurements
12.4 Close Procurements	

X1.21 SECTION 13—PROJECT STAKEHOLDER MANAGEMENT CHANGES

In keeping with current research and practice, a shift was made to focus on stakeholder engagement rather than stakeholder management. Because project managers rarely, if ever, have the ability to control stakeholders, Control Stakeholder Engagement was renamed to Monitor Stakeholder Engagement.

Changes consistent with information described in Sections X1.1 through X1.11 were implemented. Table X1-8 summarizes the Section 13 processes:

Table X1-8. Section 13 Changes

Fifth Edition Processes	Sixth Edition Processes
13.1 Identify Stakeholders	13.1 Identify Stakeholders
13.2 Plan Stakeholder Management	13.2 Plan Stakeholder Engagement
13.3 Manage Stakeholder Engagement	13.3 Manage Stakeholder Engagement
13.4 Control Stakeholder Engagement	13.4 Monitor Stakeholder Engagement

X1.22 GLOSSARY

The glossary of the *PMBOK® Guide*—Sixth Edition was updated to clarify meaning and improve the quality and accuracy of any translations. Terms that are not used in the Sixth Edition, or are not used differently from everyday usage, were eliminated.

APPENDIX X2
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PMI volunteers first attempted to codify the Project Management Body of Knowledge in the *Special Report on Ethics, Standards, and Accreditation,* published in 1983. Since that time, other volunteers have come forward to update and improve that original document and contribute to this globally recognized standard for project management, PMI's *A Guide to the Project Management Body of Knowledge (PMBOK® Guide).* This appendix lists, those individuals who have contributed to the development and production of the *PMBOK® Guide* – Sixth Edition. No list can adequately portray all the contributions of those who have volunteered to develop the *PMBOK® Guide* – Sixth Edition.

The Project Management Institute is grateful to all of these individuals for their support and acknowledges their contributions to the project management profession.

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APPENDIX X3
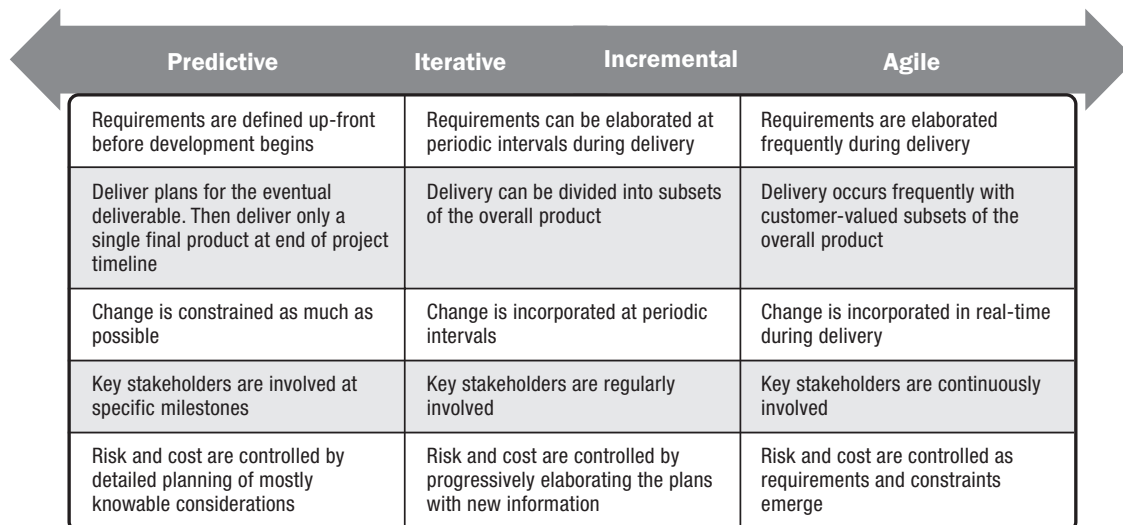# AGILE, ITERATIVE, ADAPTIVE, AND
HYBRID PROJECT ENVIRONMENTS

This appendix explores the nuances of how the Project Management Process Groups described in *The Standard for Project Management* are performed with respect to the project environment and life cycle.

Section 1.2.4.1 of the *PMBOK® Guide* states that the "project life cycle needs to be flexible enough to deal with the variety of factors included in the project." It is the nature of projects to evolve as more detailed and specific information becomes available. This ability to evolve and adapt is more relevant in environments with a high degree of change and uncertainty or with a wide variation of stakeholder interpretation and expectations.

X3.1 THE CONTINUUM OF PROJECT LIFE CYCLES

To understand the application of the process in adaptive projects, the continuum of project life cycles should be defined. The *PMBOK® Guide* Glossary describes the project life cycle as "the series of phases that a project passes through from its start to its completion." Within a project life cycle, there are generally one or more phases that are associated with the development of the product, service, or result. These are called a development life cycle. Development life cycles can be predictive (plan-driven), adaptive (agile), iterative, incremental, or a hybrid.

Figure X3-1 shows the various ways in which requirements and plans are handled, how risk and cost are managed, schedule considerations, and how the involvement of key stakeholders is handled depending on the type of life cycle being employed.

Predictive	Iterative	Incremental	Agile
Requirements are defined up-front before development begins	Requirements can be elaborated at periodic intervals during delivery		Requirements are elaborated frequently during delivery
Deliver plans for the eventual deliverable. Then deliver only a single final product at end of project timeline	Delivery can be divided into subsets of the overall product		Delivery occurs frequently with customer-valued subsets of the overall product
Change is constrained as much as possible	Change is incorporated at periodic intervals		Change is incorporated in real-time during delivery
Key stakeholders are involved at specific milestones	Key stakeholders are regularly involved		Key stakeholders are continuously involved
Risk and cost are controlled by detailed planning of mostly knowable considerations	Risk and cost are controlled by progressively elaborating the plans with new information		Risk and cost are controlled as requirements and constraints emerge

Figure X3-1. The Continuum of Project Life Cycles

Predictive project life cycles are characterized by an emphasis on specification of requirements and detailed planning during the beginning phases of a project. Detailed plans based on known requirements and constraints may reduce risk and cost. Milestones for key stakeholder involvement are also planned. As execution of the detailed plan progresses, the monitoring and controlling processes focus on constraining changes that might impact the scope, schedule, or budget.

Highly adaptive or agile life cycles for projects are characterized by progressive elaboration of requirements based on short iterative planning and executing cycles. Risk and cost are reduced by progressive evolution of initial plans. Key stakeholders are continuously involved and provide frequent feedback which enables responding to changes more quickly and also leads to better quality.

The following considerations apply to the center of the life cycle continuum: (a) risk and cost are reduced by iterative evolution of initial plans; and (b) key stakeholders have more opportunities to be involved in incremental, iterative, and agile cycles than stakeholders at the project milestones of highly predictive life cycles.

Project life cycles in the center of the life cycle continuum tend to align more closely with the predictive side or the agile side of the continuum depending on the way requirements are specified, how risk and cost are handled, and the nature of key stakeholder involvement. Projects in this part of the continuum may utilize hybrid project methods.

It should be emphasized that development life cycles are complex and multidimensional. Often, the different phases in a given project employ different life cycles, just as distinct projects within a given program may each be executed differently.

X3.2 PROJECT PHASES

Section 1.2.4.2 of the *PMBOK® Guide* defines phases as "a collection of logically related project activities that culminates in the completion of one or more deliverables." Processes in each of the Process Groups are repeated as necessary in each phase until the completion criteria for that phase have been satisfied.

Projects on the more adaptive side of the continuum make use of two recurring patterns of project phase relationships as described in Sections X3.2.1 and X3.2.2.

X3.2.1 SEQUENTIAL ITERATION-BASED PHASES

Adaptive projects are often decomposed into a sequence of phases called Iterations. Each iteration utilizes the relevant project management processes. These iterations create a cadence of predictable, timeboxed pre-agreed, consistent duration that aids with scheduling.

Performing the process groups repeatedly incurs overhead. The overhead is considered necessary to effectively manage projects with high degrees of complexity, uncertainty, and change. The effort level for iteration-based phases is illustrated in Figure X3-2.
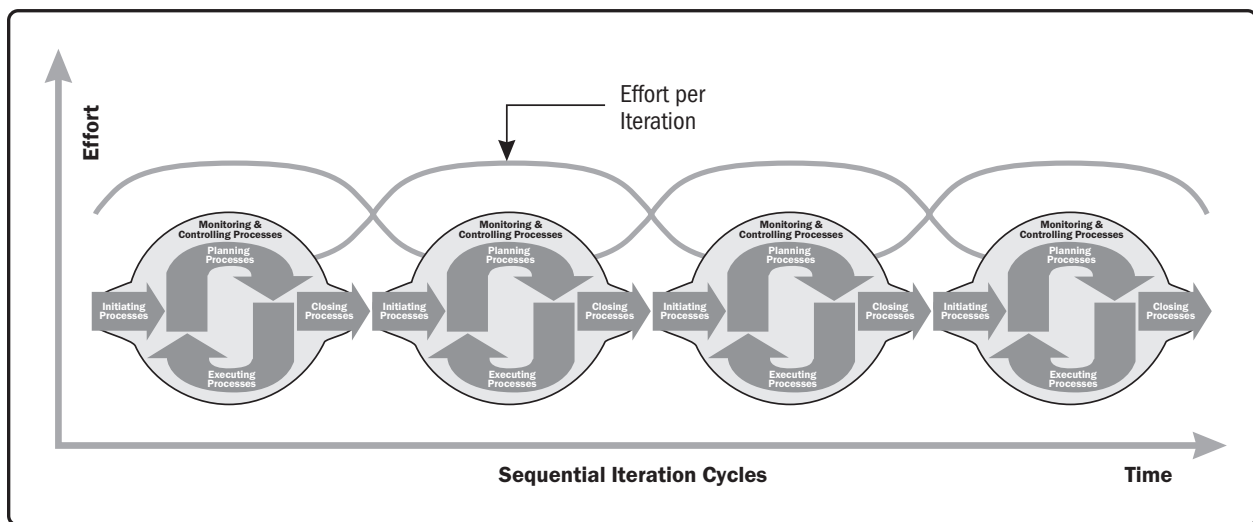
Figure X3-2. Level of Effort for Process Groups across Iteration Cycles

X3.2.2 CONTINUOUS OVERLAPPING PHASES

Projects that are highly adaptive will often perform all of the project management process groups continuously throughout the project life cycle. Inspired by techniques from lean thinking, the approach is often referred to as "continuous and adaptive planning," which acknowledges that once work starts, the plan will change, and the plan needs to reflect this new knowledge. The intent is to aggressively refine and improve all elements of the project management plan, beyond the prescheduled checkpoints associated with Iterations. The interaction of the Process Groups in this approach is illustrated in Figure X3-3.
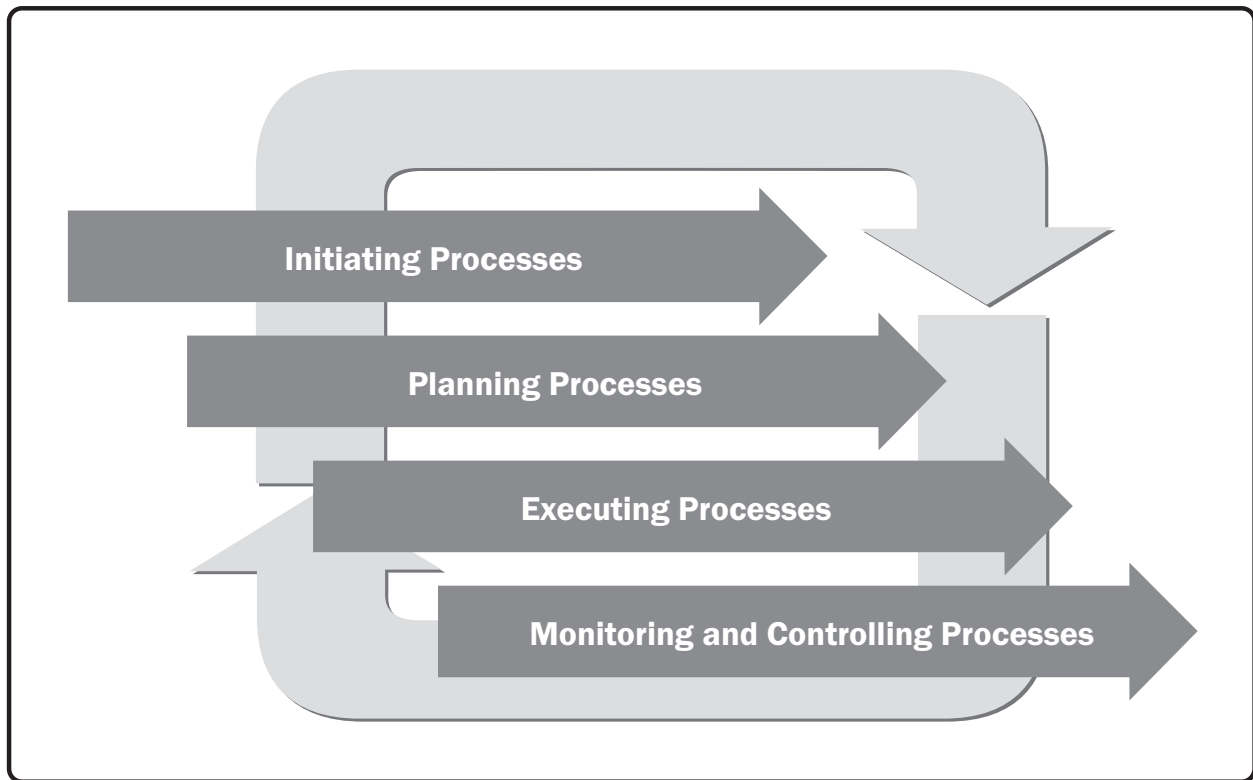
Figure X3-3. Relationship of Process Groups in Continuous Phases

These highly adaptive approaches continuously pull tasks from a prioritized list of work. This aims to minimize the overhead of managing Process Groups repeatedly, by removing the start and end of iteration activities. Continuous pull systems can be viewed as microiterations with an emphasis on maximizing the time available on execution rather than management. They do however need their own planning, tracking, and adjustment mechanisms to keep them on track and adapt to changes.

X3.3 PROCESS GROUPS IN ADAPTIVE ENVIRONMENTS

As shown in the previous section, each of the Project Management Process Groups occurs in projects across the project life cycle continuum. There are some variations in how the Process Groups interact within adaptive and highly adaptive life cycles.

X3.3.1 INITIATING PROCESS GROUP

Initiating processes are those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase. Adaptive projects revisit and revalidate the project charter on a frequent basis. As the project progresses, competing priorities and changing dynamics may cause the project constraints and success criteria to become obsolete. For this reason, the Initiating processes are performed regularly on adaptive projects in order to ensure the project is moving within constraints and toward goals that reflect the latest information.

Adaptive projects rely heavily on a knowledgeable customer or designated customer representative who can state needs and desires, and provide feedback on the emerging deliverable on a continuous, ongoing basis. Identifying this stakeholder or other stakeholders at the start of the project permits frequent interactions when performing Execution and Monitoring and Controlling processes. The associated feedback ensures that the correct project outputs are delivered. As indicated previously, an Initiating process is typically conducted on each iterative cycle of an adaptive life cycle project.

X3.3.2 PLANNING PROCESS GROUP

Planning processes are those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.

Highly predictive project life cycles are generally characterized by few changes to project scope and high stakeholder alignment. These projects benefit from detailed up-front planning. Adaptive life cycles, on the other hand, develop a set of high-level plans for the initial requirements and progressively elaborate requirements to an appropriate level of detail for the planning cycle. Therefore, predictive and adaptive life cycles differ as to how much planning is done and when it is done.

Additionally, projects navigating high degrees of complexity and uncertainty should involve as many team members and stakeholders as possible in the planning processes. The intent is to overcome uncertainty by incorporating a wide band of input into planning.

X3.3.3 EXECUTING PROCESS GROUP

Executing processes are those processes performed to complete the work defined in the project management plan to satisfy the project requirements.

Work in agile, iterative, and adaptive project life cycles is directed and managed through iterations. Each iteration is a short, fixed time period to undertake work followed by a demonstration of functionality or design. Based on the demonstration, relevant stakeholders and the team conduct a retrospective review. The demonstration and review helps check progress against the plan and determines if any changes to the project scope, schedule, or execution processes are necessary. These sessions also help manage stakeholder engagement by showing increments of work done and discussing future work. The retrospective allows issues with the execution approach to be identified and discussed in a timely fashion along with ideas for improvements. Retrospectives are a primary tool to manage project knowledge and develop the team through discussions of what is working well and team-based problem solving.

While work is undertaken via short iterations, it is also tracked and managed against longer-term project delivery timeframes. Trends of development speed, spend, defect rates, and team capacity that are tracked at an iteration level are summed and extrapolated at a project level to track completion performance. Highly adaptive approaches aim to utilize specialized team knowledge for task completion. Rather than a project manager selecting and sequencing work, higher-level objectives are explained and the team members are empowered to self-organize specific tasks as a group to best meet those objectives. This leads to the creation of practical plans with high levels of buy-in from the team members.

Junior teams working on highly adaptive projects typically need coaching and work assignments before reaching this empowered team state. However, with progressive trials within the confines of a short iteration, teams are reviewed as part of the retrospective to determine if they acquired the required skills to perform without coaching.

X3.3.4 MONITORING AND CONTROLLING PROCESS GROUP

Monitoring and Controlling processes are those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.

Iterative, agile, and adaptive approaches track, review, and regulate progress and performance by maintaining a backlog. The backlog is prioritized by a business representative with help from the project team who estimates and provides information about technical dependencies. Work is pulled from the top of the backlog for the next iteration based on business priority and team capacity. Requests for change and defect reports are evaluated by the business representative in consultation with the team for technical input and are prioritized accordingly in the backlog of work.

This single-list-of-work-and-changes approach originated in project environ-ments with very high rates of change that tended to overwhelm any attempts to separate change requests from originally planned work. Combining these work streams into a single backlog that can be easily resequenced provides a single place for stakeholders to manage and control project work, perform change control, and validate scope.

As prioritized tasks and changes are pulled from the backlog and completed via iterations, trends, and metrics on work performed, change effort and defect rates are calculated. By sampling progress frequently via short iterations, measures of team capacity and progress against the original scope are made by measuring the number of change impacts and defect remediation efforts. This allows estimates of cost, schedule, and scope to be made based on real progress rates and change impacts.

These metrics and projections are shared with project stakeholders via trend graphs (information radiators) to communicate progress, share issues, drive continuous improvement activities, and manage stakeholder expectations.

X3.3.5 CLOSING PROCESS GROUP

The Closing processes are the processes performed to formally complete or close a project, phase, or contract. Work on iterative, adaptive, and agile projects is prioritized to undertake the highest business value items first. So, if the Closing Process Group prematurely closes a project or phase, there is a high chance that some useful business value will already have been generated. This allows premature closure to be less of a failure due to sunk costs and more of an early benefits realization, quick win, or proof of concept for the business.

APPENDIX X4
SUMMARY OF KEY CONCEPTS FOR KNOWLEDGE AREAS

The purpose of this appendix is to provide a summary of the sections on Key Concepts for each of the Knowledge Areas in Sections 4-13. It can be used as an aid for project practitioners, a checklist of learning objectives for providers of project management training, or as a study aid by those preparing for certification.

X4.1 KEY CONCEPTS FOR PROJECT INTEGRATION MANAGEMENT

Key concepts for Project Integration Management include:

◆ Project Integration Management is the specific responsibility of the project manager and it cannot be delegated or transferred. The project manager is the one that combines the results from all the other Knowledge Areas to provide an overall view of the project. The project manager is ultimately responsible for the project as a whole.

◆ Projects and project management are integrative by nature, with most tasks involving more than one Knowledge Area.

◆ The relationships of processes within the Project Management Process Groups and between the Project Management Process

◆ Project Integration Management is about:

- Ensuring that the due dates of project deliverables, the project life cycle, and the benefits realization plan are aligned;

- Providing a project management plan to achieve the project objectives;

- Ensuring the creation and the use of appropriate knowledge to and from the project;

- Managing project performance and changes to the project activities;

- Making integrated decisions regarding key changes impacting the project;

- Measuring and monitoring progress and taking appropriate action;

- Collecting, analyzing and communicating project information to relevant stakeholders;

- Completing all the work of the project and formally closing each phase, contract, and the project as a whole; and

- Managing phase transitions when necessary.

X4.2 KEY CONCEPTS FOR PROJECT SCOPE MANAGEMENT

Key concepts for Project Scope Management include:

◆ Scope can refer to product scope (the features and functions that characterize a product, service, or result), or to project scope (the work performed to deliver a product, service, or result with the specified features and functions).

◆ Project life cycles range along a continuum from predictive to adaptive or agile. In a life cycle that uses a predictive approach, the project deliverables are defined at the beginning of the project and any changes to the scope are progressively managed. In an adaptive or agile approach, the deliverables are developed over multiple iterations where a detailed scope is defined and approved for each iteration when it begins.

◆ Completion of the project scope is measured against the project management plan. Completion of the product scope is measured against the product requirements.

X4.3 KEY CONCEPTS FOR PROJECT SCHEDULE MANAGEMENT

Key concepts for Project Schedule Management include:

◆ Project scheduling provides a detailed plan that represents how and when the project will deliver the products, services, and results defined in the project scope.

◆ The project schedule is used as a tool for communication, managing stakeholder expectations, and a basis for performance reporting.

◆ When possible, the detailed project schedule should remain flexible throughout the project to adjust for knowledge gained, increased understanding of the risk, and value-added activities.

X4.4 KEY CONCEPTS FOR PROJECT COST MANAGEMENT

Key concepts for Project Cost Management include:

◆ Project Cost Management is primarily concerned with the cost of the resources needed to complete project activities, but it should also consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting project deliverables.

◆ Different stakeholders will measure project costs in different ways and at different times. Stakeholder requirements for managing costs should be considered explicitly.

◆ Predicting and analyzing the prospective financial performance of the project's product may be performed outside the project, or it may be part of Project Cost Management.

X4.5 KEY CONCEPTS FOR PROJECT QUALITY MANAGEMENT

Key concepts for Project Quality Management include:

◆ Project 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.

◆ Quality and grade are different concepts. Quality is "the degree to which a set of inherent characteristics fulfills requirements" (ISO 9000).[1] Grade is a category assigned to deliverables having the same functional use but different technical characteristics. The project manager and team are responsible for managing trade-offs associated with delivering the required levels of both quality and grade.

◆ Prevention is preferred over inspection. It is better to design quality into deliverables, rather than to find quality issues during inspection. The cost of preventing mistakes is generally much less than the cost of correcting mistakes when they are found by inspection or during usage.

◆ Project managers may need to be familiar with sampling. Attribute sampling (the result either conforms or does not conform) and variable sampling (the result is rated on a continuous scale that measures the degree of conformity).

◆ Many projects establish tolerances and control limits for project and product measurements. Tolerances (the specified range of acceptable results) and control limits (the boundaries of common variation in a statistically stable process or process performance).

◆ The cost of quality (COQ) 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). Cost of quality is often the concern of program management, portfolio management, the PMO, or operations.

◆ The most effective quality management is achieved when quality is incorporated into the planning and designing of the project and product, and when organizational culture is aware and committed to quality.

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[1] International Standards Organization. 2015. Quality Management Systems—Fundamentals and Vocabulary. Geneva: Author.

X4.6 KEY CONCEPTS FOR PROJECT RESOURCE MANAGEMENT

Key concepts for Project Resource Management include:

◆ Project resources include both physical resources (equipment, materials, facilities, and infrastructure) and team resources (individuals with assigned project roles and responsibilities).

◆ Different skills and competences are needed to manage team resources versus physical resources.

◆ The project manager should be both the leader and the manager of the project team, and should invest suitable effort in acquiring, managing, motivating, and empowering team members.

◆ The project manager should be aware of team influences such as the team environment, geographical location of team members, communication among stakeholders, organizational change management, internal and external politics, cultural issues, and organizational uniqueness.

◆ The project manager is responsible for proactively developing team skills and competences while retaining and improving team satisfaction and motivation.

◆ Physical resource management is concentrated on allocating and utilizing the physical resources needed for successful completion of the project in an efficient and effective way. Failure to manage and control resources efficiently may reduce the chance of completing the project successfully.

X4.7 KEY CONCEPTS FOR PROJECT COMMUNICATIONS MANAGEMENT

Key concepts for Project Communications Management include:

◆ *Communication* is the process of exchanging information, intended or involuntary, between individuals and/ or groups. *Communications* describes the means by which information can be sent or received, either through activities, such as meetings and presentations, or artifacts, such as emails, social media, project reports, or project documentation. Project Communications Management addresses both the process of communication, as well as management of communications activities and artifacts.

◆ Effective communication creates a bridge between diverse stakeholders whose differences will generally have an impact or influence upon the project execution or outcome, so it is vital that all communication is clear and concise.

◆ Communication activities include internal and external, formal and informal, written and oral.

◆ Communication can be directed upwards to senior management stakeholders, downwards to team members, or horizontally to peers. This will affect the format and content of the message.

◆ Communication takes place consciously or unconsciously through words, facial expressions, gestures and other actions. It includes developing strategies and plans for suitable communications artifacts, and the application of skills to enhance effectiveness.

◆ Effort is required to prevent misunderstandings and miscommunication, and the methods, messengers, and messages should be carefully selected.

◆ Effective communication depends on defining the purpose of communication, understanding the receiver of the communications, and monitoring effectiveness.

X4.8 KEY CONCEPTS FOR PROJECT RISK MANAGEMENT

Key concepts for Project Risk Management include:

◆ All projects are risky. Organizations choose to take project risk in order to create value, while balancing risk and reward.

◆ Project Risk Management aims to identify and manage risks that are not covered by other project management processes.

◆ Risk exists at two levels within every project: *Individual project risk* is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives. *Overall project risk* is the effect of uncertainty on the project as a whole, arising from all sources of uncertainty including individual risks, representing the exposure of stakeholders to the implications of variations in project outcome, both positive and negative. Project Risk Management processes address both levels of risk in projects.

◆ Individual project risks can have a positive or negative effect on project objectives if they occur. Overall project risk can also be positive or negative.

◆ Risks will continue to emerge during the lifetime of the project, so Project Risk Management processes should be conducted iteratively.

◆ In order to manage risk effectively on a particular project, the project team needs to know what level of risk exposure is acceptable in pursuit of project objectives. This is defined by measurable risk thresholds that reflect the risk appetite of the organization and project stakeholders.

X4.9 KEY CONCEPTS FOR PROJECT PROCUREMENT MANAGEMENT

Key concepts for project procurement management include:

◆ The project manager should be familiar enough with the procurement process to make intelligent decisions regarding contracts and contractual relationships.

◆ Procurement involves agreements that describe the relationship between a buyer and a seller. Agreements can be simple or complex, and the procurement approach should reflect the degree of complexity. An agreement can be a contract, a service-level agreement, an understanding, a memorandum of agreement, or a purchase order.

◆ Agreements must comply with local, national, and international laws regarding contracts.

◆ The project manager should ensure that all procurements meet the specific needs of the project, while working with procurement specialists to ensure organizational policies are followed.

◆ The legally binding nature of an agreement means it will be subjected to a more extensive approval process, often involving the legal department, to ensure that it adequately describes the products, services, or results that the seller is agreeing to provide, while being in compliance with the laws and regulations regarding procurements.

◆ A complex project may involve multiple contracts simultaneously or in sequence. The buyer-seller relationship may exist at many levels on any one project, and between organizations internal to and external to the acquiring organization.

X4.10 KEY CONCEPTS FOR PROJECT STAKEHOLDER MANAGEMENT

Key concepts for project stakeholder management include:

◆ Every project has stakeholders who are impacted by or can impact the project in a positive or negative way. Some stakeholders will have a limited ability to influence the project's work or outcomes; others will have significant influence on the project and its expected outcomes.

◆ The ability of the project manager and team to correctly identify and engage all of the stakeholders in an appropriate way can mean the difference between project success and failure.

◆ To increase the chances of success, the process of stakeholder identification and engagement should commence as soon as possible after the project charter has been approved, the project manager has been assigned, and the team begins to form.

◆ The key to effective stakeholder engagement is a focus on continuous communication with all stakeholders. Stakeholder satisfaction should be identified and managed as a key project objective.

◆ The process of identifying and engaging stakeholders for the benefit of the project is iterative, and should be reviewed and updated routinely, particularly when the project moves into a new phase, or if there are significant changes in the organization or the wider stakeholder community.

APPENDIX X5
SUMMARY OF TAILORING CONSIDERATIONS
FOR KNOWLEDGE AREAS

The purpose of this appendix is to provide a summary of the Tailoring Concepts sections for each of the Knowledge Areas in Sections 4 through 13. Because each project is unique, this information can be used to aid practitioners in determining how to tailor processes, inputs, tools and techniques, and outputs for a project. This information can also help determine the degree of rigor that should be applied to the various processes in a Knowledge Area.

X5.1 PROJECT INTEGRATION MANAGEMENT

Considerations for tailoring project integration management include but are not limited to:

◆ **Project life cycle.** What is an appropriate project life cycle? What phases should comprise the project life cycle?

◆ **Development life cycle**. What development life cycle and approach is appropriate for the product, service or result? Is a predictive or adaptive approach appropriate? If adaptive, should the product be developed incrementally or iteratively? Is a hybrid approach best?

◆ **Management approaches**. What management processes are most effective based on the organizational culture and the complexity of the project?

◆ **Knowledge management.** How will knowledge be managed in the project to foster a collaborative working environment?

◆ **Change**. How will change be managed in the project?

◆ **Governance**. What control boards, committees, and other stakeholders are part of the project? What are the project status reporting requirements?

◆ **Lessons learned**. What information should be collected throughout and at the end of the project? How will historical information and lessons learned be made available to future projects?

◆ **Benefits**. When and how should benefits be reported: at the end of the project or at the end of each iteration or phase?

X5.2 PROJECT SCOPE MANAGEMENT

Considerations for tailoring project scope management include but are not limited to:

◆ **Knowledge and requirements management**. Does the organization have formal or informal knowledge and requirements management systems? What guidelines should the project manager establish for requirements to be reused in the future?

◆ **Validation and control**. Does the organization have existing formal or informal validation and control-related policies, procedures, and guidelines?

◆ **Use of agile approach**. Does the organization use agile approaches in managing projects? Is the development approach iterative or incremental? Is a predictive approach used? Will a hybrid approach be productive?

◆ **Governance**. Does the organization have formal or informal audit and governance policies, procedures, and guidelines?

X5.3 PROJECT SCHEDULE MANAGEMENT

Considerations for tailoring project schedule management include but are not limited to:

◆ **Life cycle approach.** What is the most appropriate life cycle approach that allows for a detailed schedule?

◆ **Duration and resource.** What are the factors influencing durations, such as the correlation between resource availability and productivity?

◆ **Project dimensions.** How will the presence of project complexity, technological uncertainty, product novelty, pace or progress tracking, (such as earned value management, percentage complete, red-yellow-green (stop light) indicators) impact the desired level of control?

◆ **Technology support.** Is technology used to develop, record, transmit, receive, and store project schedule model information and is it readily accessible?

X5.4 PROJECT COST MANAGEMENT

Considerations for tailoring project cost management include but are not limited to:

◆ **Knowledge management**. Does the organization have a formal knowledge management and financial databases repository that a project manager is required to use and is readily accessible?

◆ **Estimating and budgeting**. Does the organization have existing formal or informal cost estimating and budgeting-related policies, procedures, and guidelines?

◆ **Earned value management**. Does the organization use earned value management in managing projects?

◆ **Use of agile approach**. Does the organization use agile methodologies in managing projects? How does this impact cost estimating?

◆ **Governance**. Does the organization have formal or informal audit and governance policies, procedures, and guidelines?

X5.5 PROJECT QUALITY MANAGEMENT

Considerations for tailoring project quality management include but are not limited to:

◆ **Policy compliance and auditing**. What quality policies and procedures exist in the organization? What quality tools, techniques, and templates are used in the organization?

◆ **Standards and regulatory compliance**. Are there any specific quality standards in the industry that need to be applied? Are there any specific governmental, legal, or regulatory constraints that need to be taken into consideration?

◆ **Continuous improvement**. How will quality improvement be managed in the project? Is it managed at the organizational level or at the level of each project?

◆ **Stakeholder engagement**. Is there a collaborative environment with stakeholders and suppliers?

X5.6 PROJECT RESOURCE MANAGEMENT

Considerations for tailoring project resource management include but are not limited to:

◆ **Diversity**. What is the diversity background of the team?

◆ **Physical location**. What is the physical location of team members and physical resources?

◆ **Industry-specific resources**. What special resources are needed in in the industry?

◆ **Acquisition of team members**. How will team members be acquired for the project? Are team resources full-time or part-time on the project?

◆ **Development and management of team**. How is team development managed for the project? Are there organizational tools to manage team development or will new ones need to be established? Will the team need special training to manage diversity?

◆ **Life cycle approaches**. What life cycle approach will be used on the project?

X5.7 PROJECT COMMUNICATIONS MANAGEMENT

Considerations for tailoring project communications management include but are not limited to:

◆ **Stakeholders**. Are the stakeholders internal or external to the organization, or both?

◆ **Physical location**. What is the physical location of team members? Is the team colocated? Is the team in the same geographical area? Is the team distributed across multiple time zones?

◆ **Communications technology**. What technology is available to develop, record, transmit, retrieve, track, and store communication artifacts? What technologies are most appropriate and cost effective for communicating to stakeholders?

◆ **Language**. Language is a main factor to consider in communication activities. Is one language used? Or are many languages used? Have allowances been made to adjust to the complexity of team members from diverse language groups?

◆ **Knowledge management**. Does the organization have a formal knowledge management repository? Is the repository used?

X5.8 PROJECT RISK MANAGEMENT

Considerations for tailoring project risk management include but are not limited to:

◆ **Project size**. Does the project's size in terms of budget, duration, scope, or team size require a more detailed approach to risk management? Or is it small enough to justify a simplified risk process?

◆ **Project complexity**. Is a robust risk approach demanded by high levels of innovation, new technology, commercial arrangements, interfaces, or external dependencies that increase project complexity? Or is the project simple enough that a reduced risk process will suffice?

◆ **Project importance**. How strategically important is the project? Is the level of risk increased for this project because it aims to produce breakthrough opportunities, addresses significant blocks to organizational performance, or involves major product innovation?

◆ **Development approach**. Is this a waterfall project where risk processes can be followed sequentially and iteratively, or does the project follow an agile approach where risk is addressed at the start of each iteration as well as during execution?

X5.9 PROJECT PROCUREMENT MANAGEMENT

Considerations for tailoring project procurement management include but are not limited to:

◆ **Complexity of procurement**. Is there one main procurement or are there multiple procurements at different times with different sellers that add to the complexity of the procurements?

◆ **Physical location**. Are the buyers and sellers in the same location or reasonably close or in different time zones, countries, or continents?

◆ **Governance and regulatory environment**. Are local laws and regulations regarding procurement activities integrated with the organization's procurement policies? How does this affect contract auditing requirements?

◆ **Availability of contractors**. Are there available contractors who are capable of performing the work?

X5.10 PROJECT STAKEHOLDER MANAGEMENT

Considerations for tailoring project stakeholder management include but are not limited to:

◆ **Stakeholder diversity**. How many stakeholders are there? How diverse is the culture within the stakeholder community?

◆ **Complexity of stakeholder relationships**. How complex are the relationships within the stakeholder community? The more networks a stakeholder or stakeholder group participates in, the more complex the networks of information and misinformation the stakeholder may receive.

◆ **Communication technology**. What communication technology is available? What support mechanisms are in place to ensure that best value is achieved from the technology?

APPENDIX X6
TOOLS AND TECHNIQUES

X6.1 INTRODUCTION

The *PMBOK® Guide* - Sixth Edition presents tools and techniques differently from previous editions. Where appropriate, this edition groups tools and techniques by their purpose. The group name describes the intent of what needs to be done and the tools and techniques in the group represent different methods to accomplish the intent. For example, data gathering is a group with the intent of gathering data and information. Brainstorming, interviews, and market research are among the techniques that can be used to gather data and information.

This approach reflects the emphasis in the Sixth Edition on the importance of tailoring the information presented in the *PMBOK® Guide* to the needs of the environment, situation, organization, or project.

There are 132 individual tools and techniques in the *PMBOK® Guide* – Sixth Edition. These are not the only tools and techniques that can be used to manage a project. They represent those tools and techniques that are considered to be good practice on most projects most of the time. Some are mentioned once and some appear many times in the *PMBOK® Guide*.

To assist practitioners in identifying where specific tools and techniques are used, this appendix identifies each tool and technique, the group to which it belongs (if appropriate), and the process(es) where it is listed in the *PMBOK® Guide*. The process in which a tool or technique is described in the guide is in boldface type. In other processes where the tool or technique is listed, it will reference the process in which it is described. Processes may provide additional verbiage on how a tool or technique is used in a particular process.

X6.2 TOOLS AND TECHNIQUES GROUPS

The following tools and techniques groups are used throughout the *PMBOK® Guide*:

◆ **Data gathering techniques.** Used to collect data and information from a variety of sources. There are nine data gathering tools and techniques.

◆ **Data analysis techniques.** Used to organize, assess, and evaluate data and information. There are 27 data analysis tools and techniques.

◆ **Data representation techniques.** Used to show graphic representations or other methods used to convey data and information. There are 16 data representation tools and techniques.

◆ **Decision-making techniques.** Used to select a course of action from different alternatives. There are three decision-making tools and techniques.

◆ **Communication skills.** Used to transfer information between stakeholders. There are four communication skills tools and techniques.

◆ **Interpersonal and team skills.** Used to effectively lead and interact with team members and other stakeholders. There are 17 interpersonal and team skills tools and techniques.

There are 59 ungrouped tools and techniques.

Table X6-1. Categorization and Index of Tools and Techniques

Tool and Technique	Knowledge Area[A]									
	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Data Gathering Tools and Techniques										
Benchmarking		5.2			**8.1**					13.2
Brainstorming	**4.1**, 4.2	5.2			8.1			11.2		13.1
Check sheets					**8.3**					
Checklists	4.2				8.2, 8.3			**11.2**		
Focus groups	4.1, 4.2	**5.2**								
Interviews	4.1, 4.2	**5.2**			8.1			11.2, 11.3, 11.4, 11.5		
Market research									**12.1**	
Questionnaires and surveys		**5.2**			8.3					13.1
Statistical sampling					**8.3**					

Tool and Technique	Knowledge Area[A]									
	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Data Analysis Tools and Techniques										
Alternatives analysis	4.5, 4.6	5.1, 5.3	6.1, 6.4	7.1, 7.2	8.2	**9.2**, 9.6		11.5		13.4
Assessment of other risk parameters								**11.3**		
Assumption and constraint analysis								**11.2**		13.2
Cost of quality				7.2	**8.1**					
Cost-benefit analysis	4.5, 4.6				**8.1**	9.6		11.5		
Decision tree analysis								**11.4**		
Document analysis	4.7	**5.2**			8.2			11.2		13.1
Earned value analysis	4.5		6.6	**7.4**					12.3	
Influence diagrams								**11.4**		
Iteration burndown chart			**6.6**							
Make-or-buy analysis									**12.1**	
Performance reviews			**6.6**		8.3	9.6			12.3	
Process analysis					**8.2**					
Proposal evaluation									**12.2**	

Table X6-1. Categorization and Index of Tools and Techniques *(cont.)*

Tool and Technique	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Knowledge Area[A]										
Data Analysis Tools and Techniques *(cont.)*										
Regression analysis	**4.7**									
Reserve analysis			6.4	**7.2**, 7.3, 7.4				11.7		
Risk data quality assessment								**11.3**		
Risk probability and impact assessment								**11.3**		
Root cause analysis	4.5				**8.2**, 8.3			11.2		13.2, 13.4
Sensitivity analysis								**11.4**		
Simulation			6.5					**11.4**		
Stakeholder analysis								11.1		**13.1**, 13.4
SWOT analysis								**11.2**		
Technical performance analysis								**11.7**		
Trend analysis	**4.5**, 4.7	5.6	6.6	7.4		9.6			12.3	
Variance analysis	**4.5**, 4.7	5.6	6.6	7.4						
What-if scenario analysis			**6.5**, 6.6							

Table X6-1. Categorization and Index of Tools and Techniques *(cont.)*

Tool and Technique	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Data Representation Tools and Techniques										
Affinity diagrams		**5.2**			8.2					
Cause-and-effect diagrams					**8.2**, 8.3					
Control charts					**8.3**					
Flowcharts					**8.1**, 8.2					
Hierarchical charts						9.1		11.3		
Histograms					**8.2**, 8.3					
Logical data model					**8.1**					
Matrix diagrams					**8.1**, 8.2					
Mind mapping		5.2			8.1					13.2
Prioritization/ ranking										**13.2**
Probability and impact matrix								**11.3**		
Responsibility assignment matrix						9.1				
Scatter diagrams					**8.2**, 8.3					
Stakeholder engagement assessment matrix							10.1, 10.3			**13.2**, 13.4
Stakeholder mapping/ representation										**13.1**
Text-oriented formats						**9.1**				
Decision-Making Tools and Techniques										
Multicriteria decision analysis	4.6	5.2, 5.3			**8.1**, 8.2	9.3		11.5		13.4
Voting	4.5, 4.6	**5.2**, 5.5	6.4	7.2						13.4
Autocratic decision making	4.6	5.2								
Communication Skills Tools and Techniques										
Communication competence							**10.2**			
Feedback							**10.2**			13.4
Nonverbal							**10.2**			
Presentations							**10.2**			13.4

Tool and Technique	Knowledge Area[A]									
	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Interpersonal and Team Skills Tools and Techniques										
Active listening	4.4						**10.2**			13.4
Communication styles assessment							**10.1**			
Conflict management	4.1, 4.2					9.4, **9.5**	10.2			13.3
Cultural awareness							**10.1**, 10.2			13.3, 13.4
Decision making						**9.5**				
Emotional intelligence						**9.5**				
Facilitation	**4.1**, 4.2, 4.4	5.2, 5.3						11.2, 11.3, 11.4, 11.5		
Influencing						9.4, **9.5**, 9.6		11.6		
Leadership	4.4					**9.5**				13.4
Meeting management	4.1, 4.2						**10.2**			
Motivation						**9.4**				
Negotiation						9.3, 9.4, 9.6			**12.2**	13.3
Networking	4.4						**10.2**			13.4
Nominal group technique		**5.2**								
Observation/ conversation		**5.2**					10.3			13.3
Political awareness	4.4						**10.1**, 10.2			13.3, 13.4
Team building						**9.4**				

Table X6-1. Categorization and Index of Tools and Techniques *(cont.)*

Tool and Technique	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Knowledge Area[A]										
Ungrouped Tools and Techniques										
Advertising									**12.2**	
Agile release planning			**6.5**							
Analogous estimating			**6.4**	7.2		9.2				
Audits					**8.2**			11.7	12.3	
Bidder conferences									**12.2**	
Bottom-up estimating			**6.4**	7.2		9.2				
Change control tools	**4.6**									
Claims administration									**12.3**	
Colocation						**9.4**				
Communication methods							**10.1**, 10.2			
Communication models							**10.1**			
Communication requirements analysis							**10.1**			
Communication technology						9.4	**10.1**, 10.2			
Context diagram		**5.2**								
Contingent response strategies								**11.5**		
Cost aggregation				7.3						
Critical path method			**6.5**, 6.6							

Tool and Technique	Knowledge Area[A]									
	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Ungrouped Tools and Techniques *(cont.)*										
Decomposition		**5.4**	6.2							
Dependency determination and integration			**6.3**							
Design for X					**8.2**					
Expert judgment	**4.1**, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7	5.1, 5.2, 5.3, 5.4	6.1, 6.2, 6.4	7.1, 7.2, 7.3, 7.4	8.1	9.1, 9.2	10.1, 10.3	11.1, 11.2, 11.3, 11.4, 11.5, 11.6	12.1, 12.2, 12.3	13.1, 13.2, 13.3
Financing				**7.3**						
Funding limit reconciliation				**7.3**						
Ground rules										**13.3**
Historical information review				**7.3**						
Individual and team assessments						**9.4**				
Information management	**4.4**									
Inspection		5.5			**8.3**				12.3	
Knowledge management	**4.4**									
Leads and lags			**6.3**, 6.5, 6.6							
Meetings	4.1, 4.2, 4.3, 4.5, 4.6, 4.7	5.1	6.1, 6.2, 6.4	7.1	8.1, 8.3	9.1, 9.2, 9.4	**10.1**, 10,2, 10.3	11.1, 11.2, 11.3, 11.7	12.1	13.1, 13.2, 13.3, 13.4

Table X6-1. Categorization and Index of Tools and Techniques *(cont.)*

Tool and Technique	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Knowledge Area[A]										
Ungrouped Tools and Techniques *(cont.)*										
Organizational theory						**9.1**				
Parametric estimating			**6.4**	7.2		9.2				
Pre-assignment						**9.3**				
Precedence diagramming method			**6.3**							
Problem solving					**8.2**	9.6				
Product analysis		**5.3**								
Project management information system	**4.3**		6.3, 6.5, 6.6	7.2, 7.4		9.2, 9.5, 9.6	10.2, 10.3	11.6		
Project reporting					**8.2**					
Prompt lists								**11.2**		
Prototypes		**5.2**								
Quality improvement methods					**8.2**					
Recognition and rewards						**9.4**				
Representations of uncertainty								**11.4**		
Resource optimization			**6.5**, 6.6							
Risk categorization								**11.3**		
Rolling wave planning			**6.2**							

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Table X6-1. Categorization and Index of Tools and Techniques *(cont.)*

Tool and Technique	Integration	Scope	Schedule	Cost	Quality	Resources	Communication	Risk	Procurement	Stakeholder
Knowledge Area[A]										
Ungrouped Tools and Techniques *(cont.)*										
Schedule compression			**6.5**, 6.6							
Schedule network analysis			**6.5**							
Source selection analysis									**12.1**	
Strategies for opportunities								**11.5**		
Strategies for overall project risk								**11.5**		
Strategies for threats								**11.5**		
Test and inspection planning					**8.1**					
Testing/product evaluations					**8.3**					
Three-point estimating			**6.4**	7.2						
To-complete performance index				**7.4**						
Training						**9.4**				
Virtual teams						**9.3**, 9.4				

[A] The boldface entries indicate the section numbers of the processes where a tool or technique is described.