Integration Management

FOUR

How would you respond if you were asked, "What is a project manager's primary role?" The correct answer is: to perform integration management[1]—to pull all the pieces of a project together into a cohesive whole. This is so much a part of a project manager's job that it is arguably the reason for the project manager's existence in an organization and on a project.

Many people who have trouble with this knowledge area on the exam either do not currently perform integration management on their projects or do not think about integration management from a large-project perspective.

While the work of the project is being done, the team members are concentrating on completing the work packages, and the project sponsor is protecting the project from changes and loss of resources. The project manager is responsible for integration—putting all the pieces of the project together into one cohesive whole that gets the project done faster, cheaper, and with fewer resources, while meeting the project objectives.

QUICKTEST

- Integration management process
- Integrated change control
- Process for making changes
- Project management plan
  - Knowledge area management plans
  - Baselines
  - Requirements management plan
  - Change management plan
  - Configuration management plan
  - Project life cycle approach
- Project charter
- Business case
- Project selection
  - Benefit measurement methods
  - Constrained optimization methods
- Knowledge management
- Information management
- Types of knowledge
  - Tacit
  - Explicit
- Project documents
- Benefits management plan
- Assumption log
- Change requests
- Corrective action
- Preventive action
- Defect repair
- Constraints and assumptions
- Configuration management system
- Change control system
- Change control board
- Cost-benefit analysis
- Kickoff meeting
- Work authorization system
- Net present value
- Internal rate of return
- Payback period
- Present value
- Economic value added
- Opportunity cost
- Sunk costs
- Law of diminishing returns
- Working capital
- Depreciation

TRICKS OF THE TRADE Think about integration as balancing all the processes in all the knowledge areas (scope, schedule, cost, quality, resources, communications, risk, procurement, and stakeholder management) with each other. Project management processes do not happen independently. To complete a cost estimate, for example, factors such as the number of resources on the project, the scope being estimated, and the risk reserves should be taken into account. As another example, adding a new resource to the project may require cost or schedule changes. In dealing with situations that develop during a project, the project manager is integrating the processes of project management.

Integration Management FOUR

INITIATING

- **Select project manager**
- **Determine company culture and existing systems**
- **Collect processes, procedures, and historical information**
- **Divide large projects into phases or smaller projects**
- **Understand business case and benefits management plan**
- **Uncover initial requirements, assumptions, risks, constraints, and existing agreements**
- **Assess project and product feasibility within the given constraints**
- **Create measurable objectives and success criteria**
- **Develop project charter**
- Identify stakeholders and determine their expectations, interest, influence, and impact
- Request changes
- **Develop assumption log**
- Develop stakeholder register

PLANNING

(This is the only process group with a set order.)

- **Determine development approach, life cycle, and how you will plan for each knowledge area**
- Define and prioritize requirements
- Create project scope statement
- Assess what to purchase and create procurement documents
- **Determine planning team**
- Create WBS and WBS dictionary
- Create activity list
- Create network diagram
- Estimate resource requirements
- Estimate activity durations and costs
- Determine critical path
- Develop schedule
- Develop budget
- Determine quality standards, processes, and metrics
- **Determine team charter and all roles and responsibilities**
- Plan communications and stakeholder engagement
- Perform risk identification, qualitative and quantitative risk analysis, and risk response planning
- **Go back—iterations**
- Finalize procurement strategy and documents
- **Create change and configuration management plans**
- **Finalize all management plans**
- **Develop realistic and sufficient project management plan and baselines**
- **Gain formal approval of the plan**
- **Hold kickoff meeting**
- Request changes

EXECUTING

- **Execute work according to the project management plan**
- **Produce product deliverables (product scope)**
- **Gather work performance data**
- **Request changes**
- **Implement only approved changes**
- **Continuously improve; perform progressive elaboration**
- **Follow processes**
- Determine whether quality plan and processes are correct and effective
- Perform quality audits and issue quality report
- Acquire final team and physical resources
- Manage people
- Evaluate team and individual performance; provide training
- Hold team-building activities
- Give recognition and rewards
- **Use issue logs**
- **Facilitate conflict resolution**
- Release resources as work is completed
- Send and receive information, and solicit feedback
- Report on project performance
- Facilitate stakeholder engagement and manage expectations
- **Hold meetings**
- Evaluate sellers; negotiate and contract with sellers
- **Use and share project knowledge**
- Execute contingency plans
- **Update project management plan and project documents**

MONITORING & CONTROLLING

- **Take action to monitor and control the project**
- **Measure performance against performance measurement baseline**
- **Measure performance against other metrics in the project management plan**
- **Analyze and evaluate data and performance**
- **Determine if variances warrant a corrective action or other change request(s)**
- **Influence factors that cause change**
- **Request changes**
- **Perform integrated change control**
- **Approve or reject changes**
- **Update project management plan and project documents**
- **Inform stakeholders of all change request results**
- Monitor stakeholder engagement
- **Confirm configuration compliance**
- Create forecasts
- Gain customer's acceptance of interim deliverables
- Perform quality control
- Perform risk reviews, reassessments, and audits
- Manage reserves
- Manage, evaluate, and close procurements
- Evaluate use of physical resources

CLOSING

- **Confirm work is done to requirements**
- **Complete final procureme closure**
- **Gain final acceptance of product**
- **Complete financial closure**
- **Hand off completed produ**
- **Solicit customer's feedbac about the project**
- **Complete final performan reporting**
- **Index and archive records**
- **Gather final lessons learne and update knowledge bas**

Rita's Process Chart™
Integration Management
Where are we in the project management process?

The other knowledge area chapters in this book explain the detailed work of a project manager. This chapter, however, is about the high-level work a project manager needs to do. Read this chapter carefully. Integration management is a difficult area on the exam.

The following should help you understand how each part of integration management fits into the overall project management process:

The Integration Management Process	Done During
Develop Project Charter	Initiating process group
Develop Project Management Plan	Planning process group
Direct and Manage Project Work	Executing process group
Manage Project Knowledge	Executing process group
Monitor and Control Project Work	Monitoring and controlling process group
Perform Integrated Change Control	Monitoring and controlling process group
Close Project or Phase	Closing process group

Integration management cannot be understood without a solid understanding of the process of project management. Therefore, if you have limited project management training or experience, you might want to do a high-level review of this chapter now, read the rest of this book, and then come back and read this chapter again. It will make more sense the second time. Remember that integration management is the primary role of a project manager. You must understand integration from a real-world, large-project perspective.

Figure 4.1 shows the relationship between knowledge areas and process groups. All knowledge areas include processes that occur in planning and monitoring and controlling. Integration Management is the only knowledge area that has processes occurring in all process groups, throughout the project management process. The project manager is always integrating.

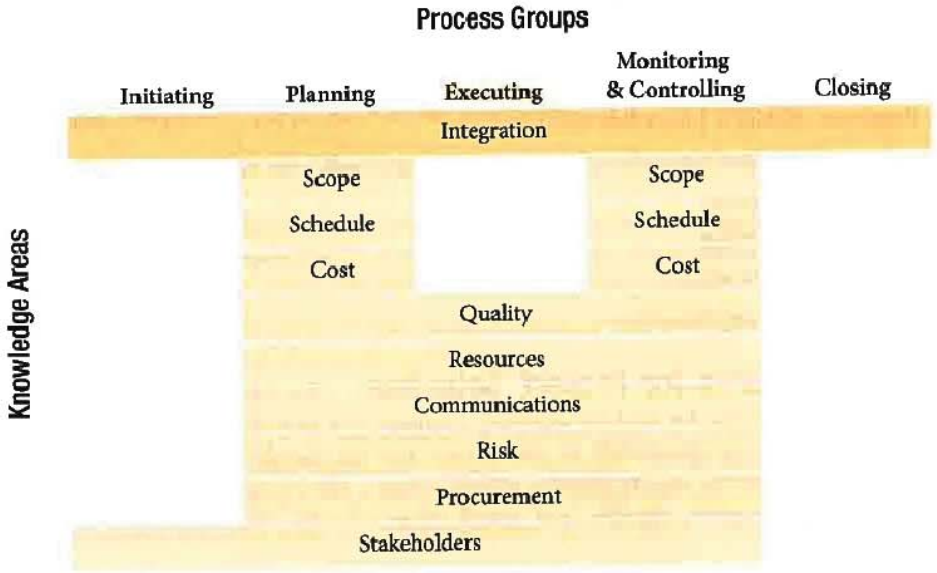

FIGURE 4.1 *The relationship between the knowledge areas and process groups*

Project Selection

Before we discuss the processes of Integration Management and all the work involved in successfully managing a project, let's take a moment to discuss what happens before a project is chartered. It is important for a project manager to know a project's history in order to manage it effectively and achieve the results for which it was intended.

The departments and individuals within your company present management with requests for many different initiatives (potential projects), all of which would require an investment of corporate resources. When answering questions on the exam, assume that the organization has a formal process to review and analyze these potential projects and select the project that best aligns with the strategic goals of the organization. There might even be a project selection committee in place to evaluate project proposals.

A project manager is not typically involved in project selection. So, you might ask, "Why is this an important topic to understand?" Good question! The reasons a project is selected and the value it is expected to bring to an organization indicate its significance to the company. The project manager needs to know if the project was selected because it will establish a new area of business, if it is being implemented to meet regulatory or compliance requirements, or if it was chosen because it was the least expensive or most feasible solution to a problem. The reasons a project was selected can impact which constraints are most flexible, and knowing this information will influence how the project manager plans and manages the project. A project manager must keep the reasons the project was selected in mind throughout the project to ensure the objectives are achieved.

For the exam, you should be familiar with the project selection methods described next, but understanding these methods is not as important as knowing that such activities occur prior to initiating a project. These activities fall outside the project boundaries (the period from project authorization through closure).

Benefit measurement and constrained optimization are two categories of project selection methods. You may see these terms used in scenarios or as distractors in answer choices. Present value is the only calculation you may be asked to perform. For the exam, you should simply be aware that the following terms relate to project selection:

- Benefit measurement methods[2] (comparative approach); examples of this method include:
  - A murder board[3] (a panel of people who try to shoot down a new project idea)
  - Peer review
  - Scoring models
  - Economic measures (described next)
- Constrained optimization methods[4] (mathematical approach); examples of this method include:
  - Linear programming
  - Integer programming
  - Dynamic programming
  - Multiobjective programming

Economic Measures for Project Selection

The following sections discuss several economic measures[5] that can be used for selecting a project. It is important to note that some of these measures are also used in processes such as quality, cost, and risk management, and in integrated change control. The measures can be used to develop project metrics, determine when changes to the plan are needed, and evaluate progress, changes, and overall project success. Such economic measures take a comparative approach.

Keep in mind that these measures aren't generally used on their own; that is, an organization would likely consider more than one of these measures (along with other factors) when selecting a project.

Return on Investment (ROI) Return on investment determines the potential profitability of an investment by calculating the benefits received in relation to the cost.

Present Value (PV) Note that you may encounter a couple of questions on the exam that require you to calculate present value. Present value means the value today of future cash flows, and it can be calculated using the following formula:

$$PV = \frac{FV}{(1+r)^n}$$

FV = future value
r = interest rate
n = number of time periods

The acronym PV is also used for planned value (described in the Cost Management chapter). You can avoid confusing these terms by considering the context in which they are used. If the question involves project work that has started, and you are evaluating schedule or cost performance, the acronym PV is represents planned value within earned value management. If the question is discussing how the project was evaluated for selection or funding, PV represents present value.

Using a simple example, see if you can answer the following question:

Question Is the present value of $300,000 to be received three years from now, with an expected interest rate of 10 percent, more or less than $300,000?

Answer Less. You can put an amount of money less than $300,000 in the bank and in three years have $300,000.

To perform the calculation: $\$300{,}000/(1+0.1)^3 = \$300{,}000/1.331 = \$225{,}394$.

Net Present Value (NPV) You will not have to calculate NPV; just know that it is the present value of the total benefits (income or revenue) minus the costs over many time periods. Calculating the NPV of each proposed project provides a means for the organization to compare many projects and select the best project to initiate. Generally, if the NPV is positive, the investment is a good choice—unless an even better investment opportunity exists. The project with the greatest NPV is typically selected.

To learn more about calculating NPV, visit rmcls.com.

Do you already have a good understanding of this topic? Test yourself with the following question.

Question An organization has two projects from which to choose. Project A will take three years to complete and has an NPV of $45,000. Project B will take six years to complete and has an NPV of $85,000. Which one is a better investment?

Answer Project B. The number of years is not relevant, as that would have been taken into account in the calculation of the NPV.

Internal Rate of Return (IRR) To understand this concept, think of a bank account. You put money in a bank account and expect to get a return—for example, 1 percent. You can think of a project in the same way. If a company has more than one project in which it could invest, the company may look at the returns of the different projects and then select the project with the highest return.

IRR does get confusing when you give it a formal definition: the rate ("interest rate") at which the project inflows ("revenues") and project outflows ("costs") are equal. Calculating IRR is complex and requires the aid of a computer. You will not have to perform any IRR calculations on the exam. Simply know that the higher the IRR number, the better.

Question An organization has two projects from which to choose: Project A with an IRR of 21 percent and Project B with an IRR of 15 percent. Which one is a better option?

Answer Project A

Payback Period This term refers to the length of time it takes for the organization to recover its investment in a project before it starts accumulating profit. For example:

Question There are two projects from which to choose: Project A with a payback period of six months and Project B with a payback period of 18 months. Which one should the organization select?

Answer Project A

Based on the information given in this example, the project with the shorter payback period is the best choice, but keep in mind that payback period is likely to be one of only several financial factors, along with other considerations, used in selecting a project. In some cases, the best choice might be a project that has a longer payback period but various other advantages.

Cost-Benefit Analysis Cost-benefit analysis compares the expected costs of a project to the potential benefits it could bring the organization. (For project selection purposes, benefits are the same as revenue. Remember that revenue is not the same as profit.) This analysis results in the calculation of a benefit-cost ratio, which can be expressed as a decimal or a ratio. A benefit-cost ratio of greater than 1 means the benefits are greater than the costs. A benefit-cost ratio of less than 1 means the costs are greater than the benefits. A benefit-cost ratio of 1 means the costs and benefits are equal.

Question What does a benefit-cost ratio of 1.7 mean?

A. The costs are greater than the benefits.
B. Revenue is 1.7 times the costs.
C. Profit is 1.7 times the costs.
D. Costs are 1.7 times the profit.

Answer B. The benefits, or revenue, the project brings to the organization are 1.7 times the cost of the initiative. Remember, the benefit-cost ratio calculation is looking at revenue, not the smaller figure of profits.

The organization may use the benefit-cost ratio to help choose from many potential projects. A project manager may also perform cost-benefit analysis to determine the best solution approach once a project is selected. The project manager may perform the analysis at a high level during project initiating and at a more detailed level during project planning. This information helps determine things such as what level of quality efforts are appropriate for the project, what equipment or technology should be purchased, and whether it would be best to outsource certain pieces of work.

Exercise Remember, you do not have to be an accountant to pass the exam. You do not have to use accounting formulas (aside, possibly, from a couple of present value questions). But you do need to have a general understanding of what the terms mean. So, test yourself! For each row in the following chart, enter the letter of the project you would select based on the information provided.

	Project A	Project B	Which Project Would You Pick?
Net present value	$95,000	$75,000	
IRR	13 percent	17 percent	
Payback period	16 months	21 months	
Benefit-cost ratio	2.79	1.3	

Answer

	Project A	Project B	Which Project Would You Pick?
Net present value	$95,000	$75,000	A
IRR	13 percent	17 percent	B
Payback period	16 months	21 months	A
Benefit-cost ratio	2.79	1.3	A

The following are some additional accounting terms related to project selection that you should be familiar with for the exam.

Economic Value Added (EVA)[6] In terms of project selection, this concept is concerned with whether the project returns to the company more value than the initiative costs. (Note that this is a different concept than earned value analysis, which can also have the acronym of EVA. Earned value, discussed in the Cost Management chapter, is frequently mentioned on the exam, whereas economic value added should rarely appear in questions or answer choices.)

Opportunity Cost This term refers to the opportunity given up by selecting one project over another. This does not require any calculation. See the following example:

Question An organization has two projects to choose from: Project A with an NPV of $45,000 and Project B with an NPV of $85,000. What is the opportunity cost of selecting Project B?

Answer $45,000

The opportunity cost is the value of the project not selected.

Sunk Costs Sunk costs are expended costs. People unfamiliar with accounting standards might have trouble with the following question:

Question An organization has a project with an initial budget of $1,000,000. The project is half complete, and it has spent $2,000,000. Should the organization consider the fact that it is already $1,000,000 over budget when determining whether to continue with the project?

Answer No. The money spent is gone.

Accounting standards say that sunk costs should not be considered when deciding whether to continue with a troubled project.

Law of Diminishing Returns[7] This law states that after a certain point, adding more input (for example, programmers) will not produce a proportional increase in productivity (such as modules of code per hour). A single programmer may produce at a rate of 1 module per hour. With a second programmer, the two may produce at a rate of 1.75 modules per hour (0.75 increase). With a third programmer, the group may produce at a rate of 2.25 modules per hour (0.5 increase). This disparity may be due to many factors. For example, additional coordination is required as more programmers are added to a project.

Working Capital This term refers to an organization's current assets minus its current liabilities. In other words, it is the amount of money the company has available to invest, including investing in projects.

Depreciation Large assets, such as equipment, lose value over time. Accounting standards call this depreciation. Several methods are used to account for depreciation. The exam may ask you what they are. You will not have to perform any calculations. (See, we said we could make this easy for you!) Rather, you should simply understand the following concepts about the two forms of depreciation:

- **Straight-line depreciation** With straight-line depreciation, the same amount of depreciation is taken each year.

  Example: A $1,000 item with a 10-year useful life and no salvage value (the value of an item at the end of its life) would be depreciated at $100 per year.

- **Accelerated depreciation** For many years, the exam has not asked detailed questions on this topic. Just know the following for the exam:
  - There are two forms of accelerated depreciation:
    - Double declining balance
    - Sum of the years digits
  - Accelerated depreciation depreciates faster than straight-line depreciation.

  Example: A $1,000 item with a 10-year useful life and no salvage value (the value of an item at the end of its life) would be depreciated at $180 the first year, $150 the second, $130 the next, and so on.

TRICKS OF THE TRADE The exam may present information about project selection in the following ways.

First, the exam may ask questions relating to business cases and project selection methods. You need to understand that there is a selection process for a project, know what that process is, and be aware that the project must support the company's strategic goals.

Second, the exam may use project selection concepts, such as internal rate of return, as distractors. Such information may be provided in the question even when you do not need the data to answer the question. Read the questions carefully to pick out which data is relevant.

The project selection process results in the development of a business case. The business case describes the business need, the proposed solution, and the expected value of the change. It includes both tangible and intangible costs and benefits of the proposed solution. The business case will influence how you approach every project management process covered in this book, beginning with the creation of a project charter.[8] Developing the charter is the first of many processes that make up a successful project.

Develop Project Charter PAGE 75

Process Develop Project Charter
Process Group Initiating
Knowledge Area Integration Management

The first part of integration management is developing a project charter. The exam could include up to eight questions that reference a charter. You should understand what a project charter is, why it is important, and how it is used throughout the life of the project.

Exercise Test yourself! Answer the following question.

What Is Included in a Project Charter?

Answer Unfortunately, many companies expect project charters to include information such as a detailed schedule and a full risk analysis. Such information is not available at this point in the project management process, however. A project charter is not a project management plan! Read the rest of this section to learn what is included in a project charter and to see some examples.

Creating the project charter involves planning the project at a high level to assess whether it is feasible within the given constraints, but detailed planning does not happen until after the charter is signed. In project initiating, you may meet with key stakeholders and define the high-level objectives, constraints, requirements, scope, risks, and assumptions in an effort to assess the feasibility of the project. Much of this information will also be used for benefits analysis, in which you and key stakeholders confirm the project aligns with the organization's strategic goals and is likely to deliver the anticipated value. Detailed planning takes time and costs money, and this time and money should not be spent until the project is officially authorized by approval of the project charter.

Business documents—including the business case and the benefits management plan—are key inputs to the development of the project charter. They provide critical information to the project manager and team, such as:

- Why the project was undertaken
- A summary of the relationship between the project objectives and the strategic goals of the organization

Note that these documents do not need to be updated throughout the life of the project, but can be periodically reviewed by the project manager.

Business Case

A business case is the justification for a project or initiative. Most organizations require a strong business case to fund a project because there are so many competing needs for available resources. Defining a business case requires sophisticated analysis and evaluation, as we discussed in the project selection topic. It will help the organization decide whether or not to move forward with creating the solution.

The exam assumes that every project has a defined business case and that it is unacceptable to select a project based on anything but a sound business case. The business case captures the business need; it explains why the project was selected, how it fits into the organization's strategic goals, and how it will bring business value to the organization. (How each organization defines business value will vary, but such a definition could include quantifiable benefits, such as financial gain, as well as less obvious benefits such as increased name recognition.)

Let's look at an example of how a business case can affect the way a project is managed.

> *A company has selected a particular project because the project will contribute to its strategic plan of entering a new area of business. The project manager has a project management plan that includes an approved schedule and budget. The project manager finds that the approved budget is a constraint that could inhibit the company's successful entrance into the new market. She asks for a change in budget, rather than cutting costs on the project to stay within the project management plan. If the project manager had not asked for the budget increase, the company might have missed its objective of successfully launching itself into the new area of business.*

Benefits Management Plan

The benefits management plan is a document that captures the organization's desired benefits from a project, whether economic or intangible, and explains how those benefits will be maximized and sustained. It also defines metrics and processes for measuring a project's benefits. As an input to the charter, the benefits management plan is important, as it provides information to be used to determine whether a project's deliverables will help the organization in meeting its strategic goals and objectives.

Constraints and Assumptions

Identifying and documenting high-level project constraints and assumptions uncovered during project initiating is important. Assumptions and constraints are documented as part of the business case. These are often highlighted in the project charter (as depicted in the charter examples within this chapter) to make sure they are considered and accepted as part of the sponsor's formal approval. Assumptions and constraints are also documented in the assumption log.[9]

Constraints are factors—such as limits on resources, budget, schedule, and scope (for example, management saying the project must be completed with only five resources)—that limit the team's options. Assumptions are things that are assumed to be true but that may not be true (for example, "It is assumed that we will not need engineering department approval before we start the activity."). Constraints and assumptions are inputs to many project management processes. They are identified at a high level in project initiating and are then refined and documented in detail as part of the Define Scope process in project planning.

Once they are identified, constraints and assumptions need to be managed. The sponsor, the team, and other stakeholders may help identify constraints and assumptions and review them for validity throughout the life of the project. If the constraints change or the assumptions are proven wrong, the project management plan[10] may need to change. Assumptions analysis is part of the risk management process.

Agreements/Contracts All projects should have charters, whether the project is an internal initiative or is being done for an external customer. The development of a charter often starts with some form of agreement or understanding. In the case of an internal project, the initial agreement may be as informal as an email or a conversation about what the project will entail. It could also take the form of a memorandum of understanding or a letter of agreement. When the work is being done for an outside organization, a formal contract is typically involved. (See the Procurement Management chapter for more information about agreements and contracts.)

Although we often think of the buyer creating a project charter, the organization providing services to the buyer should also create a charter. This means that on a project where there is a buyer and a seller, both organizations would create project charters that have different points of view. The buyer's reason for the project, as stated in their project charter, might be to achieve a particular product scope while meeting project constraints. The seller's reason for working on the project, as stated in their project charter, might be to increase revenue, enhance their reputation, or gain additional work from the buyer.

In addition to these items, any relevant organizational process assets (such as processes, any governance framework, methods for monitoring and reporting, templates, historical information, and lessons learned) or enterprise environmental factors (such as applicable standards, legal requirements, existing infrastructure, and organizational culture) that are present in the organization should be taken into consideration when creating the charter. The project manager works with the sponsor and others who can offer expertise on different aspects of the project to create the charter.

The following is a brief example of a project charter for a small project. It does not represent the scale of projects you should be thinking about for the exam, but it should help you to understand the elements of a project charter. You will see a sample charter for a large project later in this chapter. These charter examples focus on what is done in the real world and what you need to know for the exam. They go beyond what is listed as part of the project charter in the *PMBOK® Guide*.

NOTE: The following project charter example refers to attached documents. These documents are not shown as part of this example.

Project Charter

Project Title and Description *(What is the project?)* **Customer Satisfaction Fix-It Project**
Over the last few months, the quality assurance department has discovered that it takes many customers four times longer to place orders for XYZ equipment using our online ordering system than it takes to place similar orders through our competitors' systems. The purpose of this project is to investigate the reasons for the problem and propose a solution. Development and implementation of the solution will be authorized as a subsequent project (Customer Satisfaction Fix-It Project II).

The quality control department has detailed records of their findings, which will contribute to the analysis work on this project.

Project Manager Assigned and Authority Level *(Who is given authority to lead the project, and can they determine, manage, and approve changes to budget, schedule, and team assignments?)*
Victor Rojas will be the project manager for this project and will have the authority to select team members and determine the final project budget and schedule.

Business Case *(Why is the project being done? On what financial or other basis can we justify doing this project? Describe the project purpose and justification.)*
Because it takes many customers four times longer to place orders for XYZ equipment using our online ordering system than it takes to place similar orders through our competitors' systems, our company is losing potential revenue. The company has also experienced a measured decrease in customer satisfaction as a result of the problems with the online ordering system. This project is the first of two projects designed to prevent a further erosion of customer satisfaction. We expect that improved customer satisfaction will increase revenue to the company in the first year by at least $200,000 due to a decrease in service calls and incomplete orders. As a side benefit, we hope the project will generate ideas on improving customer satisfaction while determining how to address the problem with our online ordering system.

Resources Preassigned *(How many or which resources will be provided?)*
Two IT analysts have been assigned and dedicated to the project because of their expertise in computer systems of this type. Other resources will be determined by the project manager during planning.

Key Stakeholder List *(Who will affect or be affected by the project [influence the project], as known to date?)*
Key stakeholders include Vihaan Gupta representing Quality Control, Benjamin Lang in Customer Service, and Shirley Price in Marketing. These stakeholders will be available as needed.

Stakeholder Requirements as Known *(Requirements related to both project and product scope.)*
Attached to this document are the detailed specifications for the existing system along with the requirements the existing system was designed to meet. It is expected that this project will not change the existing system, but rather make a recommendation for improving it.

The project includes utilizing the data available from Quality Control.

High Level Product Description/Key Deliverables *(What are the key product deliverables that are wanted, and what will be the end result of the project?)*
Interim deliverables will include:

- Detailed customer ordering process flow
- Analysis of the time it takes to complete each step of the ordering process
- Recommended change
- Estimated time and cost of the proposed change
- WBS
- List of risks

The final deliverable will be a report that outlines what can be changed, how much it will cost, the expected decrease in the time it will take to place an order, and what work will need to be done to implement the solution.

High-Level Assumptions *(What is believed to be true or reliable in the situation? What do we believe to be the case but do not have proof or data for? See details in the assumption log.)*

- The existing requirements for the current system (aside from those relating to the speed of order entry) are sufficient and correct for an online ordering system that is four times faster than the current system.
- The current network will be able to support the program changes.
- No new hardware will be required.
- The current subject matter experts and developers have the expertise to evaluate the problem and recommend a solution that will achieve the objectives.
- Internal resources will have the time to work on the project in addition to their current responsibilities.

High-Level Constraints *(What factors may limit our ability to deliver? What boundaries or parameters will the project have to function within?)*

- WBS must be complete in two weeks.
- Risk register is due in three weeks.
- The scope is limited to identifying a solution that will reduce the time it takes to complete an online order.

Measurable Project Objectives *(How does the project tie into the organization's strategic goals? What project objectives support those goals? The objectives must be measurable and will depend on the defined priority of the project constraints.)*

The objective of this project is to develop a solution that will improve customer satisfaction rates for online orders to 95 percent by reducing the time customers spend placing orders to 25 percent of the current time. Scope and customer satisfaction are the top priorities on this project, closely followed by schedule and then cost.

- Summary milestone schedule: Due no later than September 1, 20XX
- Preapproved financial resources: $50,000

Project Approval Requirements *(What items need to be approved for the project, and who will have sign-off authority? What designates success?)*

Approvals for this project include:

- The sponsors will approve the WBS before planning efforts continue.
- The sponsors will approve the list of risks before planning efforts continue.
- The sponsors will give final project approval.

Overall Project Risks *(Overall potential threats and opportunities for the project)*

- Because this project analyzes customer satisfaction, the project may help generate ideas to improve customer satisfaction, resulting in higher levels of customer retention.
- Because we are using internal resources to analyze and propose a solution, it is possible that they may not be aware of all possible solutions, and the proposed solution may be inadequate to address the problem successfully.
- Because this problem is greatly troubling to our customers, project delay could result in lost customers, further jeopardizing the likelihood of meeting this year's sales goals.
- Because assessment of this system is difficult, implementation of the proposed solution to change the system could impact other business functions.

Project Exit Criteria *(What needs must be met so that the project manager will be able to close or terminate the project or phase?)*

A final report will include a description of the solution, how much the solution will cost, and the expected decrease in the time it takes to place an order expected to result from implementing the solution. The findings contained in the report must be agreed to by the representatives of Quality Control, Customer Service, and Marketing, in addition to the project team.

Project Sponsors Authorizing This Project

Alexandra Guyot, Executive Vice President

Christopher Davis, Vice President

Exercise Test yourself! Answer the question below.

What Does the Project Charter Do for the Project Manager?

Answer Do not underestimate the value of the project charter! The project charter is such an important document that a project cannot be started without one. The project charter is your target for the project and serves as a definition of how success will be measured. Without a project charter, the project and project manager cannot be successful. Know the following for the exam.

The project manager may create the project charter, but it is issued (signed off on) by the sponsor as part of project initiating. The project charter should be broad enough that it does not need to change as the project progresses. (Any change to the project charter should call into question whether the project should continue.) It provides, at a minimum, the following benefits:

- The project charter should clarify and encourage understanding between the sponsor and project manager of the major deliverables and milestones. It should also define the key roles and responsibilities on the project. This information should be shared with all stakeholders.
- The project charter formally recognizes (authorizes) the existence of the project, or establishes the project. This means that a project does not exist without a project charter.
- The project charter gives the project manager authority to spend money.
- The project charter gives the project manager authority to commit corporate resources to the project. On the exam, this is a commonly described benefit or use of the project charter. In most project situations, the project team does not report to the project manager in the corporate structure, which can lead to cooperation and performance issues. The project charter helps to prevent these issues.
- The project charter provides the objectives, high-level requirements, and success criteria for the project.
- The process of creating the charter uncovers assumptions about the project, which the project manager can later address in the detailed requirements-gathering, scope-definition, and risk management efforts.
- The project charter links the project to the ongoing work of the organization.

Can you see that the creation of a project charter influences all the project management knowledge areas (scope, schedule, cost, quality, resources, communications, risk, procurement, and stakeholder management)?

Large Projects As we've discussed, you need to maintain a large-project perspective when answering questions on the exam. To help you understand this critical concept, review the following project charter for a large project, and then complete the exercise.

NOTE: The following charter example refers to attached documents. These documents are not shown as part of this example.

Project Charter

Project Title and Description *(What is the project?)* **Upgrade the Payroll Systems**
We're a large, multinational organization with more than 20,000 employees, so human resource management is critical to our success. To more efficiently compensate our employees, we want to replace or upgrade the employee payroll systems to better reflect the changing nature of our workforce. Employees now work in various locations (offices and homes) around the world, work simultaneously for multiple business units, and have more varied work schedules than ever before. Current geographically focused payroll systems are not integrated, are inflexible, and require significant clerical time to maintain them manually. With the existing systems, consolidated corporate reporting and analysis is expensive and inefficient.

Project Manager Assigned and Authority Level *(Who is given authority to lead the project, and can they determine, manage, and approve changes to budget, schedule, staffing, etc.?)*
Isaiah Higgins will be the project manager for this project. He may request any team members he sees fit and will work with resource managers to secure the needed resources. He has signature authority up to $10,000. Ashley Chan is assigned as assistant project manager.

Business Case *(Why is the project being done? On what financial or other basis can we justify doing this project?)*
Administering payroll currently costs $2.4 million annually along with the unmeasured costs of procedural inefficiencies. The industry average payroll processing costs for a global company our size is $100 per employee per year, or $2 million overall per year. Anticipated savings of $400,000 per year (assuming a three-year payback period) justifies the approval of this project. See the detailed business case attached to this charter.

Resources Preassigned *(How many or which resources will be provided?)*
The corporate payroll processing group will be closely involved in this project, along with the payroll specialists who work in our local offices. A senior team of business analysts, enterprise architects, and software designers has been identified for the initial research and analysis phase. Procurement and legal representatives will be involved in vendor contract processes, including development of RFPs and contracts when deemed necessary. English will be the primary project language; local language experts will be involved to ensure country-specific regulations and laws are understood. Other required resources must be identified and negotiated for by the project manager.

Key Stakeholder List *(Who will affect or be affected by the project [influence the project], as known to date?)*
Attached is a list of stakeholder groups that will be impacted by this project. It includes all employees, divided into payees, corporate management, legal, procurement, and payroll administrators. It also includes outside representatives of government taxing authorities, benefit providers, and suppliers of payroll-processing solutions.

Stakeholder Requirements as Known *(Requirements related to both project and product scope.)*

Req. Number	High-Level Requirements
R1	Pay employees based on the agreed-upon rate/salary on the agreed-upon schedule.
R2	Adhere to country-specific government requirements related to tax withholding and payment schedules.
R3	Adhere to state, province, county, or other local government requirements related to tax withholding and payment schedules.
R4	Allow the company to provide benefits for employees as approved by the Board of Directors.
R5	Allow the company to collect benefit premium payments from employee pay as agreed to by each employee.
R6	Keep all employee data confidential, secure, and archived as required by law in each jurisdiction.

High Level Product Description/Key Deliverables *(What are the key product deliverables that are wanted and what will be the end result of the project?)*

The result of this project should be one or more systems that support payroll processing for all employees, at or below the industry average cost. Specific desired features include:

- The systems should allow direct deposit of employee pay into any financial institution in the world, along with notification of deposit via email or text message to any device.
- Workers should be able to change their address, number of dependents, tax withholding parameters, and benefit characteristics via a website at any time from any location.
- The systems must support consolidated management and reporting of corporate payroll processing, plus government mandated reporting and payments.

High-Level Assumptions *(What is believed to be true or reliable in the situation? What do we believe to be the case but do not have proof or data for? See details in the assumption log.)*

- There are payroll applications available that support the countries in which our employees are located.
- The average cost of $100 per employee per year is accurate for our industry.
- Each employee reports their primary residence in just one country for tax reporting purposes.
- We have internal resources available to evaluate and do the work assigned.

High-Level Constraints *(What factors may limit our ability to deliver? What boundaries or parameters will the project have to function within?)*

- The system must be able to comply with all international payroll rules and perform direct deposits globally.
- The solution and the supporting systems must be able to maintain organizational information security standards that meet or exceed individual country standards.
- Year-end tax reporting must be completed by the new system in the year of the implementation (payroll data must be converted).
- Summary milestone schedule: Due no later than October 6, 20XX
- Preapproved financial resources: $1,200,000

Measurable Project Objectives *(How does the project tie into the organization's strategic goals? What project objectives support those goals? The objectives need to be measurable and will depend on the defined priority of the project constraints.)*

The main objective of this project is to decrease costs by at least $400,000 annually. A second objective, which supports the first, is to increase productivity for new employees and payroll processing employees.

- Decrease payroll processing costs by 15 percent in two years by decreasing manual clerical processes.
- Decrease the duration of the new worker onboarding process from an average of 5 business days to 2 business days within 18 months.

Project Approval Requirements *(What items need to be approved for the project, and who will have sign-off authority? What designates success?)*

Approvals for this project include:

- Decision to purchase application software to support the payroll systems (VP of Operations)
- Choice of vendor application package (Director of HR)
- High-level design of the new systems (Director of HR)
- Global transition plan for new systems rollout (VP of Operations)

Overall Project Risks *(Overall potential threats and opportunities for the project)*

- Because of the complexity of employee pay calculations and the large number of employees, we may have errors in employee payroll during implementation of the new systems. (High impact)
- Because of the number of localities supported and differing regulations, we may have errors in government tax payments and regulatory compliance during implementation of the new systems. (High impact)
- Because of the volatility in the software application marketplace, we may select an unreliable vendor for delivery of the payroll-processing applications. (High impact)

Project Exit Criteria *(What needs must be met so that the project manager will be able to close or terminate the project or phase?)*

- A new payroll processing system that meets the project objectives and requirements and incorporates all key deliverables described herein will be delivered within defined cost and budget constraints.
- *Or,* if it is determined that the project objectives of cost saving cannot be met, the project manager will recommend termination of the project.
- *Or,* if it is determined that another solution will better meet the organizational needs, the sponsor should be notified for closing approval, and a business case will be developed for the new solution.

Project Sponsors Authorizing This Project

Muhammad Chauhan, Executive Vice President	Jessica Bouchard, Director of Human Resources

Exercise Make a list of what is different about managing the large project described in this charter versus managing the small project described in the earlier charter example.

What Would Be Different about Managing the Large Project versus the Small Project?

What Would Be Different about Managing the Large Project versus the Small Project?

Answer The following are some possible answers to this question, although there are certainly other correct answers. The large project:

- Has a larger stakeholder group, and therefore requires more effort to manage relationships and stakeholder expectations and involvement
- Has a more diverse team composition
- Requires a broader and more complex communications management plan to deal with the number of stakeholders and language issues
- Contends with multiple nations, cultures, time zones, languages, and laws
- Will be affected by currency exchange rates
- Requires a more formal change management process to handle the requested changes
- Has thousands of activities to track
- Has larger activities, making it more difficult to develop good duration and cost estimates
- Has a more complex network diagram with many discretionary and external dependencies
- Requires a more robust tracking system for all the project metrics
- Involves multiple contracts, requiring more management of the sellers
- Has much more risk, requiring a more detailed risk management process

Regardless of whether you have a large or small project, developing the project charter requires the following actions:

- Identifying stakeholders
- Meeting with key stakeholders to confirm high-level requirements, project scope, risks, assumptions, and issues
- Defining product scope
- Defining project objectives, constraints, and success criteria
- Documenting risks

Some of the tools and techniques that can be used during this process include data gathering (interviews, brainstorming, focus groups, etc.), conflict management, and meeting management. During meetings with the sponsor and key stakeholders, the project manager can obtain needed information and work with experts to understand and address organizational strategy and develop measurable project objectives.

Assumption Log As you might expect, the project charter is the primary output of this process. The other output of this process is the assumption log, which contains a list of all assumptions and constraints that relate to the project. Note that some project managers also include initial assumptions and constraints in the project charter. The assumption log is typically added to during planning and updated throughout the project as assumptions and constraints change and new assumptions are uncovered.

Develop Project Management Plan PAGE 82

Process Develop Project Management Plan
Process Group Planning
Knowledge Area Integration Management

Project managers must plan before they act. Let's first look at what management plans are, and then move on to discuss the project management plan.

Management Plans For the exam, it is very important to understand the concept of management plans. Management plans document the strategy and approach for managing the project and the processes related to the knowledge areas of scope, schedule, cost, quality, resources, communications, risk, procurement, and stakeholder management. This means there is a management plan for each knowledge area. These plans are, in essence, a set of documents with processes, procedures, practices, and standards the team will follow to ensure consistent results. When creating a management plan, you ask yourself, "How will I define, plan, manage (execute), and control scope (or schedule, cost, quality, etc.) for the project?" You think ahead, and document how you will plan for each knowledge area (and ultimately the project) based on its particular needs, how you will manage each knowledge area during executing, and how you will monitor and control each knowledge area. This effort should cover all aspects of the project management process. You also need to think about the people involved in the project and how you will manage those people, evaluate their work, and keep them engaged. Management plans are, of necessity, unique to each project in order to address the project's particular needs. The format and level of detail of management plans should be customized to fit the needs of the project, the style of the project manager, and the organizational influences.

If you don't create management plans for your projects or don't create them to the extent described here, this area of the exam may be difficult for you. So, let's consider an example of how you would address planning, executing, and monitoring and controlling cost management. The planning portion of a management plan is where we define the processes and procedures that will be followed when completing planning for the knowledge area. In our cost example, we need to address questions such as: "How will we make sure all costs are identified and estimated?" "Who will be involved in estimating costs?" "What methods of estimating costs will we use?" "What historical records, processes, and organizational requirements will need to be used or met?" "What estimating tools and techniques will we employ?" "What level of accuracy is appropriate?" "How will funding and cost constraints be considered when establishing the budget?" "What data, metrics, and measurements do we need for planning cost?"

The executing portion of a management plan focuses on the processes and procedures for doing the work (note that some knowledge areas, such as cost management, don't have separate executing processes; in such a case, the work performance data related to the knowledge area is gathered as part of Direct and Manage Project Work and must still be planned for). The executing component of a cost management plan

answers questions such as: "What cost data is needed?" "Who is responsible for gathering it?" "Where will we capture the raw data that will later be used in monitoring and controlling?"

The monitoring and controlling component of a management plan defines the processes and procedures to measure project progress, compare actual project results to what was planned, and determine how to handle variances that require a change.

The creation of management plans is an integral part of a project manager's job. If you are not familiar with management plans and have no experience creating them, do not just study this concept. Before you read further, spend some time imagining what management plans for scope, schedule, quality, resources, communications, risk, procurement, and stakeholder management might contain for a large project. Many project managers don't realize how big their knowledge gap is regarding management plans until it finds them on the exam. Don't let this happen to you!

TRICKS OF THE TRADE Here is a trick to understanding the topic of management plans for the exam. Know that management plans look forward in time and that there are management plans for all the knowledge areas. There are also the following management plans:

- Change management plan
- Configuration management plan
- Requirements management plan

When taking the exam, assume the project manager has created each of these management plans. For example, if a question refers to a problem on a project, the answer might be for the project manager to look at the management plan for that aspect of the project to see how the plan says such a problem will be handled. Or when the work is being done, the project manager might refer to the cost management plan to see how costs are supposed to be measured and evaluated on the project.

Project Management Plan

Now let's talk about the project management plan. What do you currently think of as a project management plan or project plan? If you think of such a plan as just a schedule, then it's time to significantly expand your understanding of this concept.

The project management plan integrates all the individual management plans into a cohesive whole, creating a centralized document to describe what is involved in the project. The overall project management plan also includes the baselines for the project. Do you remember the discussion in the Project Management Processes chapter about how the iterations in project planning lead to a realistic project management plan? This means a project management plan is a set of plans and baselines (not just a schedule). The key components of the project management plan are discussed in the following sections.

Project Life Cycle

The project life cycle describes the phases of work on a project required to produce the deliverables (for example, requirements, design, code, test, implement). Project life cycles range from plan driven to change driven.

Development Approach

Development approaches to produce the project deliverables range from plan driven to change driven.

Management Reviews

Milestones will be built into the project management plan, indicating times when management and stakeholders will compare project progress to what was planned and identify needed changes to any of the management plans.

Project Management Processes That Will Be Used on the Project Think about the science of project management for a moment. Would you want to use everything in the *PMBOK® Guide* to the same extent on every project? No! A project manager should determine the extent to which processes need to be used, based on the needs of the project. Tailoring the process to be followed is part of developing the project management plan.

Knowledge Area Management Plans These are the management plans for scope, schedule, cost, quality, resources, communications, risk, procurement, and stakeholder management. (The individual management plans are discussed in more detail in chapters 5 through 13 of this book.)

Baselines[11] (Performance Measurement Baseline) The project management plan includes scope, schedule, and cost baselines, against which the project manager will report project performance. These baselines are created during planning. They are a record of what the project had planned, scheduled, and budgeted for in terms of scope, schedule, and cost performance, and are used to compare the project's actual performance against planned performance. The following are the elements included in each baseline:

- **Scope baseline** The project scope statement, work breakdown structure (WBS), and WBS dictionary
- **Schedule baseline** The agreed-upon schedule, including the start and stop dates for each activity, and scheduled milestones
- **Cost baseline** The time-phased cost budget (the spending plan indicating how much money is approved for the project and when the funds are required and will be available)

Together these baselines are called the performance measurement baseline.

What do baselines mean for the project manager and team? The project manager must be able to clearly, completely, and realistically define scope, schedule, and cost to develop the baselines. That's not all, however. The project performance, and the performance of the project manager, will be measured against the baselines. The project manager and team will watch for deviations from the baselines while the work is being done. If a deviation is discovered, they will assess whether adjustments can be made to the project to deal with the problem. These adjustments might involve submitting a change request for corrective or preventive action or defect repair. Depending on the extent and type of action required, the baselines themselves do not always change. If minor adjustments will not correct the deviation, however, a request to change the baselines might be necessary. A substantial part of project monitoring and controlling is making sure the baselines are achieved, which in turn helps ensure the sponsor and the organization get the complete benefits of the project they chartered. Therefore, as a project manager, your ability to not only plan a project but also to control the project and get it completed as planned is very important.

Requested changes to the baselines are evaluated and approved in the Perform Integrated Change Control process. Baseline changes are so serious that the evolution of the baselines should be documented to show when and why changes were made.

TRICKS OF THE TRADE The exam tests you at an expert level. You need to understand that deviations from baselines are often due to incomplete risk identification and risk management. Therefore, if the exam asks what to do when a project deviates significantly from established baselines, the correct answer is likely the one about reviewing the project's risk management process. Many project managers do not understand that such an effort should be done. Does it make sense to you now that we've pointed it out?

Baselines are mentioned frequently on the exam. Make sure you understand the concepts described here, including what the project manager's attitude should be regarding the project's baselines and any changes to those baselines.

Requirements Management Plan Part of the scope management process (which is described in the next chapter) involves defining and planning for stakeholders' needs, wants, expectations, and assumptions to determine the requirements for the project. The requirements management plan defines how requirements will be gathered, analyzed, prioritized, evaluated, and documented, as well as how the requirements will be managed and controlled throughout the project.

Change Management Plan Controlling a project to the baselines and the rest of the project management plan is so important that the project manager needs to think in advance about where there might be changes and what to do to limit the negative effects of changes. Are you this focused on change management on your projects? Regardless of whether you work on small or large projects, your role is not to just facilitate changes. Instead, you need to plan the project in a way that minimizes the need for changes and prevents unnecessary changes. You also need to proactively look for needed changes, thereby solving problems before they have a major negative impact on the project. Because making changes is much more costly than including the work from the beginning, changes should not be undertaken lightly.

The change management plan describes how changes will be managed and controlled, and may include:

- Change control procedures (how and who)
- The approval levels for authorizing changes
- The creation of a change control board to approve changes, as well as the roles and responsibilities of those on the board (the change control board is described later in this chapter)
- A plan outlining how changes will be managed and controlled
- Who should attend meetings regarding changes
- The organizational tools to use to track and control changes
- Information on reporting the outcome of change requests
- The emergency change process

Note that a change management plan will often have a separate process for addressing each of the knowledge areas, taking into account the specific needs within each knowledge area.

Change Control System Many organizations have a change control system as part of their project management information system (PMIS). This system includes standardized forms, reports, processes, procedures, and software to track and control changes. It is part of an organization's enterprise environmental factors.

Configuration Management Plan With all the product and project documentation that is part of managing a project and all the changes to this documentation that will occur throughout the life of the project, it is essential to have a plan for making sure everyone knows what version of the scope, schedule, and other components of the project management plan is the latest version. This is the purpose of the configuration management plan. It defines the naming conventions, the version control system, and the document storage and retrieval system, and details how you will manage the changes to the documentation, including which organizational tools you will use in this effort.

Configuration Management System[12] Like the change control system, the configuration management system is part of the project management information system (PMIS). It contains the organization's standardized configuration management tools, processes, and procedures that are used to track and control the evolution of the project documentation.

Putting the Project Management Plan Together The project management plan, including the individual management plans and the scope, schedule, and cost baselines, is created by completing the activities described in the Planning column of Rita's Process Chart™. Once the project management plan is complete, the sponsor or key stakeholders review and approve it. The Develop Project Management Plan process must result in a project management plan that is bought into, approved, realistic, and formal. In other words, the project management plan needs to be agreed to by those involved in the project, it needs to be formally approved, everyone needs to believe the project can be done according to the plan, and it needs to remain a formal document that is controlled and used throughout the project. If this is a new concept to you, make sure you spend time thinking about how to accomplish this in the real world.

Let's see how everything connects so far by looking at figure 4.2.

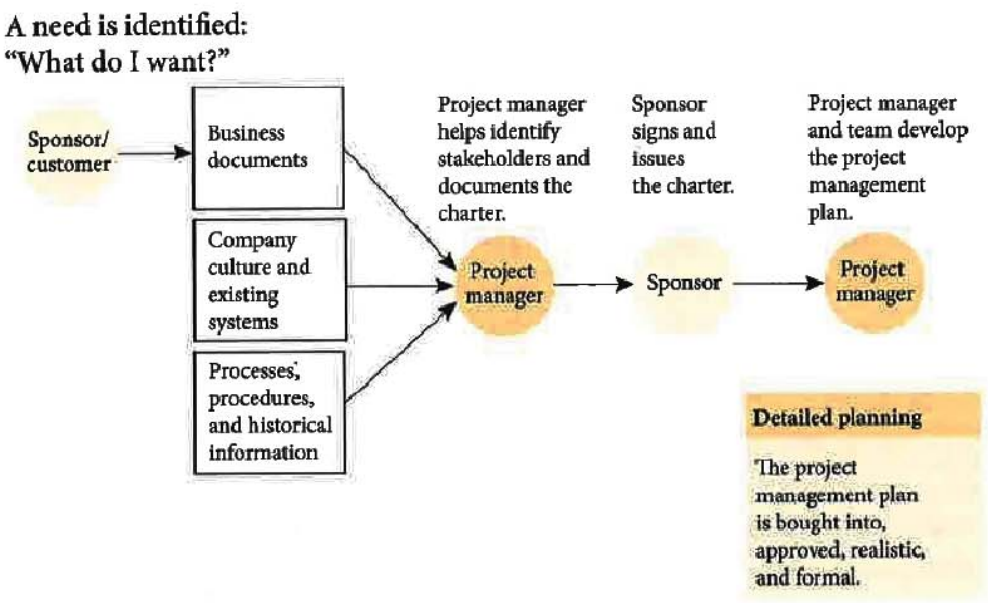

FIGURE 4.2 *Project initiating and planning*

Once the project management plan has been completed, the project manager uses it as a tool to help manage the project on a daily basis. It is not just a document created for the sponsor and other key stakeholders. Although it may evolve over the life of the project through progressive elaboration or approved changes, the project management plan is designed to be as complete as possible when project executing begins.

Exercise Test yourself! Make a list of the specific actions required to create a project management plan that is bought into, approved, realistic, and formal.

Answer Some of the possible answers to this exercise include:

- Select the best life cycle and approach for the project.
- Determine a methodology for creating the project management plan.
- Agree on reporting formats and communications plans.
- Agree on processes to report, control, and incorporate changes.
- Make sure the approach and processes are consistent with the PMO and/or program management plan, if the project is part of a program.
- Analyze the stakeholders' needs, wants, expectations, and assumptions.
- Capture the project requirements as completely as possible.
- Analyze the skills and knowledge of all the stakeholders, and determine how you will use them on the project.
- Meet with stakeholders to define their roles on the project.
- Meet with resource managers to get the best resources possible.
- Work with team members to estimate the project.
- Give team members a chance to approve the final schedule that converts the team's activity estimates into a calendar schedule.
- Get resource managers to approve the schedule and confirm when their resources will be used.
- Work through iterations of the plan (for example, update the work breakdown structure after you complete risk analysis).
- Create the necessary project documents.
- Apply risk reserves to the project schedule and budget.
- Look for impacts on your project from other projects.
- Hold meetings or presentations to let the sponsor know if any of the project requirements that were outlined in the project charter cannot be met.
- Perform schedule compression (crash, fast track, change scope or quality, etc.), and present options to the sponsor.

If you included most of the answers in the previous list, you are in good shape. But why is it so important to have a project management plan that is realistic and that everyone believes can be done? Because later in the project management process, you will need to constantly measure progress against the project management plan to see how the project is going. The end date, end cost, and other constraints in the project must be met. There are no excuses. You will use the project management plan (including the scope, schedule, and cost baselines contained in the plan) as a measurement tool to make sure the project delivers within these constraints.

So when you think of the project management plan, think of all the facilitations, meetings, sign-offs, interactions with other projects, conflict resolution, negotiations, schedule compressions, etc. that will be required to bring the plan to the point of being bought into, approved, realistic, and formal. Expect questions on the exam about how to use your skills to develop the project management plan, as well as how it makes a difference as you manage work on the project and solve challenges that occur.

Project Documents A lot of information needs to be captured on a project, and not all of that information is recorded in the project management plan. The *PMBOK® Guide* uses the term "project documents" to refer to any project-related documents that are not part of the project management plan. They include the assumption and issue logs, cost and duration estimates, lessons learned register, project schedule and resource calendars, quality reports, resource requirements along with requirements documentation, and other such documentation (see page 89 in the *PMBOK® Guide* for a longer list of examples). While the sponsor and/or key stakeholders will see and approve the project management plan, most project documents (excluding some documents such as the charter, agreements, contracts, and statements of work) are created by the project manager for use on the project and typically are not shown to or approved by the sponsor.

Due to the iterative nature of planning and the nature of the work throughout the rest of the project, project documents must be updated frequently. For the exam, know that project documents updates are an output of many of the project management processes, though this book will not cover these updates as an output of every process.

Project Management Plan Approval Since the project management plan is a formal document that defines how the project will be managed, executed, and controlled and includes items such as the project completion date, milestones, costs, etc., it typically requires formal approval by management, the sponsor, the project team, and other key stakeholders. Formal approval means sign-off (signatures). If the project manager has identified all stakeholders and their requirements and objectives, included the appropriate project and product scope in the plan, and dealt with conflicting priorities in advance, getting the project management plan approved should be relatively straightforward.

Kickoff Meeting Before the Develop Project Management Plan process can be completed and project executing can begin, a kickoff meeting should be held. This is a meeting of the key parties involved in the project (customers, sellers, the project team, senior management, functional management, and the sponsor). The purpose of this meeting is to announce the start of the project, to ensure everyone is familiar with its details—including the project objectives and stakeholders' roles and responsibilities—and to ensure a commitment to the project from everyone. In other words, the meeting is held to make sure everyone is on the same page. In addition to introducing those involved in the project, the meeting may review such items as project milestones, project risks, the communications management plan, and the meeting schedule.

Direct and Manage Project Work PAGE 90

Process Direct & Manage Project Work
Process Group Executing
Knowledge Area Integration Management

This process represents the integration aspect of project executing.
In Direct and Manage Project Work, the project manager integrates all the executing work into one coordinated effort to accomplish the project management plan and produce the deliverables. In addition to completing the activities and deliverables in the project management plan, Direct and Manage Project

Work involves gathering work performance data, creating and using the issue log, requesting changes, and completing the work resulting from approved change requests.

The Direct and Manage Project Work process involves managing people and keeping them engaged in the project, doing the work, finding ways to work more efficiently, requesting changes, and implementing approved changes. It is about being of service to the team to help them get the work completed, ensuring a common understanding of the project among stakeholders, and keeping everyone focused and informed by documenting and facilitating resolution of issues. In other words, the project manager needs to do things such as facilitate meetings and technical discussions, make sure the stakeholders whose scope was not included in the project understand they will not receive that scope, use the work authorization system[13] to keep the team and functional managers informed of upcoming work assignments and milestones, help remove roadblocks that would prevent the team from completing work, look at improving processes, and inform other departments within the organization how the project may affect their work.

There is another piece of the Direct and Manage Project Work process that you need to be aware of for the exam. When executing the project, the project manager takes time to focus on managing the schedule, budget, risks, quality, and all other knowledge areas. This way of thinking about project executing is not an approach that many project managers take. We just manage the project as a whole, rather than giving individual attention to each knowledge area. This can also mean we do not take the time to properly look at how issues relating to one knowledge area affect other knowledge areas (for example how scope management issues can affect quality and resource management). We may forget to even think about some of the knowledge areas. Integration management requires project managers to keep all the knowledge areas in mind at all times.

The project management information system (PMIS) is used to help the project manager keep track of the many aspects of the project. The PMIS includes automated tools, such as scheduling software, a configuration management system, shared workspaces for file storage or distribution, work authorization software, time-tracking software, procurement management software, and repositories for historical information.

The work authorization system is the project manager's system for authorizing the start of work packages or activities, and it is part of the PMIS. If you have never used such a system, imagine a large construction project with hundreds of people working on the project. Can you have a plumber and an electrician show up to work in one small area at the same time? No. Remember that a project is planned to the level of detail needed for that particular project. There might be instances when the project manager needs to manage to a detailed level, as in the case of the plumber and the electrician. To handle these types of situations, a work authorization system is put in place to make sure work is only started when a formal authorization is given. In many cases, this tool for authorizing work is a company-wide system used on the project, not created just for the project. There will likely only be one question about this on the exam, but the term may be included more frequently as an answer choice.

It is likely that the project manager will also make use of meetings as a tool for keeping the team and stakeholders informed and engaged in the project work during this process. Depending on the needs of the project and the project approach, the format of these meetings can range from informal stand-up sessions to structured meetings with an agenda and a focus on a specific aspect of the project. Within the Direct and Manage Work process, meeting topics may include project updates, lessons learned, upcoming project activities, and, of course, risk management.

The Direct and Manage Project Work process can be illustrated as shown in figure 4.3.

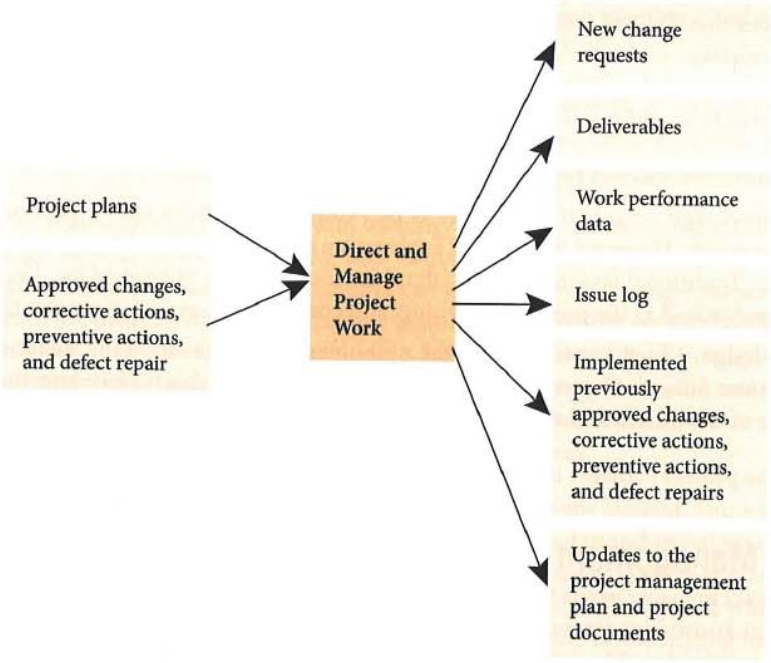

FIGURE 4.3 *Direct and Manage Project Work process*

The outputs of this process include the issue log, any newly discovered work performance data, possible change requests, and deliverables. A deliverable can be any product or result that is produced as part of a project. Other outputs include updates to project management plan components, organizational process assets, and project documents, such as the activity list, assumption log, lessons learned register, stakeholder register, requirements documentation, and risk register.

Manage Project Knowledge PAGE 98

Process Manage Project Knowledge
Process Group Executing
Knowledge Area Integration Management

A project doesn't—or at least shouldn't—exist in a vacuum. Think of the tremendous amount of knowledge required to properly plan and execute a project. Project managers can benefit from the knowledge base of the organization, particularly from the experiences and discoveries of others on past, similar projects. The Manage Project Knowledge process provides a means to take advantage of the knowledge the organization has accumulated over time. In addition, it requires each project to actively contribute to that knowledge base. This includes sharing new processes, successes, etc. internally within the project, as well as making that knowledge accessible throughout the entire organization.

Successful knowledge management requires an organizational culture of trust in which the project manager and stakeholders exchange knowledge without fear of judgment. Some of the knowledge to be shared will involve experiences that did not work out as planned. But we can often learn more from mistakes than successes. Each mistake, each unidentified stakeholder, each missed risk trigger, and each unrealistic schedule teaches us something. What a valuable thing it is to share such information and possibly save another project or individual from the same outcome.

This process includes two distinct types of knowledge—explicit and tacit:

- **Explicit knowledge** Explicit knowledge is fact-based, and can be easily communicated through words and symbols. However, it may need explanation or context to provide value to recipients of this information. Traditional lessons learned fall under this category of knowledge. Lessons learned are generated and shared as the project is ongoing, and consolidated as part of project closing.
- **Tacit knowledge** Tacit knowledge, on the other hand, includes emotions, experience, and ability, which are more difficult to communicate clearly. The sharing of this type of knowledge requires the atmosphere of trust discussed earlier.

In this process, the project manager is responsible for managing both knowledge and information.

Knowledge Management

Collaboration and the sharing of knowledge are key to successful projects. The project manager needs to plan and develop an environment within a project that will support the sharing of tacit knowledge (including the ways people do their work, their experiences and best practices, and how they solved problems they encountered in their work). The availability of online knowledge-sharing tools helps facilitate knowledge sharing among distributed teams, enabling team members and others to benefit from a broad range of experience. Discussion forums and interactive events and meetings, whether in person or virtual, support the sharing of knowledge and experience.

Information Management

People on projects need to create and share information, or explicit knowledge, as efficiently as possible. Information management tools and techniques can help with this. The processes for capturing explicit knowledge include documentation in the lessons learned register and other repositories of explicit knowledge. Explicit knowledge is shared by making it available in the PMIS, through discussion, and via direct communication.

On the exam, you may encounter situational questions that test your understanding of the need to cultivate and share knowledge and information. You may be asked how to establish an environment that encourages the project team to share tacit and explicit knowledge. Or you may be asked how you would make adjustments to the environment when that doesn't happen as intended. Answers might include such actions as holding retrospective sessions and engaging in interactive communication with individual stakeholders.

Legal and regulatory requirements and constraints such as nondisclosure agreements may limit or impact the gathering or sharing of particular information due to confidentiality or privacy concerns, or may dictate the format and type of information that can be disseminated. It is important for the project manager to be aware of these constraints and to communicate to the team any restrictions regarding the sharing of information they may be exposed to during the project. For example, on a project involving development of banking software, the team may have access to personal and financial information of customers of the bank for which the software is being developed. This is an obvious example of information that team members would not be permitted to share, other than in the context of the project work.

The entire project management plan is an input to the Manage Project Knowledge process. In particular, the communications, stakeholder engagement, and configuration management plans all provide direction for managing knowledge and information by the project manager, team members, and other stakeholders. Do you see why this is an integration process?

One input to this process that might seem confusing at first is deliverables. In fact, deliverables represent great amounts of knowledge regarding all aspects of what it will take to complete them. This might include new knowledge around standards or metrics, or the processes used to create the deliverables.

Knowledge can be shared formally through team training, seminars, and workshops. Other techniques for sharing knowledge include work shadowing and activity observation. Instead of receiving hard-to-understand process documentation, a team member can watch someone doing a particular job or activity to more easily learn the process. A similar technique is storytelling. Simply asking, "Walk me through how you would do this task," can encourage understanding. Informal sharing occurs through the application of interpersonal and team skills, including active listening and networking. Successful and consistent sharing of knowledge and information contributes to a more productive work environment and increases the ability of project teams to achieve project and organizational objectives.

Specific knowledge shared through this process is referred to as lessons learned. You will see the topic of lessons learned mentioned often throughout this book, both as an input to and an output of many processes. As an input, they help improve the current project. As an output, they help make the organization better. Lessons learned are defined as "what was done right, what was done wrong, and what would be done differently if the project could be redone." Accurately and thoroughly documenting lessons learned is a professional responsibility.

You need to collect and review lessons learned from similar projects before starting work on a new project. Why make the same mistakes or face the same problems others have faced? Why not benefit from others' experience? Imagine you could reach into a filing cabinet or access a database to see data for all the projects your company has undertaken. How valuable would that be?

Lessons learned are collected and saved in a lessons learned register, which is the main output of this process. Do not underestimate the value of this shared information! Remember that the lessons learned register is a living document, which is shared throughout the project, as well as when the project is completed. New lessons learned may not only be added to the lessons learned register but may also be incorporated into the organization's recommended practices.

Your organization may have a template for lessons learned documentation, but even if it does not, lessons learned should include an overview of the situation, what was done, the impact of actions taken, and any updates to the project management plan or project documents necessitated by the action.

In the first chapter of this book, we described lessons learned as a PMI-ism. Lessons learned are an essential asset to managing a project, as they are taken into account as well as created throughout a project. Complete the following exercise to test your understanding of lessons learned.

Exercise Test yourself! Lessons learned include what type of information?

Answer The lessons learned register includes what was done right, what was done wrong, and what could have been done differently. Another way of saying this is that lessons learned include reasons why issues occur, change requests, workarounds, reestimating, preventive and corrective actions, and defect repair the project has faced, as well as the reasoning behind any implemented changes. They also include successes, such as new sources of information, newly developed processes, ways of tracking work, and even new information on resources who demonstrated outstanding skills or were able to contribute to the project in unexpected ways.

To make lessons learned as valuable as possible, use categories to ensure that all are captured. Some categories that should be captured are:

- **Technical aspects of the project** What was right and wrong about how we completed the work to produce the product? What did we learn that will be useful in the future? (Examples include acceptable metrics and variance levels, new processes, improved or revised processes for particular results, and the effectiveness of particular acceptance criteria.)
- **Project management** How did we do with WBS creation, risk planning, etc.? What did we learn that will be useful in the future? (Examples include recommendations for transitioning project results to the business and operations teams, recommended changes to the organization's procurements process, and experiences working with particular sellers.)
- **Management** How did I do with communications and leadership as a project manager? What did we learn that will be useful in the future? (Examples include the results of stakeholder analysis and stakeholder engagement efforts.)

TRICKS OF THE TRADE Many project managers do not understand the role of lessons learned on projects. The graphic in figure 4.4 helps explain their function.

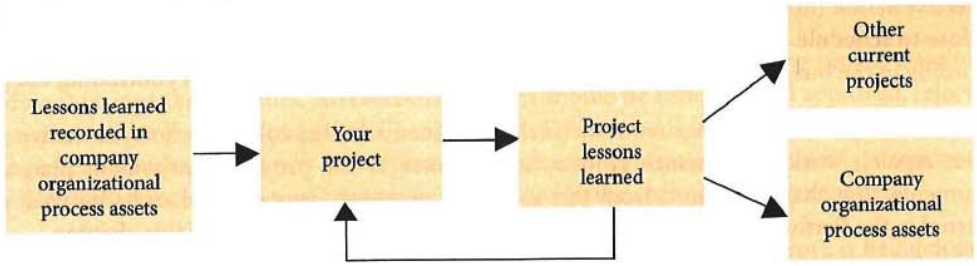

FIGURE 4.4 *Lessons learned on a project*

Remember it is not only knowledge and information that are gained from this process. Equally important is developing the organizational culture to promote growth through the sharing of knowledge and experiences.

Monitor and Control Project Work PAGE 105

Process Monitor & Control Project Work
Process Group Monitoring & Controlling
Knowledge Area Integration Management

The Monitor and Control Project Work process involves looking at what is happening on the project and comparing the actual and forecasted performance to what was planned. It is a monitoring and controlling function that is done from project initiating through project closing.

When you think of a large project, it makes sense that the project manager would make a formal effort to monitor and control how the project management and knowledge area processes are going. This process involves aggregating the work performance information from monitoring and controlling knowledge area processes to evaluate and assess how their individual process results are impacting the other knowledge areas and their plans and baselines. For example, scope may be completed on a project but the quality may not be acceptable, or the schedule might be met but at excessive cost. This process also involves monitoring any other performance requirements that were included in the project management plan. Monitoring and controlling project work encourages a holistic view of the project performance and enables the project manager to take appropriate action to keep the project on track.

The integration function of Monitor and Control Project Work also includes activities such as analyzing and tracking risks, performing quality control activities, assessing possible outcomes across the project using data analysis techniques (including alternatives, cost-benefit, earned value, root cause, trend, and variance analysis), and reviewing changes and corrective actions made on the project to see if they were effective.

TRICKS OF THE TRADE If the exam talks about monitoring and controlling project work, it may not be referring to the entire monitoring and controlling process group. Instead, it may be referring to the specific integration management process: Monitor and Control Project Work. Remember that monitoring and controlling means measuring against all aspects of the project management plan.

Many project managers do not control their projects to the project management plan. If the exam asks what you should do if a work activity on the project takes longer than estimated, the answer is to request corrective action (discussed later in this section) to make up for the delay. Such action keeps the project on or close to schedule and allows the project manager to feel comfortable that the scope will be completed according to the budget and schedule agreed to. This knowledge is the value of controlling the project.

This effort may result in change requests (including recommended corrective and preventive actions and defect repair), work performance reports, and updates to the project management plan and project documents. The change requests from this and other processes are evaluated and approved, rejected, or deferred in the Perform Integrated Change Control process, described later in this chapter.

The following sections highlight some important concepts related to the Monitor and Control Project Work process.

Change Requests

PAGE 112 AND THROUGHOUT No matter how well you plan a project, there will always be changes. Change requests can have differing focuses, depending on which process they are generated in. Three main categories of change requests are corrective action, preventive action, and defect repair. Changes may involve additions to the project requested by the customer, changes to the plan that the team believes would make their work more efficient, or even changes to the policies and procedures used on the project.

The need for changes are identified as you manage the execution of the project and as part of monitoring and controlling when you measure project performance against the performance measurement baseline. See the "Perform Integrated Change Control" section for more about changes.

Note that change requests are also outputs of Plan Risk Responses and Plan Procurement Management, both of which are planning processes. Change requests are generated from these processes when the risk response plans or procurement documents are elaborated after the project management plan has been approved. For example, on a three-year project, it is unlikely that all procurement documents can be completed prior to plan approval. If the seller is not needed until year three, notes regarding the procurement and estimates for schedule and budget are accepted in the plan and elaborated later.

Corrective Action

PAGE 112 AND THROUGHOUT A corrective action is any action taken to bring expected future project performance in line with the project management plan. Without a realistic performance measurement baseline and/or project management plan, including acceptable variances, you cannot determine when a variance has occurred and when corrective action is needed. Those who have serious problems with this in the real world have problems on the exam. What do you do on your projects? Do you have predetermined areas to measure, and have you identified an acceptable range in which the measurements can fall (control limits) to determine if a project is on schedule and on budget?

You cannot simply jump in and start implementing corrective actions. Instead, you need to:

- Consciously focus on identifying areas that need corrective action.
- Look for problems, using observation, active listening, and measurement, rather than just waiting for them to be brought to your attention.
- Create metrics during project planning that cover all aspects of the project.
- Have a realistic project management plan to measure against.
- Continue to measure throughout the project.
- Know when the project is off track, and requires corrective action.
- Find the root cause of the variance.

- Measure project performance after a corrective action is implemented to evaluate the effectiveness of the corrective action.
- Determine whether there is a need to recommend further corrective action.

Typically, corrective actions are undertaken to adjust performance within the existing project baselines; the actions do not change the baselines. All corrective actions should be reviewed and approved, rejected, or deferred as part of the Perform Integrated Change Control process. All changes that would affect the project management plan, baselines, policies or procedures, charter, contracts, or statements of work need the approval of the change control board or sponsor, as outlined in the change management plan.

As you can see, a significant portion of the project manager's time while the project work is being done is spent measuring performance (to determine the need for corrective action) and implementing corrective actions. Therefore, you can expect many questions about this topic on the exam. Do not expect all these questions to use the words "corrective action," however. Some questions may just describe a situation and ask you, "What is the best thing to do?" To answer those types of questions, you need to know when to look for corrective actions. Try the next exercise to see if you understand when you might identify the need for such actions.

Exercise In the following scenarios, which process would generate requests for corrective action?

When	Process Name
When meeting with the customer to obtain acceptance of interim deliverables	
When measuring project performance against the performance measurement baseline	
When making sure people are using the correct processes	
When evaluating whether performance reports are meeting stakeholders' needs	
When working with the project team	
When assessing stakeholder relationships	
When you notice that there are many unidentified risks occurring	
When evaluating a seller's performance	
When evaluating team members' performance	
When making sure deliverables meet quality standards	
When communicating with stakeholders to resolve issues and manage their perceptions about the project	

Answer

When	Process Name
When meeting with the customer to obtain acceptance of interim deliverables	Validate Scope
When measuring project performance against the performance measurement baseline	Control Scope, Control Schedule, Control Costs
When making sure people are using the correct processes	Manage Quality
When evaluating whether performance reports are meeting stakeholders' needs	Monitor Communications
When working with the project team	Manage Team
When assessing stakeholder relationships	Monitor Stakeholder Engagement
When you notice that there are many unidentified risks occurring	Monitor Risks
When evaluating a seller's performance	Control Procurements
When evaluating team members' performance	Manage Team
When making sure deliverables meet quality standards	Control Quality
When communicating with stakeholders to resolve issues and manage their perceptions about the project	Manage Stakeholder Engagement

Preventive Action PAGE 112 AND THROUGHOUT While taking corrective action involves dealing with actual deviations from the performance measurement baseline or other metrics, taking preventive action means dealing with anticipated or possible deviations from the performance measurement baseline and other metrics. The process for taking preventive action is not as clear as it is for taking corrective actions. Knowing when preventive action is needed requires more experience than calculation because you are evaluating trends in the measurement analysis and anticipating that, if they continue, they could lead to deviation from the performance measurement baseline or other metrics. Examples of preventive actions include:

- Adjusting the project to prevent the same problem from occurring again later in the project
- Changing a resource because the resource's last activity nearly failed to meet its acceptance criteria
- Arranging for team members to gain training in a certain area because there is no one with the necessary skills to back up a team member who may unexpectedly get sick

Typically, preventive actions are undertaken to adjust performance within the existing project baselines; the actions do not change the baselines. All preventive actions should be reviewed and approved or rejected as part of the Perform Integrated Change Control process. Proposed changes that would affect the project management plan, baselines, policies or procedures, charter, contracts, or statements of work would likely have to go to the change control board or sponsor for approval, as outlined in the change management plan.

You will see preventive action mentioned throughout the *PMBOK® Guide*. Preventive action can be implemented at any time on any project management process.

Defect Repair[14] PAGE 112 AND THROUGHOUT

Defect repair is another way of saying "rework." Defect repair may be requested when a component of the project does not meet specifications. As with corrective and preventive actions, any defect repairs should be reviewed and approved or rejected as part of the Perform Integrated Change Control process.[15]

Perform Integrated Change Control PAGE 113

Process Perform Integrated Change Control
Process Group Monitoring & Controlling
Knowledge Area Integration Management

At any time during the project, changes to any part of the project may be requested. Keep in mind, however, that just because a change is requested does not mean it has to be—or even should be—implemented. All change requests are evaluated and accepted, rejected, or deferred in the Perform Integrated Change Control process. A key focus of integrated change control is to look at the impact of each change on all the project constraints. For example, any scope change needs to be assessed for its impact on quality, risk, schedule, cost, resources, and customer satisfaction. The value of analyzing the impact of changes is to reduce the potential risk of not fulfilling project objectives.

For the changes that are accepted, updates and replanning efforts are required to make sure the project team is working with a completely current and integrated project management plan, performance measurement baseline, and project documents. These updating and replanning efforts take place during Perform Integrated Change Control. The approved changes are then implemented in Direct and Manage Project Work, Control Quality, and Control Procurements.

So do you need to go through Perform Integrated Change Control to make changes to processes or plans that haven't been finalized? No! When developing the project charter, project management plan, and baseline, changes can be made without a formal change request. But after the charter or the project management plan have been approved, requested changes need to be evaluated for resolution in integrated change control. Read exam questions carefully to understand whether a requested change pertains to something that is still in the process of being finalized or has already been finalized. This will help you determine whether integrated change control is required.

Integrated change control can be a difficult topic on the exam for people who do not work on projects that have formal change procedures. It can also be difficult for project managers who simply estimate the cost and/or schedule impact of a change and stop there, rather than looking for the impacts of a change on the other parts of the project. You can check your understanding of this topic with the following example:

> *A stakeholder wants to add scope to the project. You estimate that the change will add two weeks to the project duration. What do you do next?*

Do not simply read on! Try to answer the question. Understanding the Perform Integrated Change Control process is very important. There may be as many as 20 questions on this topic on the exam.

So what is your answer? Is it to look for ways to save time so the change can be accommodated? Or should you get the change approved? How about asking for an extension of time to accommodate the change?

None of the previous choices are the correct answer. Instead, the next thing to do would be to see how the proposed change impacts the project cost, quality, risk, resources, and possibly customer satisfaction. Whenever the exam mentions changes, keep in mind that a change to one of the project constraints should be evaluated for impacts on all the other constraints.

To fully evaluate the impacts of a change, it is necessary to have:

- A realistic project management plan to measure against
- A complete product scope and project scope (see the definitions in the Scope Management chapter)

Are changes bad? In many industries, this can be a controversial question. Changes can have negative effects. In fact, changes can be expensive and can disrupt the project. Some studies have shown that changes made late in the project can be up to 100 times more expensive than if they were made early in the project. The function of each process within the monitoring and controlling process group is to control changes. If there are a lot of changes on a project, it can become impossible for a project manager to coordinate the work, because it is constantly shifting. Team members are frequently pulled off assigned work to help implement or evaluate changes.

Change is inevitable on projects, but a project manager should work to prevent the root cause of changes whenever possible. And in many cases, the root cause may be that the project manager did not properly plan the project. The need for changes may indicate that the project manager did not fully identify stakeholders and uncover their requirements or that they did not properly complete other project management actions. All possible changes must be planned, managed, and controlled.

To control changes on the project, the project manager should:

- Work to obtain complete and thorough requirements as soon as possible.
- Spend enough time on risk management to comprehensively identify the project's risks.
- Establish schedule and cost reserves (see the discussion of reserve analysis in the Schedule Management, Cost Management, and Risk Management chapters).
- Have a process in place to control changes.
- Follow the process to control changes.
- Have a process and templates in place for creating change requests.
- Have clear roles and responsibilities for approving changes.
- Reevaluate the business case in the project charter if the number of changes becomes excessive.
- Consider terminating a project that has excessive changes and starting a new project with a more complete set of requirements.
- Allow only approved changes to be added to the project baselines.

Changes can be grouped into two broad categories—those that affect the project management plan, baselines, policies and procedures, charter, or contracts, or statements of work, and those that do not. If a change does not affect the project management plan, baselines, company policies and procedures, the charter, contracts, or statements of work, a company's change management policies may allow the project manager to approve the change. If, on the other hand, the change does affect those key elements, the change typically needs to go to a change control board and/or sponsor for a decision.

Change Control Board (CCB)[16]

Why should the project manager always have to be the one to deny a change request? They might not even have the knowledge or expertise to analyze a change request. Depending on the project manager's level of authority, their role might be to facilitate decisions about certain changes, rather than actually make the decisions. For these reasons, many projects have formally established change control boards responsible for reviewing and analyzing change requests in accordance with the change management plan for the project. The CCB then approves, defers, or rejects the changes. The results of the board's decisions are documented in the project's change log. The board may include the project manager, the customer, experts, the sponsor, functional managers, and others. For the exam, assume that most projects have change control boards—with the exception of change-driven projects.

Process for Making Changes

The exam has many situational questions that deal with how to make changes. Here are two examples.

Question A functional manager wants to make a change to the project. What is the first thing a project manager should do?

Question Someone wants to make a change to the project scope. What is the best thing to do first?

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The answers are the same in either case. A trick for answering questions that ask about the process for making changes is to know that, on a high-level basis, the project manager should follow these steps:

1. **Evaluate the impact** Evaluate (assess) the impact of the change on all aspects of the project (for example, this change will add three weeks to the project length, require $20,000 additional funding, and have no effect on resources).
2. **Identify options** This can include cutting other activities, compressing the schedule by crashing or fast tracking, or looking at other options. For example, you may be able to decrease the potential effect of the change on the project by spending more time decreasing project risk, or by adding another resource to the project team.
3. **Get the change request approved internally**
4. **Get customer buy-in** (if required)

The process of handling changes is often tested on the exam. Note in the previous steps that changes are always evaluated before any other action is taken. In most cases, evaluation involves using data analysis techniques to determine the impact of the change on all the project constraints.

Next, options to handle the change, such as crashing, fast tracking, reestimating, and using "what if" analysis, are considered and evaluated. (See the Schedule Management chapter for a discussion of crashing, fast tracking, and reestimating.)

Do you remember the following question from earlier in the chapter? It is an example of the type of question you may see on the exam:

> *A stakeholder wants to add scope to the project. You estimate that the change will add two weeks to the project duration. What do you do next?*

Notice how the following question is different:

> *A change in scope has been determined to have no effect on the project constraints. What is the best thing to do?*

Be careful when reading these questions. Expect the right answer to depend on how the question is written. Sometimes evaluation has been done, so the best thing to do is to look for options. Sometimes evaluation and looking for options have been done, and the best thing to do is to meet with the sponsor or change control board.

In the second question, evaluation (step 1 in the Trick of the Trade above) has been done. The answer would be to look for options (step 2 above), and then meet with the sponsor or change control board (step 3 above) to discuss the change and its lack of impact on the project constraints. After informing the sponsor or change control board, the project manager may inform the customer using the process defined in the communications management plan (step 4 above).

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Detailed Process for Making Changes

Now that you know the high-level process, let's look at a more detailed process for making changes:

1. **Prevent the root cause of changes** The project manager should not just focus on managing changes; they should proactively eliminate the need for changes.
2. **Identify the need for a change** Changes can come from the project manager, as a result of measuring against the performance measurement baseline, or from the sponsor, the team, management, the customer, or other stakeholders. The project manager should be actively looking for changes from all these sources because discovering a change early will decrease the impact of the change.
3. **Evaluate the impact of the change within the knowledge area** If it is a scope change, how will it affect the rest of the scope of the project? If it is a schedule change, how will it affect the rest of the schedule for the project?
4. **Create a change request** Changes can be made to the product scope, any part of the project management plan, contracts, charter, statements of work, policies and procedures, or even the performance measurement baseline. The process of making a change should follow the change management plan.
5. **Perform integrated change control** How will the change affect all the other project constraints?
    a. **Assess the change** Does the change fall within the project charter? If not, it should not be a change to your project; it may be an entirely different project. If the change is not beneficial to the project, it should not be approved. Also note that any change for which a reserve has been created (a previously identified risk event) would be accounted for in the project management plan as part of risk management efforts and should be handled as part of the Implement Risk Responses process rather than Perform Integrated Change Control. The techniques of alternative and cost-benefit analysis are helpful in understanding the full impact of a change request.
    b. **Identify options** Actions to decrease threats or increase opportunities include compressing the schedule through crashing or fast tracking, changing how the work is performed, adjusting quality, or cutting scope so that the effect of the change will be minimized.

    Sometimes it may be necessary to accept the negative consequences of a change, if the positive impact that would result from the change is more valuable to the project. It is a matter of balancing project constraints. For example, the benefits of adding new scope to the project may outweigh the negative impact of adjusting the schedule to accommodate the additional time the change would require. (See the Schedule Management chapter for a discussion of the critical path.)
    c. **The change is approved, rejected, or deferred** Again, the project manager may be able to approve many changes. But those that affect the project management plan, baselines, charter, etc. would likely need to go to a change control board and/or the sponsor. Decision-making techniques help in this effort. The approved changes are then implemented in the Direct and Manage Project Work, Control Quality, and Control Procurements processes.
    d. **Update the status of the change in the change log** This helps everyone know the status of the change. If a change is not approved, the reasons it was rejected should be documented.
    e. **Adjust the project management plan, project documents, and baselines as necessary** Some approved changes need to be incorporated into the project baselines. The changes could affect other parts of the project management plan or project documents or could affect the way the project manager will manage the project. Project documentation must be updated to reflect the changes. This means replanning must be done to incorporate the impacts of the change into the new version of the documents and plan before the team starts executing the change. For example, if there is a change in scope, the scope baseline (the

WBS, WBS dictionary, and project scope statement), the project management plan, and the requirements traceability matrix should be updated. If that change in scope affects other areas of the project, the associated documentation (such as the activity list, resource management plan and other resource documentation, schedule, budget, or risk register) also needs to be updated.

6. **Manage stakeholders' expectations by communicating the change to stakeholders affected by the change** How often do you remember to do this? You could think of this, in part, as configuration management (version control to make sure everyone is working off the same project documentation).
7. **Manage the project to the revised project management plan and project documents**

Exercise Test yourself! Describe common changes on projects, and determine what you would do to handle each. An example is provided. Because of the wide variety of possible changes, this exercise does not include answers, but it will help you prepare for questions related to change on the exam.

Common Change	How to Handle It
Customer wants to add scope	Make sure you know what the specific scope is and why it is necessary. Make sure all the data required in the change request is filled out. Assess the change, including whether reserves were allocated on the project to accommodate the addition of the scope. Evaluate the impact of the change. Look for options. Have the change reviewed by the change control board if necessary.

Close Project or Phase PAGE 121

Process Close Project or Phase
Process Group Closing
Knowledge Area Integration Management

(See also the Project Management Processes chapter of this book for a discussion of the closing process group.)

Many of the actions of the Close Project or Phase process have already been presented in the Project Management Processes chapter. You need to understand that this effort finalizes all activities across all process groups to formally close out the project or project phase. This process is typically addressed in about 12 questions on the exam.

TRICKS OF THE TRADE® Is your project really done when the technical work is done? Not if you don't close it out! The Close Project or Phase process encompasses the actions of closing as outlined in the project management plan. For example, individual contracts are closed as part of the Control Procurements process in monitoring and controlling, and all contracts must be closed out before the project is closed. Close Project or Phase ensures that final contract documentation and customer acceptance have been received.

There are many inputs to this process, including all the accumulated work performance data, information and reports, communications, and updates that have been created during the project, including the following:

- The charter—to confirm that exit criteria was met
- The business case—to validate that it was fulfilled
- The benefits management plan—to evaluate and report on benefits delivery
- The project management plan—to confirm that all planned work was completed within baselines with approved changes
- Deliverables—to complete the final review for acceptance and transition to ongoing business
- The lessons learned register—to archive lessons learned in the lessons learned repository
- The risk register and the risk report, with final data on which risks occurred and how the strategies worked—to confirm that all risks were managed successfully
- The change log—to evaluate the number of changes and the impact of those changes on the project
- Agreements and procurement documentation—to confirm that all contracts are closed

The project manager will work with subject matter experts to analyze the data, including all the documents from the project, and complete the final work to close the project. Regression analysis will be done to examine the project variables—such as the schedule, budget, and risks that occurred—and how they impacted the project and its outcomes. The project manager will look at planned versus actual project results, identify variances to the plan, along with their impacts, and identify additional lessons learned that can be shared or used in the organization.

A project manager must get formal acceptance of the project and its deliverables, issue a final report that shows the project has been successful, issue the final lessons learned, and index and archive all the project records. Do you understand the importance of the items included in Rita's Process Chart™? Make sure you become familiar with all the concepts and actions listed here, and, if you do not currently do these things on your projects, imagine completing these activities in the real world on large projects. For the exam, be sure to remember that you always close out a project, no matter the circumstances under which it stops, is terminated, or is completed!

There are financial, legal, and administrative efforts involved in closing. Let's look again at the activities presented in Rita's Process Chart™.

- Confirm work is done to requirements.
- Obtain formal confirmation that contracts are completed.
- Gain final acceptance of the product.
- Complete financial closure.
- Hand off completed product.
- Solicit customer's feedback about the project.
- Complete final performance reporting.
- Index and archive records.
- Gather final lessons learned, and update knowledge base.

Note that the Close Project or Phase process involves getting the final, formal acceptance of the project or phase as a whole from the customer, whereas the Validate Scope process in scope management (a monitoring and controlling process) involves getting formal acceptance from the customer for interim deliverables. The project needs both processes.

Does it make sense to you that the Close Project or Phase process is an integration management function? If not, think of the example of final performance reporting. Can you see how you would have to report on all knowledge areas? How about the example of indexing and archiving project records? You need to do so for records from all the knowledge areas.

Take some time to think about project closing and how it applies to proper project management for large projects before you take the exam.

Practice Exam

1. You are planning communications on a new service development project. Your stakeholder list is large, but not terribly complicated. Not all stakeholders will understand the need for developing an actual communications plan, and you already have good relationships with most stakeholders on this project. What is one of the major driving forces for communication on a project?
   A. Optimization
   B. Integrity
   C. Integration
   D. Differentiation

2. The customer has accepted the completed project scope. However, the lessons learned required by the project management office have not been completed. What is the status of the project?
   A. The project is incomplete because it needs to be replanned.
   B. The project is incomplete until all project and product deliverables are complete and accepted.
   C. The project is complete because the customer has accepted the deliverables.
   D. The project is complete because it has reached its due date.

3. Your well-planned project is likely to encounter a number of change requests and approved changes during its life cycle. In the change management plan, you have outlined the processes that you and others will use to understand the impacts of changes. Getting stakeholder acceptance of the decisions related to change on this project is critical, as a failed project could impact shareholder value and the earning projections for the organization. Your attention is best focused on which of the following regarding changes on your project?
   A. Making changes
   B. Tracking and recording changes
   C. Informing the sponsor of changes
   D. Preventing unnecessary changes

4. The customer on a project tells the project manager they have run out of money to pay for the project. What should the project manager do first?
   A. Shift more of the work to later in the schedule to allow time for the customer to get the funds.
   B. Close Project or Phase.
   C. Stop work.
   D. Release part of the project team.

5. All the following are parts of an effective change management plan except:
   A. Procedures
   B. Standards for reports
   C. Meeting
   D. Lessons learned

6. A work authorization system can be used to:
   A. Manage who does each activity.
   B. Manage when and in what sequence work is done.
   C. Manage when each activity is done.
   D. Manage who does each activity and when it is done.

7. A project is plagued by requested changes to the project charter. Who has the primary responsibility to decide if these changes are necessary?
   A. The project manager
   B. The project team
   C. The sponsor
   D. The stakeholders

8. Effective project integration usually requires an emphasis on:
   A. The careers of the team members
   B. Timely updates to the project management plan
   C. Effective communication at key interface points
   D. Product control

9. Integration is done by the:
   A. Project manager
   B. Team
   C. Sponsor
   D. Stakeholders

10. The project manager's many responsibilities include being of service to the team, integrating new team members as the project progresses, and ensuring that the project meets its objectives within scope, time, budget, and other constraints. Which of the following best describes the project manager's role as an integrator?
    A. Help team members become familiar with the project.
    B. Put all the pieces of a project into a cohesive whole.
    C. Put all the pieces of a project into a program.
    D. Get all team members together into a cohesive whole.

11. Approved corrective actions are an input to which of the following processes?
    A. Validate Scope
    B. Direct and Manage Project Work
    C. Develop Project Charter
    D. Develop Schedule

12. Double declining balance is a form of:
    A. Decelerated depreciation
    B. Straight-line depreciation
    C. Accelerated depreciation
    D. Life cycle costing

13. At various points during project execution, the project manager reviews the project charter. Which of the following best describes what a project charter may be used for when the work is being completed?
    A. To make sure all the team members are rewarded
    B. To help determine if a scope change should be approved
    C. To assess the effectiveness of the change control system
    D. To make sure that all the documentation on the project is completed

14. Which of the following best describes a project management plan?
    A. A printout from project management software
    B. A bar chart
    C. Scope, risk, resource, and other management plans
    D. The project scope

15. You have recently joined an organization that is just beginning to follow formal project management practices. In a meeting, your manager describes your next assignment, a project to select and implement a new telephone system for the customer service department. When you request a signed charter authorizing you to begin work, the manager suggests you "just draft something." Which of the following is true about the development of a project charter?
    A. The sponsor creates the project charter, and the project manager approves it.
    B. The project team creates the project charter, and the PMO approves it.
    C. The executive manager creates the project charter, and the functional manager approves it.
    D. The project manager creates the project charter, and the sponsor approves it.

16. A project management plan should be realistic in order to be used to manage the project. Which of the following is the best method to achieve a realistic project management plan?
    A. The sponsor creates the project management plan based on input from the project manager.
    B. The functional manager creates the project management plan based on input from the project manager.
    C. The project manager creates the project management plan based on input from senior management.
    D. The project manager creates the project management plan based on input from the team.

17. You have taken over a project during project planning and have discovered that six individuals have signed the project charter. Which of the following should most concern you?
    A. Who will be a member of the change control board
    B. Spending more time on configuration management
    C. Getting a single project sponsor
    D. Determining the reporting structure

18. The project manager is working to clearly describe the level of involvement expected from everyone on the project in order to prevent rework, conflict, and coordination problems. Which of the following best describes the project manager's efforts?
    A. Develop Project Management Plan and Plan Quality Management
    B. Manage Stakeholder Engagement and Direct and Manage Project Work
    C. Validate Scope and Control Quality
    D. Identify Risks and Develop Project Team

19. All the following are parts of the Direct and Manage Project Work process except:
    A. Identifying changes
    B. Using a work breakdown structure
    C. Implementing corrective actions
    D. Setting up a project control system

20. A project manager is appointed to head a highly technical project in an area with which this person has limited familiarity. The project manager delegates the processes of Develop Schedule, Estimate Costs, Define Activities, and Estimate Activity Resources to various project team members, and basically serves as an occasional referee and coordinator of activities. The results of this approach are likely to be:
    A. A team functioning throughout the project at a very high level, demonstrating creativity and commitment
    B. A team that initially experiences some amounts of confusion, but that after a period of time becomes a cohesive and effective unit
    C. A team that is not highly productive, but that stays together because of the work environment created by the project manager
    D. A team that is characterized by poor performance, low morale, high levels of conflict, and high turnover

21. You are in the middle of leading a major modification project for an existing manufactured product when you learn that the resources promised at the beginning of the project are not available. According to your plans, these resources will be needed soon, and their unavailability will affect your timeline and possibly other aspects of the project. What is the best thing to do?
    A. Show how the resources were originally promised to your project.
    B. Replan the project without the resources.
    C. Explain the impact if the promised resources are not made available.
    D. Crash the project.

22. The primary customer of a project has requested an application change during user testing. As project manager, how should you address this issue?
    A. Develop a risk mitigation plan.
    B. Create a formal change request.
    C. Inform the project sponsor of changes to scope, cost, and schedule.
    D. Ensure the scope change complies with all relevant contractual provisions.

23. The project manager has just received a change request from the customer that does not affect the project schedule and is easy to complete. What should the project manager do first?
    A. Make the change happen as soon as possible.
    B. Contact the project sponsor for permission.
    C. Go to the change control board.
    D. Evaluate the impacts on other project constraints.

24. You are the project manager for an existing year-long project that must be completed. Your company just won a major new project. It will begin in three months and is valued at $2,000,000. The new project has a greater starting value and is therefore likely to have a higher priority than your project. It may affect your resources. You are concerned about how you will manage your project so that both projects can be implemented successfully. What is the first thing you should do when you hear of the new project?
    A. Ask management how the new project will use resources.
    B. Resource level your project.
    C. Crash your project.
    D. Ask management how the new project will affect your project.

25. You were just assigned to take over a project from another project manager who is leaving the company. The previous project manager tells you that the project is on schedule, but only because he has constantly pushed the team to perform. What is the first thing you should do as the new project manager?
    A. Check risk status.
    B. Check cost performance.
    C. Determine a management strategy.
    D. Tell the team your objectives.

26. You are assigned as the project manager in the middle of the project. The project is within the baselines, but the customer is not happy with the performance of the project. What is the first thing you should do?
    A. Discuss it with the project team.
    B. Recalculate baselines.
    C. Renegotiate the contract.
    D. Meet with the customer.

27. In the middle of the project, the project manager is informed by her scheduler that the project control limits are secure. That same morning, she receives a note from a team member about a problem he is having. The note says, "This activity is driving me crazy, and the manager of the accounting department won't help me until the activity's float is in jeopardy." In addition, the project manager has emails from a minor stakeholder and 14 emails from team members. While she is reading the emails, a team member walks into the project manager's office to tell her a corrective action was implemented by a team member from the project management office, but was not documented. What should the project manager do next?
    A. Report the documentation violation to the project management office, evaluate the security of the control limits, and review the emailing rules in the communications management plan.
    B. Clarify the reasoning behind documentation being a problem, get the accounting department to assist the team member, and respond to the minor stakeholder.
    C. Add the implemented corrective action to the change log, discuss the value of documentation at the next team meeting, and smooth the team member's issue with the accounting department.
    D. Find out who caused the problem with the accounting department, respond to the minor stakeholder before responding to the other emails, and review the process in the communications management plan for reporting concerns with the team member having the documentation problem.

28. The client demands changes to the product specification that will add only two weeks to the critical path. Which of the following is the best thing for the project manager to do?
    A. Compress the schedule to recover the two weeks.
    B. Cut scope to recover the two weeks.
    C. Consult with the sponsor about options.
    D. Advise the client of the impact of the change.

29. During executing, the project manager determines that a change is needed to material purchased for the project. The project manager calls a meeting of the team to plan how to make the change. This is an example of:
    A. Management by objectives
    B. Lack of a change management plan
    C. Good team relations
    D. Lack of a clear work breakdown structure

30. The project was going well when all of a sudden there were changes to the project coming from multiple stakeholders. After all the changes were determined, the project manager spent time with the stakeholders to find out why there were changes and to discover any more.

    The project work had quieted down when a team member casually mentioned to the project manager that he added functionality to a product of the project. "Do not worry," he said, "I did not impact schedule, cost, or quality!" What should the project manager do first?

    A. Ask the team member how the need for the functionality was determined.
    B. Hold a meeting to review the team member's completed work.
    C. Look for other added functionality.
    D. Ask the team member how he knows there is no schedule, cost, or quality impact.

31. You are asked to prepare a budget for completing a project that was started last year and then shelved for six months. All the following would be included in the project budget except:

    A. Fixed costs
    B. Sunk costs
    C. Direct costs
    D. Variable costs

32. Which of the following sequences represents straight-line depreciation?

    A. $100, $100, $100
    B. $100, $120, $140
    C. $100, $120, $160
    D. $160, $140, $120

33. A project is chartered to determine new ways to extend the product life of one of the company's medium-producing products. The project manager comes from the engineering department, and the team comes from the product management and marketing departments.

    The project scope statement and project planning are completed when a stakeholder notifies the team that there is a better way to complete one of the work packages. The stakeholder supplies a technical review letter from his department proving that the new way to complete the work package will actually be faster than the old way.

    The project manager has had similar experiences with this department on other projects, and was expecting this to happen on this project. What is the first thing the project manager should do?

    A. Contact the department and complain again about their missing the deadline for submission of scope.
    B. Determine how this change will impact the cost to complete the work package and the quality of the product of the work package.
    C. See if there is a way to change from a matrix organization to a functional organization so as to eliminate all the interference from other departments.
    D. Ask the department if they have any other changes.

34. Project A has an internal rate of return (IRR) of 21 percent. Project B has an IRR of 7 percent. Project C has an IRR of 31 percent. Project D has an IRR of 19 percent. Which of these would be the best project?

    A. Project A
    B. Project B
    C. Project C
    D. Project D

35. An output of the Close Project or Phase process is the creation of:
    A. Project archives
    B. A project charter
    C. A project management plan
    D. A risk management plan

36. All the following occur during the Close Project or Phase process except:
    A. Creating lessons learned
    B. Formal acceptance
    C. Performance reporting
    D. Performing cost-benefit analysis

37. Which of the following is included in a project charter?
    A. A risk management strategy
    B. Work package estimates
    C. Detailed resource estimates
    D. The business case for the project

38. A project manager is trying to convince management to use more formal project management procedures and has decided to start improving the company's project management by obtaining a project charter for each of his projects. Which of the following best describes how a project charter would help the project manager?
    A. It describes the details of what needs to be done.
    B. It lists the names of all team members.
    C. It gives the project manager authority.
    D. It describes the history of similar or related projects.

39. Linear programming is an example of what type of project selection criteria?
    A. Constrained optimization
    B. Comparative approach
    C. Benefit measurement
    D. Impact analysis

40. You have been involved in creating the project charter, but could not get it approved. Your manager and his boss have asked that the project begin immediately. Which of the following is the best thing to do?
    A. Set up an integrated change control process.
    B. Show your manager the impact of proceeding without approval.
    C. Focus on completing projects that have signed project charters.
    D. Start work on only the critical path activities.

41. The engineering department has uncovered a problem with the cost accounting system and has asked the systems department to analyze what is wrong and fix the problem. You are a project manager working with the cost accounting program on another project. Management has issued a change request to the change control board to add the new work to your project.

    Your existing project has a cost performance index (CPI) of 1.2 and a schedule performance index (SPI) of 1.3, so you have some room to add work without delaying your existing project or going over budget. However, you cannot see how the new work fits within the project charter for your existing project. After some analysis, you determine that the new work and existing work do not overlap and can be done concurrently. They also require different skill sets. Which of the following is the best thing to do?

    A. Develop a project charter.
    B. Reestimate the project schedule with input from the engineering department.
    C. Validate the scope of the new work with the help of the stakeholders.
    D. Identify specific changes to the existing work.

42. All technical work is completed on the project. Which of the following remains to be done?

    A. Validate Scope
    B. Plan Risk Responses
    C. Create a staffing management plan
    D. Complete lessons learned

43. The project manager can help to influence the processes that affect change on projects by creating and using the most appropriate planning strategies and tools. Assuming the project manager has created and is executing the best possible project management plan, the project sponsor should help the project manager to protect the project against unnecessary changes. Which of the following best reflects the phrase, "influencing the factors that affect change?"

    A. Telling people that changes are not allowed after planning is complete
    B. Determining the sources of changes and fixing the root causes
    C. Adding more activities to the work breakdown structure to accommodate risks
    D. Calculating the impact of changes to date on the project

44. The organization is about to begin a series of similar projects. The projects will be managed consecutively. Each project involves developing an online cooking video focused on foods appropriate to the month in which they will be released. For example, the summer videos will include picnic food and cool treats, and the December video will feature holiday foods for Hanukkah, Christmas, and Kwanzaa. The project sponsor is adamant that the management plan for each project includes an emphasis on making the best possible use of the lessons learned register. He believes that other projects have not been successful because they failed to take advantage of lessons learned from previously completed projects. The lessons learned register should be updated:

    A. At the end of each project phase
    B. Throughout the project
    C. Weekly
    D. At the end of the project

45. Knowledge management is a key responsibility of the project manager. This responsibility includes managing two kinds of knowledge on a project: tacit and explicit. Which of the following definitions are correct?
    A. Tacit knowledge is fact-based and can be easily communicated through words and symbols.
    B. Tacit knowledge may need explanation or context to provide value to recipients of this information.
    C. Tacit knowledge includes emotions, experience, and abilities.
    D. Lessons learned are an example of tacit knowledge.

Answers

1. **Answer** C
   Explanation The project manager is an integrator. This is a question about your role as an integrator and communicator.

2. **Answer** B
   Explanation Replanning is uncalled for by the situation described. Reaching the planned completion date does not mean the project is necessarily finished. A project is complete when all work, including all project management work, is complete, and the product of the project and all project deliverables are accepted. The lessons learned are project management deliverables, and therefore must be completed for the project to be complete.

3. **Answer** D
   Explanation Project managers should be proactive. The only proactive answer here is preventing unnecessary changes.

4. **Answer** B
   Explanation Every project must be closed, as closure provides benefit to the performing organization. This means simply stopping work is not the best choice. Shifting work and releasing team members will only postpone dealing with the problem, not solve it. The best thing for the project manager to do is begin the Close Project or Phase process.

5. **Answer** D
   Explanation A change management plan includes the processes and procedures that allow smooth evaluation and tracking of changes. Lessons learned are reviews of the processes and procedures after the fact—to improve them on future projects.

6. **Answer** B
   Explanation Who does each activity is managed with the responsibility assignment matrix. When each activity is done is managed with the project schedule. A work authorization system is used to coordinate when and in what order the work is performed so that work and people may properly interface with other work and other people.

7. **Answer** C
   Explanation The sponsor issues the project charter, so they should help the project manager control changes to the charter. The primary responsibility lies with the sponsor. Remember that any change to the project charter should call into question whether the project should continue.

8. **Answer** C
   Explanation This question is asking for the most important of the choices. Think about what is involved in integration: project management plan development, project management plan execution, and integrated change control. Updates and product control are parts of project monitoring and controlling, while integration includes more than control. Advancing the careers of team members falls under project executing (the Develop Project Team process). To integrate the project components into a cohesive whole, communication is key whenever one activity will interface with another or one team member will interface with another, and when any other form of interfacing will occur.

9. **Answer** A
   Explanation Integration is a key responsibility of the project manager.

10. **Answer** B
    Explanation Integration refers to combining activities, not team members.

11. **Answer** B
Explanation Direct and Manage Project Work is the only correct response.

12. **Answer** C
Explanation Double declining balance is a form of depreciation. That eliminates the choice of life cycle costing. The choices of decelerated depreciation and straight-line depreciation are also incorrect because double declining balance is a form of accelerated depreciation.

13. **Answer** B
Explanation One way to decide if a change should be approved is to determine whether the work falls within the project charter. If not, it should be rejected, assigned to a more appropriate project, or addressed as a project of its own.

14. **Answer** C
Explanation The project management plan includes more than just a bar chart and the project manager's plan for completing the work. It includes all the management plans for the project.

15. **Answer** D
Explanation The project manager may create the project charter, but it is approved and authorized by the project sponsor, giving the project manager authority to proceed with the project.

16. **Answer** D
Explanation To narrow down the answer options, this question could be rephrased to ask, "Who creates the project management plan?" The best answer is that the project management plan is created by the project manager but requires input from the team.

17. **Answer** B
Explanation Determining who will be on the change control board and determining the reporting structure may have already been done. In any case, these choices are not directly impacted by the number of sponsors who have signed the charter. Having a single project sponsor is not necessary. This situation implies that there are six areas concerned with this project. In addition to focusing on the added communications requirements, you should be concerned with competing needs and requirements impacting your efforts on configuration management.

18. **Answer** A
Explanation Notice that this question uses the words "working to clearly describe" and "prevent." Taken together, they should tell you the project is in project planning. This eliminates all choices except Develop Project Management Plan and Plan Quality Management. Coordination and conflict prevention relate to Develop Project Management Plan, and preventing rework is part of Plan Quality Management.

19. **Answer** D
Explanation A WBS is created in project planning, but can be used to help manage the project during project executing. The wording in the question was not "creating a WBS," but "using a WBS." A project control system is set up during project planning, not during project executing, and therefore is the exception.

20. **Answer** D
Explanation A project manager must manage and integrate all aspects of a project. If all activities are delegated, chaos ensues, and team members will spend more time jockeying for position than completing activities.

21. **Answer** C
Explanation Crashing and replanning are essentially delaying the problem. Instead, the project manager should try to prevent it by showing the consequences if the resources are not available. This is a more effective strategy than saying, "But you gave those resources to me."

22. **Answer** B
Explanation Your first action is to formally document the requested change to the requirements, and then follow the integrated change control process.

23. **Answer** D
Explanation The other impacts to the project should be evaluated first. The change could impact scope, cost, quality, risk, resources, and/or customer satisfaction. Once these are evaluated, the change control board, if one exists, can approve or deny the change.

24. **Answer** D
Explanation You do not have enough information to consider resource leveling or crashing this project. As you work on any project, you need to constantly reevaluate the project objectives and how the project relates to other concurrent projects. Is your project still in line with corporate objectives? If the other project will impact yours, you need to be proactive and work on options now.

25. **Answer** C
Explanation Before you can do anything else, you have to know what you are going to do. Developing the management strategy will provide the framework for all the rest of the choices presented and the other activities that need to be done.

26. **Answer** D
Explanation First, you need to find out why the customer is not happy. Then meet with the team and determine options.

27. **Answer** C
Explanation Notice how much information is thrown at you in this question. It is important to practice reading through questions to discover what is important and what is simply background information. In this question, the only thing relevant was the corrective action taken. Once you discover what the primary issue is, look at the choices to find out which is best for addressing that issue. What is the primary issue here? Did you realize the team member's note is about a non-critical path activity? ("Until the project float is in jeopardy" means there is float; thus, the activity is not on the critical path.) So, is the issue the non-critical path activity or the documentation? You might disagree with the logic, but in this case the answer is the documentation. In the real world, problems often repeat. Without a record of what was done, there is no opportunity to consider the same solution for future problems. Documentation is critical to projects. Because the change log becomes part of the historical records database, it is best to first record the corrective action taken, then discuss the value of documentation at the next team meeting, and, finally, smooth the team member's issue with the accounting department.

28. **Answer** C
Explanation Do you remember what to do when there is a change? Evaluate first. You wouldn't take action before getting approval, so compressing the schedule or cutting scope would happen after consulting the sponsor and/or advising the client of the impact of the change. You would not go to the customer before going to your internal management, so advising the client is not the correct thing to do next. The next step is to discuss options with the sponsor.

29. **Answer** B
Explanation The project manager is asking how to make a change. Such a question cannot be resolved using management by objectives, team relations, or a work breakdown structure. The procedures, forms, sign-offs, and other similar requirements for handling changes should have already been determined in the change management plan. Because they were not, the project manager will waste valuable work time trying to figure it out after the fact.

30. **Answer** D
Explanation Notice that the first paragraph is extraneous. Also notice that the question states that the change has already been made. The project manager's actions would be different if the change had not been made. The project manager, with the help of others, must determine how the change impacts the project as a whole. Asking the team member how he knows there is no impact on schedule, cost, or quality is the best answer. This begins the project manager's analysis of the impacts to the project as a whole by finding out what analysis has already been done. This change minimally involves a change to the scope baseline, and likely other baselines as well. A change request must ultimately be submitted to integrated change control, but that is not listed as an option.

31. **Answer** B
Explanation Sunk costs are expended costs. The rule is that they should not be considered when deciding whether to continue with a troubled project.

32. **Answer** A
Explanation Straight-line depreciation uses the same amount each time period.

33. **Answer** B
Explanation Complaining about the missed deadline could be done, but it is not proactive. It would be helpful to get to the root cause of why this department always comes up with such ideas or changes after the project begins. However, this is not the immediate problem; the change is the immediate problem, and therefore complaining is not best. The type of project organization described is a matrix organization. There is not anything inherently wrong with such an organization, nor is there anything in this particular situation that would require it to be changed. So, changing the way the company is organized cannot be best. The department's history indicates that asking if the department has other changes is something that should definitely be done, but the proposed change needs more immediate attention. Looking at impacts of the change begins integrated change control.

34. **Answer** C
Explanation Remember, the internal rate of return is similar to the interest rate you get from the bank. The higher the rate, the better the return.

35. **Answer** A
Explanation The project charter is created in initiating. The project management plan and risk management plan are outputs of project planning. Project records, including the charter and all management plans, are archived in the Close Project or Phase process.

36. **Answer** D
Explanation Cost-benefit analysis is done earlier in the project to help select between alternatives. All the other choices are done during the Close Project or Phase process. Therefore, performing cost-benefit analysis must be the best answer.

37. **Answer** D
Explanation A risk management strategy and work package estimates are not created until project planning, but the project charter is created in initiating. A project charter may include the names of some resources (the project manager, for example), but not detailed resource estimates. Of the choices given, only the business case for the project is included in the project charter.

38. **Answer** C
Explanation The exam will ask questions like this to make sure you know the benefits you should be getting out of the processes and tools of project management. The details of what needs to be done are found in the WBS dictionary. The names of team members are included in the responsibility assignment matrix and other documents. Project history is found in the lessons learned and other historical records. A major benefit of a project charter is that it documents the authority given to the project manager.

39. **Answer** A
Explanation Constrained optimization uses mathematical models. Linear programming is a mathematical model.

40. **Answer** B
Explanation The best thing to do would be to show the impact. This is the only choice that prevents future problems—always the best choice. The other choices just pretend the problem does not exist.

41. **Answer** A
Explanation How long did it take you to read this question? Expect long-winded questions like this on the exam. Take another look at the choices before you continue reading.

This question is essentially asking if the new work should be added to the existing project. There may be many business reasons to try to do this, but from a project management perspective, major additions to the project are generally discouraged. In this case, the new work is a self-contained unit of work, has no overlap with the existing work, does not fit within the project charter, and needs a different skill set. Therefore, it is best to make it a new project.

The first step to answering this question is to realize that the work should be a separate project. The second step is to look at the choices and see which relates to initiating a new project. Reestimating the project sounds like the best choice only if you did not realize that the new work should be a separate project. Validating scope is done during project monitoring and controlling, and does not relate to the decision of whether to add work to the project. Identifying scope changes also implies that the new work has been accepted as an addition to the existing project. Developing a project charter is among the first steps of initiating a new project, and the best choice in this situation.

42. **Answer** D
Explanation Did you pick Validate Scope? Then you may have forgotten that the Validate Scope process is done during project monitoring and controlling, not project closing. Planning the risk responses and creating the staffing management plan are done earlier in the project. The lessons learned can only be completed after the work is completed.

43. **Answer** B
Explanation A project manager should be looking at where changes are coming from and doing whatever is necessary to limit the negative effects of change on the project. They need to find the root cause, so future changes may be avoided.

44. **Answer** B
Explanation The lessons learned register is a living document. It should be updated throughout the project, for the benefit of the current project, future, similar projects, and the organization as whole. The communications management plan documents how new lessons learned should be shared.

45. **Answer** C
Explanation Tacit knowledge includes emotions, experience, and ability. Sharing this type of knowledge requires an atmosphere of trust within the team or organization. The other choices relate to explicit knowledge.