PMP®

PROJECT MANAGEMENT PROFESSIONAL

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Introducing Project Risk Management

Risk is everywhere. From driving a car to parachuting, risk is inherent in the activities we choose. Within a project, risks are unplanned events or conditions that can have a positive or negative effect on its success. Not all risks are bad, but almost all are seen as a threat.

The risks that activities bring are an exchange for the benefits we get from accepting that risk. If a person chooses to jump out of a perfectly good airplane for the thrill of the fall, the exhilaration of the parachute opening, and the view of earth rushing up, there is a risk that the chute may not open—a risk that thrill seekers are willing to accept.

Project managers, to some extent, are like these thrill seekers. Parachutists complete training, pack their chutes, check and double-check their equipment, and make certain there's an emergency chute for those "just-in-case" scenarios. Project managers—good project managers—have a similar approach.

Risks in a project, should they come to fruition, can mean total project failure, increased costs, and extended project duration among other things. Risk often has a negative connotation, but like the parachutist, the acceptance of the risk can also offer a reward. For the parachutist, the risk is certain death—but the reward is the thrill of the activity. For project managers, risk can mean failure, but the reward can mean a time or cost savings, as well as other benefits.

Risk management is the process in which the project manager and project team identify project risks, analyze and rank them, and determine what actions, if any, need to be taken to avert these threats. Associated with this process are the costs, time, and quality concerns of the project brought about by the solutions to those risks. In addition, the reactions to risks are analyzed for any secondary risks the solutions may have created.

In this chapter, we'll discuss risk management planning, risk identification, analysis, response planning, and the monitoring and control of the identified risks. For the PMP exam, you'll need a firm grasp on these concepts. You'll be taking a real risk if you don't know them well.

Planning for Risk Management

Risk management planning is about making decisions. The project manager, the project team, and other key stakeholders are involved to determine the risk management processes. The risk management process is in relation to the scope of the project, the priority of the project within the performing organization, and the impact of the project

deliverables. In other words, a simple, low-impact project won't have the same level of risk planning as a high-priority, complex project.

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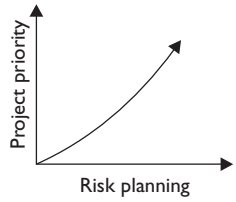


Referring to the Project Charter

One of the first inputs to risk management is the project charter. The project charter, as you may recall, formally authorizes the project, and clearly identifies the project manager as the authority who will assign resources to the project. The charter is needed in risk management planning because it identifies the business need of the project and the overall product description.

Risks that can prevent the project from satisfying the business need of the project must be addressed. The product description must also be evaluated to determine what risks may be preventing the project work from obtaining the acceptable product description.

Relying on Risk Management Policies

Organizations often have a pre-defined approach to risk management. The policies can define the activities to initiate, plan, and respond to risk. The project manager must map the project risk management to these policies to conform to the organization's requirements. Within the confines of the risk management policy, the project manager must identify any component that can hinder the success of the project.

Considering Roles and Responsibilities

In many organizations, there are predefined roles and responsibilities that influence risk management planning, the decisions relevant to the risks, and the involvement of the project participants. These roles and responsibilities—and the policies associated with working with these individuals—should be identified and considered early in the project process to save time and frustration.

In addition, the project manager should have full knowledge of the power and autonomy he has on the project. For example, a project manager may want to create plans and reactions to the risks within a project, but the policies within the performing

organization limit the amount of power the project manager has to make decisions regarding risk management. Knowledge of the limit of that power can help him work with management or customers to successfully alleviate risk.

Examining Stakeholder Tolerance

Depending on the project, the conditions, and the potential for loss or reward, stakeholders will have differing tolerances for risk. Stakeholders' risk tolerance may be known at the launch of the project, through written policy statements, or by their actions during the project.

Consider a project to install new medical equipment in a hospital: there's little room for acceptance of errors because life and death are on the line. No shortcuts or quick fixes are allowed. Now, consider a project to create a community garden. Not only are life and death not on the line in the garden project, but the acceptance of risk is different as well.

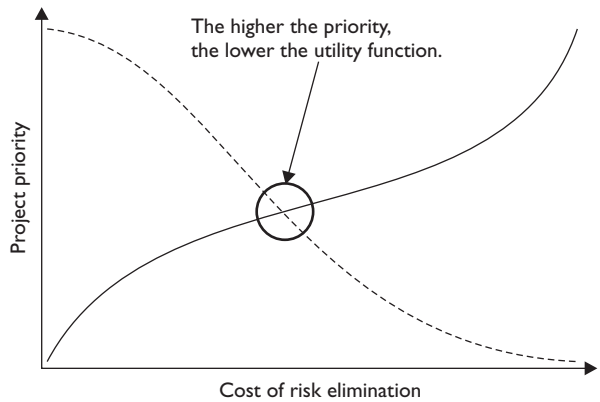
A person's willingness to accept risk is known as the utility function. The time and money costs required to eliminate the chance of failure is in proportion to the stakeholders' tolerance of risk on the project. The cost of assuring there are no threats must be balanced with the confidence that the project can be completed without extraordinary costs. Figure 11-1 demonstrates the utility function.

Using a Risk Management Plan Template

The performing organization may rely on templates for the risk management plan. The template can guide the project manager and the project team through the planning processes, the risk identification, and the values that may trigger additional planning.

FIGURE 11-1

The value of the project is relational to the cost of risk avoidance.



Hopefully, the organization allows the template to be modified or appended based on the nature of the project. As most projects, however, resemble other historical projects, the template may need only minor changes to be adapted to the current project.

A risk management plan may grant the project manager decision-making abilities on risks below a certain threshold. Risks above a preset threshold will have to be escalated to management for determination of their cost and impact on the project success.

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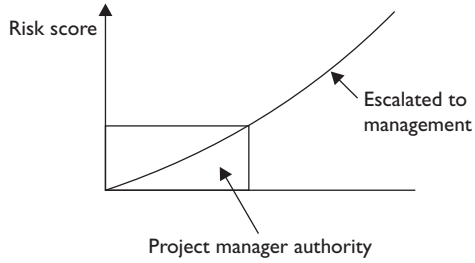


Revisiting the Work Breakdown Structure

The work breakdown structure (WBS) serves as an input to the risk management planning processes. The WBS is needed to help the project manager, and the project team identifies the components of the project and what risks may be unique to a particular area of the project versus a risk shared across the entire project.

For example, a project to create a new building has different components in the WBS: foundation, framing, interior, finishing, and so on. Within each parent component in the WBS there may be risk unique to only that category of deliverables. However, there may also be risks that should they come to fruition could affect the entire project's success. For example, a risk in the foundation could affect the entire structure later in the project life cycle. Figure 11-2 demonstrates how the WBS can contribute to risk management.

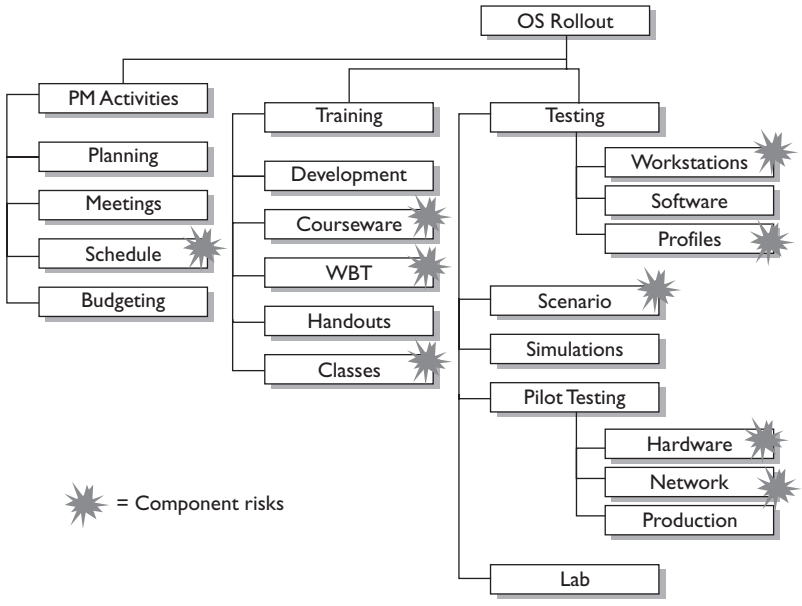
Creating the Risk Management Plan

Through planning meetings, the risk management plan is created. Risk management plan templates, performing organization policies, and the risk tolerance level of the stakeholders aid the creation of the risk management plan. Attendees should include

- The project manager
- Project team leaders
- Key stakeholders

FIGURE 11-2

The WBS can help identify risks within the project.



- Personnel specific to risk management
- Any other persons with authority or needed input to the risk management processes

Examining the *Risk Management Plan*

The risk management plan does not detail the planned responses to individual risks within the project—this is the purpose of the risk response plan. The risk management plan is responsible for determining

- How risks will be identified
- How quantitative analysis will be completed
- How qualitative analysis will be completed
- How risk response planning will happen
- How risks will be monitored
- How ongoing risk management activities will happen throughout the project life cycle

Methodology

The methodology is concerned with how the risk management processes will take place. The methodology asks

- What tools are available to use for risk management?
- What approaches are acceptable within the performing organization?
- What data sources can be accessed and used for risk management?
- What approach is best for the project type, the phase of the project, and which is most appropriate given the conditions of the project?
- How much flexibility is available for the project given the conditions, the timeframe, and the project budget?

Roles and Responsibilities

The roles and responsibilities identify the groups and individuals that will participate in the leadership and support for each of the risk management activities within the project plan. In some instances, risk management teams outside of the project team may have a more realistic, unbiased approach to the risk identification, impact, and overall risk management needs than the actual project team.

Budgeting

Based on the size, impact, and priority of the project, a budget may need to be established for the project's risk management activities. A project with high priority and no budget allotment for risk management activities may face uncertain times ahead. A realistic dollar amount is needed for risk management activities if the project is to be successful.

Scheduling

The risk management process needs a schedule to determine how often and when risk management activities should happen throughout the project. If risk management happens too late in the project, then the project could be delayed because of the time needed to identify, assess, and respond to the risks. A realistic schedule should be developed early in the project to accommodate risks, risk analysis, and risk reaction.

Risk Analysis Scoring

Prior to beginning quantitative and qualitative analysis, a clearly defined scoring system and interpretation of the scoring system must be in place. Altering the scoring process during risk analysis—or from analysis to analysis—can skew the seriousness of a risk, its impact, and the effect of the risk on the project. The project manager and

the project team must have clearly defined scores that will be applied to the analysis to ensure consistency throughout the project.

Thresholds

Thresholds are preset factors to show when the project conditions cross an action or when a response is required. Like the risks analysis scoring, threshold determination will need to be determined as soon as possible within the project plan to avoid delays. The project team's ideal threshold may differ from the customer's. Establishing a preset value prior to the project implementation will save time, frustration, and additional costs and delays.

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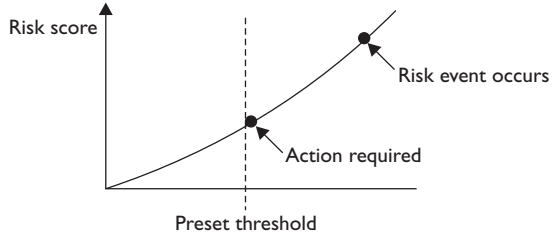

Reporting Formats

The reporting format requirements determine the type, detail, and requirements of the risk response plan. This plan is concerned with how the outputs of the risk management processes will be documented, analyzed, and communicated to management, customers, the project team, and other stakeholders.

Tracking

As risk management activities are induced, they will need to be documented. The documented actions and their results will support ongoing decisions within the current project (as well as future projects), and will serve as information for management, the project team, the customers, and other stakeholders. Should the performing organization choose to audit the risk management processes, the tracking of these activities is crucial. Based on the scope and impact of the project, the level of detail within the tracking and documentation of the risk management activities can vary.

Identifying Risks

After completing the risk management plan it's time to get to work identifying risks that can hinder the project's success. Risk identification is the process of identifying the risks and then documenting how their presence can affect the project. Risk identification is

an iterative process and can be completed by the project manager, the project team, a risk management team, and even SMEs. In some instances, stakeholders and even people outside of the project can complete additional waves of risk identification.

Preparing for Risk Identification

The risk management plan is one of the key inputs to the risk identification process. It describes how the risks will be identified, requirements for risk analysis, and the overall management of the risk response process. The risk management plan does not include the actual responses to the risks, but rather the approach to the management of the process. In addition to the risk management plan, there are several other inputs to the risk identification process.

Relying on Project Planning

Effective risk identification requires an understanding of why the project exists. The people doing the risk identification have to understand the project's purpose in order to recognize risks that could affect the project. These risk identifiers should understand the customer's objectives, expectations, and intent.

Project planning outputs referenced here can include

- The project charter
- The work breakdown structure
- Duration estimates
- The network diagram
- The project schedule
- Cost estimates
- The project budget
- Quality plans
- Resource requirements
- The resource management plan
- Procurement issues
- Communication requirements
- Assumptions
- Constraints

Creating Risk Categories

As risks are identified within the project, they should be categorized. Risk categories should be identified before risk identification begins—and should include common risks that are typical in the industry where the project is occurring. Risk categories help organize, rank, and isolate risks within the project. There are four major categories of risks:

- **Technical, quality, or performance risks** Technical risks are associated with new, unproven, or complex technology being used on the project. Changes to the technology during the project implementation can also be a risk. Quality risks are the levels set for expectations of impractical quality and performance. Changes to industry standards during the project can also be lumped into this category of risks.
- **Project management risks** These risks deal with faults in the management of the project: unsuccessful allocation of time, resources, and scheduling; unacceptable work results (low-quality work); and lousy project management as a whole.
- **Organizational risks** The performing organization can contribute to the project's risks through: unreasonable cost, time, and scope expectations; poor project prioritization; inadequate funding or the disruption of funding; the competition with other projects for internal resources.
- **External risks** These risks are outside of the project but directly affect it: legal issues, labor issues, a shift in project priorities, and weather. "Force majeure" risks can be scary and usually call for disaster recovery rather than project management. These are risks caused by earthquakes, tornados, floods, civil unrest, and other disasters.

Referring to Historical Information

Historical information is always an excellent source of information for risk identification. If the performing organization has done similar projects in the past, the historical information should be able to shed light on the risks identified early in the project, as well as risks identified throughout the project, and provide information in the final project reports. In addition to the documentation, stakeholders of the original project may have information to offer based on their experience within the project.

Historical information can also come from sources outside of the organization. The project manager should consider referencing commercial databases, articles, studies, and other readily available material relevant to the project work.

Identifying the Project Risks

Armed with the inputs to risk identification, the project manager and the project team are prepared to begin identifying risks. Risk identification should be a methodical, planned approach. Should risk identification move in several different directions at once then some risks may be overlooked. A systematic, scientific approach is best.

Reviewing Project Documents

One of the first steps the project team should take is to review the project documentation. The project plan, scope, and other project files should be reviewed. Constraints and assumptions should be reviewed, considered, and analyzed for risks. This structure review takes a very broad look at the project plan, the scope, and the activities defined within the project.

Brainstorming the Project

Brainstorming is likely the most common approach to risk identification. It's usually completed together as a project team to identify the risks within the project. The risks are identified in broad terms, posted, and then the risks' characteristics are detailed. The identified risks are categorized and will pass through qualitative and quantitative risk analysis later.

A multidisciplinary team, hosted by a project facilitator, can also complete brainstorming. This approach can include subject matter experts, project team members, customers, and other stakeholders to contribute to the risk identification process.

Using the Delphi Technique

The Delphi Technique is an anonymous method to query experts about foreseeable risks within a project, phase, or component of a project. The results of the survey are analyzed by a third party, organized, and then circulated to the experts. There can be several rounds of anonymous discussion with the Delphi Technique—without fear of backlash or offending other participants in the process.

The Delphi Technique is completely anonymous and the goal is to gain consensus on project risks within the project. The anonymous nature of the process ensures that no one expert's advice overtly influences the opinion of another participant.

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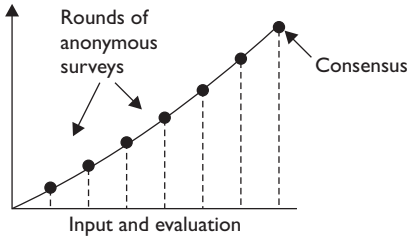

Identifying Risks Through Interviews

Interviewing subject-matter experts and project stakeholders is an excellent approach to identifying risks on the current project based on the interviewees' experience. The people responsible for risk identifications share the overall purpose of the project, the project's WBS, and likely the same assumptions as the interviewee.

The interviewee, through questions and discussion, shares his insight on what risks he perceives within the project. The goal of the process is to learn from the expert what risks may be hidden within the project, what risks this person has encountered on similar work, and what insight the person has into the project work.

Analyzing SWOT

SWOT means strengths, weaknesses, opportunities, and threats. SWOT analysis is the process of examining the project from each of the characteristic's point of view. For example, a technology project may identify SWOT as:

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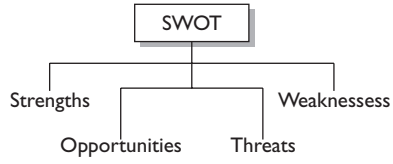

- **Strengths** The technology to be installed in the project has been installed by other large companies in our industry.
- **Weaknesses** We have never installed this technology before.
- **Opportunities** The new technology will allow us to reduce our cycle time for time-to-market on new products. Opportunities are things, conditions, or events that allow an organization to differentiate itself from competitors and improve its standing in the marketplace.
- **Threats** The time to complete the training and simulation may overlap with product updates, new versions, and external changes to our technology portfolio.

Using Checklists

If the current project is similar to projects completed in the past, using a checklist of risks is a good approach. The advantage of a checklist to identify risks is that it's a simple and direct approach to identify risks. The disadvantage of using a checklist for risk identification is that the participants may limit their risk identification to only the risk categories on the checklists. It's virtually impossible to create a complete and useable checklist of risks for most projects.

Checklists, if they are used, should be used as a guide—not as a complete and final list of risk identification. Risks that are not included on the checklists should be explored, documented, and planned for. Although checklists are an excellent tool, they often limit the project team in identifying all of the risks relevant to the current project.

exam Watch

Checklists are great for risk and quality management. At project closure, however, be certain to update the checklists for future projects. The current project will act as future historical information.

If checklists are used, then at project closure the checklist must be revisited to ensure the list is accurate and complete for future projects that may use the same checklists.

Examining the Assumptions

All projects have assumptions. Assumption analysis is the process of examining the assumptions to see what risks may stem from false assumptions. Examining assumptions is about finding the validity of the assumptions. For example, consider a project to install a new piece of software on every computer within an organization. The project team has made the assumption that all of the computers within the organization meet the minimum requirements to install the software. If this assumption were wrong, then cost increases and schedule delays would occur.

Examining the assumptions also requires a review of assumptions across the whole project for consistency. For example, consider a project with an assumption that a senior employee will be needed throughout the entire project work; the cost estimate, however, has been billed at the rate of a junior employee.

Utilizing Diagramming Techniques

There are several diagramming techniques that can be utilized by the project team to identify risks:

- **Ishikawa** These cause-and-effect diagrams are also called fishbone diagrams. These are great for root cause analysis of what factors are causing the risks

within the project. The goal is to identify and treat the root of the problem, not the symptom.

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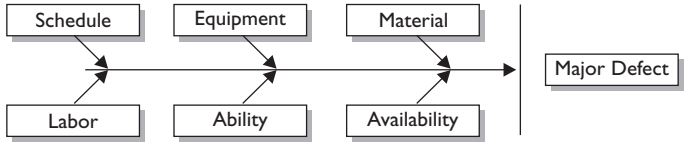

- **Flow charts** System or process flow charts show the relation between components and how the overall process works. These are useful for identifying risks between system components.
- **Influence diagrams** An influence diagram charts out a decision problem. It identifies all of the elements, variables, decisions, and objectives—and how each factor may influence another.

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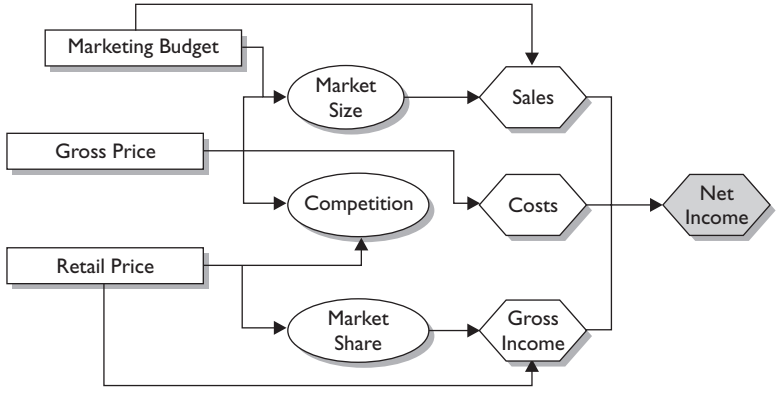


Examining the Results of Risk Identification

As the project progresses, and risk identification continues to happen, there are several outputs of risk identification:

- **Risks** Of course the most obvious output of risk identification is the risk that has been successfully identified. Recall that a risk is an uncertain event or condition that possesses the potential to have a positive or negative affect on the project's success.
- **Triggers** These are warning signs or symptoms that a risk has occurred or is about to occur. For example, should a vendor fail to complete their portion of the project as scheduled, the project completion may be delayed.
- **Inputs to other processes** Risk identification can contribute to other processes. For example, the WBS may not be sufficiently decomposed to allow risk

identification to continue. Another example is that the current sequencing of activities has too many risks, so the rescheduling and sequencing of activities are needed. The reschedule and sequencing of activities will require risk identification to happen again.

Using Qualitative Risk Analysis

Qualitative risk "qualifies" the risks that have been identified in the project. Specifically, qualitative risk analysis examines and prioritizes the risks based on their probability of occurring and the impact on the project if the risks did occur. Qualitative risk analysis is a broad approach to ranking risks by priority, which then guides the risk reaction process.

The end result of qualitative risk analysis (once risks have been identified and prioritized) can lead to more in-depth quantitative risk analysis, or move directly into risk response planning.

exam Watch

When you think of "qualitative," think of qualifying. You are qualifying, or justifying, the seriousness of the risk for further analysis. Some PMP candidates like to remember that qualitative is a list. The "L" in qualitative and list ties the two together.

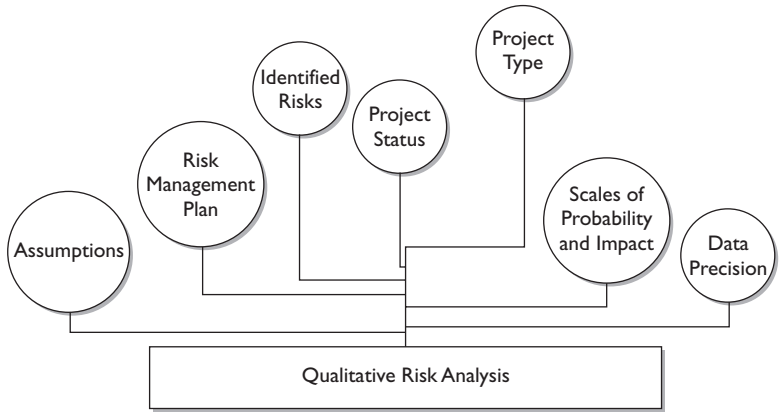
Preparing for Qualitative Risk Analysis

The risk management plan is the first input to qualitative risk analysis. The plan will dictate the process, the methodologies to be used, and the scoring model for identified risks. In addition to the risk management plan, the identified risks, obviously, will be needed to perform an analysis. These are the risks that will be scored and ranked based on their probability and impact. Figure 11-3 demonstrates all of the inputs to qualitative risk analysis.

The status of the project will also affect the process of qualitative risk analysis. Early in the project, there may be several risks that have not yet surfaced. Later in the project, new risks may become evident and need to pass through qualitative analysis. The status of the project is linked to the available time needed to analyze and study the risks. There may be more time early in the project, while a looming deadline near the project's end may create a sense of urgency to find a solution for the newly identified risks.

FIGURE 11-3

Many factors contribute to qualitative risk analysis.



The project type also has some bearing in the process. A project that has never been done before, such as the installation of a new technology has more uncertainty than projects that have been done over and over within an organization. Recurring projects have historical information to rely on, while first-time projects have limited resources to build a risk hypothesis upon.

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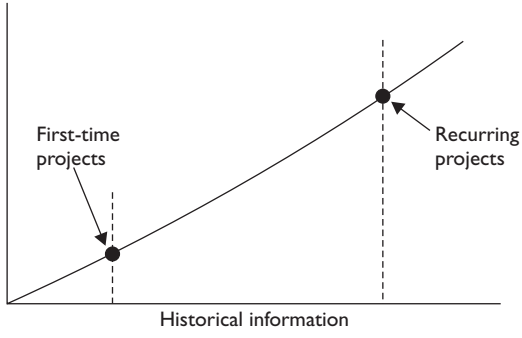


All risks are based upon some belief, proof, and data. The accuracy and source of the data must be evaluated to determine the level of confidence in the identified risks. A hunch that an element is a risk is not as reliable as measured statistics, historical information, or expert knowledge that an element is a risk. The data precision is in proportion to the reality of the risk.

Prior to the risk analysis, a pre-determined scale of probability and impact must be in place. There are multiple scales a project manager can elect to use, but generally these should be in alignment with the risk management plan. If the performing organization has a risk management model, the scale identified by the performing organization should be used. (We'll discuss the scale values in the next section.)

Finally, the assumptions used in the project must be revisited. During the risk identification process, the project team identified and documented the assumptions used within the project. These assumptions will be evaluated as risks to the project success.

Completing Qualitative Analysis

Not all risks are worth responding to while others demand attention. Qualitative analysis is a subjective approach to organizing and prioritizing risks. Through a methodical and logical approach, the identified risks are rated according to probability and potential impact.

The outcome of the ranking determines four things:

- It identifies the risks that require additional analysis through quantitative risk analysis.
- It identifies the risks that may proceed directly to risk response planning.
- It identifies risks that are not critical, project-stopping risks, but that still must be documented.
- It prioritizes risks.

Applying Probability and Impact

The project risks are rated according to their probability and impact. Risk probability is the likelihood that a risk event may happen, while risk impact is the consequence that the result of the event will have on the project objectives. Each risk is measured based on its likelihood and its impact. There are two approaches to ranking risks:

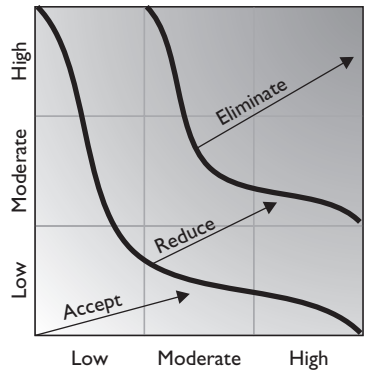
- Cardinal scales identify the probability and impact on a numerical value from .01 (very low) to 1.0 (certain).
- Ordinal scales identify and rank the risks as very high to very unlikely.

Creating a Probability-Impact Matrix

Each identified risk is fed into a probability-impact matrix, as seen in Figure 11-4. The matrix maps out the risk, its probability and possible impact. The risks with higher probability and impact are a more serious threat to the project objectives than the risks with lower impact and consequences. The risks that are threats to the project require quantitative analysis to determine the root of the risks, the methods to control the risks, and effective risk management. We'll discuss quantitative risk management later in this chapter.

FIGURE 11-4

A probability-impact matrix measures the identified risks within the project.



The project is best served when the probability scale and the impact scale are predefined prior to qualitative analysis. For example, the probability scale rates the likelihood of an individual risk happening and can be on a linear scale (.1, .3, .5, .7, .9) or the scale can be the ordinal scale. The scale, however, should be defined and agreed upon in the risk management plan. The impact scale, which measures the severity of the risk on the project's objectives, can also be ordinal or cardinal.

The value of identifying and assigning the scales to use prior to the process of qualitative analysis allows all risks to be ranked by the system and allows for future identified risks to be measured and ranked by the same system. A shift in risk rating methodologies mid-project can cause disagreements in the method of handling the project risks.

A probability-impact matrix, as seen in Figure 11-5, multiples the value for the risk probability by the risk impact for a total risk score. For example, an identified risk in a project is the possibility that the vendor may be late in delivering the hardware. The probability is rated at .9, but the impact of the risk on the project is rated at .10. The risk score is calculated by multiplying the probability times the impact—in this case, resulting in a score of .09.

The scores within the probability-impact matrix can be referenced against the performing organization's policies for risk reaction. Based on the risk score, the performing organization can place the risk in differing categories to guide risk reaction. There are three common categories based on risk score:

- **Red condition** High risk; these risks scores are high in impact and probability.
- **Yellow condition** These risks are somewhat high in impact and probability.
- **Green condition** Risks with a green label are generally fairly low in impact, probability, or both.

FIGURE 11-5

A probability-impact matrix scores the identified risks.

Risk Scores					
Probability					
0.9	0.05	0.09	0.18	0.36	0.72
0.7	0.04	0.07	0.14	0.28	0.56
0.5	0.03	0.05	0.10	0.20	0.40
0.3	0.02	0.03	0.06	0.12	0.24
0.1	0.01	0.01	0.02	0.04	0.08
	0.05	0.10	0.20	0.40	0.80
	Impact				

Legend: Low, Moderate, High

on the job

Your organization may not have a classification of risks of red, yellow, and green. Your project risks should map to the methodology your organization uses to identify and classify project risks. If there is no classification of risks, take initiative and create one for your project. Be certain to document your classification for historical information and include this information in your Lessons Learned documentation.

Testing the Assumptions

False assumptions can ruin the project. A false assumption can wreck time, cost, and even the quality of a project deliverable. Assumptions, for this reason, are treated as risks and must be tested and weighed to truncate the possibility of an assumption turning against the project. Assumptions are weighed using two factors:

- **Assumption stability** How reliable is the information that led to this assumption?
- **Assumption consequence** What is the effect on the project if this assumption is false?

The answers to these two questions will help the project team be able to deliver the project with more confidence. Should an assumption prove to be false, the weight of the assumption consequence may be low to high—depending on the nature of the assumption.

Relying on Data Precision

One of the toughest parts of qualitative risk analysis is the biased, subjective nature of the process. A project manager and the project team must question the reliability and reality of the data that lead to the ranking of the risks. For example, Susan may have

very high confidence in herself to work with a new, unproven technology. Based on this opinion, she petitions the probability of the work to be a very low score.

However, because she has no experience with the technology due to its newness, the probability of the risk of failure is actually very high. The biased opinion that Susan can complete the work with zero defects and problems is slightly skewed because she has never worked with the technology before. Obviously, a low-ranked score on a risk that should be ranked high can have detrimental effects on the project's success.

Data precision ranking takes into consideration the biased nature of the ranking, the accuracy of the data submitted, and the reliability of the nature submitted to examine the risk scores. Data precision ranking is concerned with:

- The level of understanding of the project risk
- The available data and information about the identified risk
- The quality of the data and information of the identified risk
- The reliability of the data about the identified risk

Examining the Results of Qualitative Risk Analysis

Qualitative risk analysis happens throughout the project. As new risks become evident and identified, the project manager should route the risks through the qualitative risk analysis process. The end results of qualitative risk analysis are

- **Overall risk ranking of the project** The overall risk ranking of the project allows the project manager, management, customers, and other interested stakeholders to comprehend the risk, the nature of the risks, and the condition between the risk score and the likelihood of success for a project. The risk score can be compared to other projects to determine project selection, placement of talent to a project, prioritization, the creation of a benefit-cost ratio, or even the cancellation of a project because it is deemed too risky.
- **Prioritized risks** The risks in the project can be prioritized by their score, their rank of high, medium, or low, or by their WBS components. Risks can also be categorized by their urgency for an immediate response versus those risks that can wait for a response.
- **Identification of risks requiring additional analysis** The risks categorized as high will likely need additional analysis, such as quantitative analysis. Some risks may demand immediate risk management based on the nature of the risks and the status of the project.

- **Trends in qualitative analysis** As the project progresses and risk analysis is repeated, trends in the ranking and analysis of the risk may become apparent. These trends can allow the project manager and other risk experts to respond to the root cause and predicted trends to eliminate or respond to the risks within the project.

Preparing for Quantitative Risk Analysis

Quantitative risk analysis attempts to numerically assess the probability and impact of the identified risks. Quantitative risk analysis also creates an overall risk score for the project. This method is more in-depth than qualitative risk analysis and relies on several different tools to accomplish its goal.

Qualitative risk analysis typically precedes quantitative analysis. All or a portion of the identified risks in qualitative risk analysis can be examined in the quantitative analysis. The performing organization may have policies on the risk scores in qualitative analysis, which require the risks to advance to the quantitative analysis. The availability of time and budget may also be a factor in the determination of which risks should pass through quantitative analysis. Quantitative analysis is a more time-consuming process, and is therefore also more expensive. There are several goals of quantitative risk analysis:

- To ascertain the likelihood of reaching project success
- To ascertain the likelihood of reaching a particular project objective
- To determine the risk exposure for the project
- To determine the likely amount of the contingency reserve needed for the project
- To determine the risks with the largest impact on the project
- To determine realistic time, cost, and scope targets

Quantitative risk analysis relies on hard numbers. Each risk is assigned a score, not a high, medium, low ranking.

You can remember quantitative analysis as the "N" in quantitative and the "N" in numbers.

Considering the Inputs for Quantitative Analysis

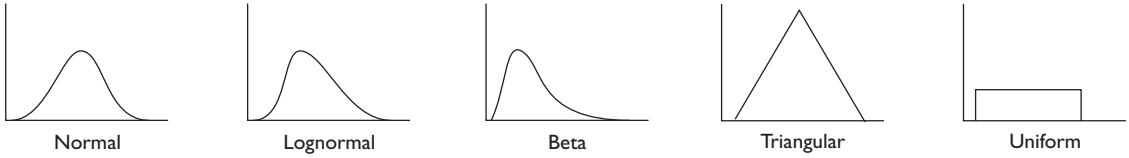
Based on the time and budget allotments for quantitative analysis, as defined in the risk management plan, the project manager can move into quantitative analysis. There are, however, seven inputs to quantitative risk analysis the project manager should rely on :

- **Risk management plan** The risk management plan identifies the risk management methodology, the allotted budget for risk analysis, the schedule, and the risk scoring mechanics—among other attributes.
- **Identified risks** The risks that have been identified and promoted to quantitative analysis are needed.
- **Prioritized risks** The risks as ranked by weight, priority, or WBS component will need to be readily available. This information can offer significant information for the quantitative analysis of the risks, reveal trends among the risks, and show those risks that require the most attention.
- **List of risks marked for additional analysis** Any risks with a high or moderate score need quantitative analysis. These risks require immediate attention since their presence can ensure detrimental effects on the project's success.
- **Historical information** Similar projects will likely have similar risks. The history of how the risks were managed, mismanaged, or discovered during the project can provide crucial information regarding the current project. In addition, there may be historical information available through commercial databases or other sources.
- **Expert judgment** Individuals, other project teams within the performing organizations, subject matter experts, or other consultants may provide valuable experience and insight into the identified risks.
- **Other planning outputs** These include the cost and schedule estimates, documented logic of project decisions, scheduling information, and information on the technical attributes of the project.

Interviewing Stakeholders and Experts

Interviews with stakeholders and subject matter experts can be one of the first tools to quantify the identified risks. The interview can focus on worst-case, best-case, and most-likely scenarios if the goal of the quantitative analysis is to create a triangular distribution; most quantitative analysis, however, uses continuous probability distributions. Figure 11-6 shows five sample distributions: normal, triangular, uniform, beta, and lognormal.

FIGURE 11-6 Distributions illustrate the likelihood and impact of an event.



Continuous probability distribution is an examination of the probability of all possibilities within a given range. For each variable, the probability of a risk event, and the corresponding consequence for the event, may vary. In other words, dependent on whether the risk event occurs and how it happens, a reaction to the event may also occur. The distribution of the probabilities and impact include

- Uniform
- Normal
- Triangular
- Beta
- Lognormal

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Don't invest too much time on knowing these distribution types for the exam. The questions on quantitative analysis will focus on more accessible methods than these in-depth, analytic approaches.

Applying Sensitivity Analysis

Sensitivity analysis examines each project risk on its own merit. All other risks in the project are set at a baseline value. The individual risk then is examined to see how it may affect the success of the project. The goal of sensitivity analysis is to determine which individual risks have the greatest impact on the project's success and then to escalate the risk management processes on these risk events.

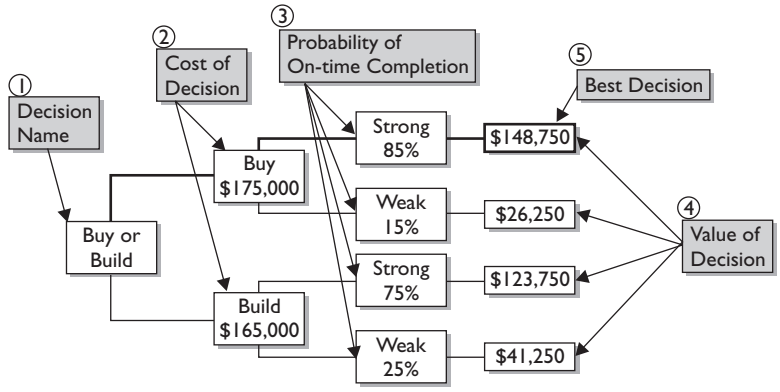
Using a Decision Tree

A decision tree is a method to determine which of two decisions is the best to make. For example, it can be used to determine buy-versus-build scenarios, lease-or-purchase equations, or whether to use in-house resources rather than outsourcing the project work. The decision tree model examines the cost and benefits of both decision outcomes and weighs the probability of success for each of the decisions.

The purpose of the decision tree is to make a decision, calculate the value of that decision, or to determine which decision costs the least. Follow Figure 11-7 through the various steps of the decision tree process.

FIGURE 11-7

Decision trees analyze the probability of events and calculate decision value.



Completing a Decision Tree

As the project manager of the new GFB Project, you have to decide whether to create a new web application in-house or send the project out to a developer. The developer you would use (if you were to outsource the work) quotes the project cost at $175,000. Based on previous work with this company, you are 85 percent certain they will finish the work on time.

Your in-house development team quotes the cost of the work as $165,000. Again, based on previous experience with your in-house developers, you feel 75 percent certain they can complete the work on time. Now let's apply what we know to a decision tree:

- Buy or build is simply the decision name.
- The cost of the decision if you "buy" the work outside of your company is $175,000. If you build the software in-house, the cost of the decision is $165,000.
- Based on your probability of completion by a given date, you apply the 85 percent certain to the "strong" finish for the buy branch of the tree. Because you're 85 percent certain, you're also 15 percent uncertain; this value is assigned to the "weak" value on the buy branch. You complete the same process for the build branch of the tree.
- The value of the decision is the percentage of strong and weak applied to each branch of the tree.
- The best decision is based solely on the largest value of all possible decisions.

Using a Project Simulation

Project simulations allow the project team to play "what-if" games without affecting any areas of production. The Monte Carlo technique is the most common simulation.

Monte Carlo got its name from Monte Carlo, Monaco (world-renowned for its slot machines, roulette wheels, and other games of pure chance). Monte Carlo, typically completed through a computer software program, completely simulates a project with values for all possible variables to predict the most likely model.

Examining the Results of Quantitative Risk Analysis

Quantitative risk analysis is completed throughout the project as risks are identified and passed through qualitative analysis, as project conditions change, or on a preset schedule. The end result of quantitative risk analysis include

- **A prioritized list of risks** This list of quantified risks demonstrates those risks with the highest potential for endangering the project's success. This list includes the risks that have the greatest opportunity for the project. Each risk is identified with its probability and impact.
- **Probabilistic analysis** The risks within the project allow the project manager or other experts to predict the likelihood of the project success. The project may be altered by the response to certain risks; this response can increase cost and delay the project completion date.
- **Probability of costs and schedule objectives** Based on the identified risks, their impact, and probability of occurring, forecasts for the project schedule and the project costs are created. The more negative risks that occur within a project, the greater the chance of delays and increased costs.
- **Trends** As the project moves towards completion, quantitative risk analysis may be repeated over and over. In each round of analysis, trends in the identified risks may become visible. The trends in the risk can help the project team eliminate the root cause of the risk, reduce their probability, or control their impact.

Planning for Risk Response

Risk response planning is all about options and actions. It focuses on how to decrease the possibility of risks from adversely affecting the project's objectives, and on how to increase the likelihood of positive risks that can aid the project. Risk response planning assigns responsibilities to people and groups close to the risk event. Risks will increase or decrease based on the effectiveness of risk response planning.

INSIDE THE EXAM

Inside the Exam

Risk management planning is the process of determining how risk management will be handled. The stakeholder analysis will reveal their willingness to accept risk—which is also known as their utility function. The performing organization may have standard practices for risk management, risk management templates, or guidance from historical information.

There are two types of risk: business risk, which is gains or losses from a financial point of view; and pure risks, which only has a down side. Both types of risks must be assessed and managed.

Risk identification happens early on the project to allot time for risk response planning. Risk identification also happens throughout the project. The project manager, the project team, customers, and other stakeholders are involved in the process. There are several methods to risk identification, though interviews and the Delphi Technique are two of the most common approaches.

Qualitative analysis qualifies the list of risks in a matrix based on impact and probability. This subjective approach uses a common *very low*, *low*, *moderate*, *high*, and *very high* ranking. The risks can be prioritized based on their score.

After qualitative analysis, some risks may be sent through quantitative analysis. This approach attempts to quantify the risks with hard numbers, values, and data. Quantification of the risk can lead to time and cost contingencies for the project, priority of the risks, and an overall risk score. Monte Carlo simulations are typically associated with quantitative risk analysis.

There are four risk responses

- **Avoidance** The project plan is altered to avoid the identified risk.
- **Mitigation** Effort is made to reduce the probability, impact, or both of an identified risk in the project before the risk event occurs.
- **Transference** The risk is assigned to a third party, usually for a fee. The risk still exists, but the responsibility is deflected to the third party.
- **Acceptance** The risks are seen as nominal so they are accepted. Risks, regardless of size, that have no other recourse may also be accepted.

As the project progresses, risk monitoring and control is implemented. Risks are monitored for signs that they may be coming to fruition. The project team and the project manager execute the risk response plan and document the results. Earned value analysis, which is typically used to measure project performance, can also be used to signal impending project risks.

The responses to identified risks must be in balance with the risk itself. The cost and time invested in a risk must be met with the gains from reducing the risk's impact and probability. In other words, a million-dollar solution for a hundred-dollar problem is unacceptable. The people or individuals that are assigned to the risk must have the authority to react to the project risk as planned. In most cases, there will be several risk responses that may be viable for the risk—the best choice for the identified risk must be documented, agreed upon, and then followed through should the risk come to fruition.

Preparing for Risk Response

To successfully prepare for risk response, the project manager, project team, and appropriate stakeholders will rely on several inputs—many of which stem from qualitative and quantitative risk analysis—such as:

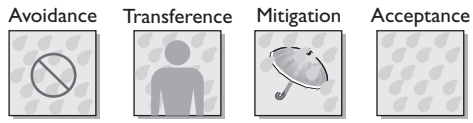
- The risk management plan
- A list of prioritized risks
- Risk ranking
- A prioritized list of quantified risk
- A probabilistic analysis of the project
- The probability of the project meeting the cost and schedule goals
- The list of potential responses decided upon when risks were first identified
- Any risk owners that have been identified
- A listing of common cause risks to address multiple risks with an achievable solution
- Trends from qualitative and quantitative analysis

Creating Risk Responses

There are several tools and techniques that the project team can employ to respond to risks. Each risk should be evaluated to determine which category of risk response is most appropriate. When a category of risk response has been selected, the response must then be developed, refined, documented, and readied for use, if needed. In addition, secondary responses may be selected for each risk. The purpose of risk response planning is to bring the overall risk of the project down to an acceptable level. In addition, risk response planning must address any risks that are scored unacceptably high.

FIGURE 11-8

Risk responses can be remembered through a simple analogy.



There are four categories of risk response as seen in Figure 11-8; each will be discussed in the following sections:

- Avoidance
- Transference
- Mitigation
- Acceptance

Avoiding the Risk

Avoidance is simply avoiding the risk. This can be accomplished many different ways and generally happens early in the project when any change will result in fewer consequences than later in the project plan. Examples of avoidance include

- Changing the project plan to eliminate the risk.
- Clarifying project requirements to avoid discrepancies.
- Hiring additional project team members that have experience with the technology that the project deals with.
- Using a proven methodology rather than a new approach

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You can remember the avoidance risk by using the analogy of a lunch outing. If it's raining outside and you don't want to get wet, you can avoid the rain by staying indoors.

Transferring the Risk

Transference is the process of transferring the risk (and the ownership of the risk) to a third party. The risk doesn't disappear, it's just someone else's problem. Transference of a risk usually costs a premium for the third party to own and manage that risk. Common examples of risk transference include

- Insurance
- Performance bonds
- Warrantees

- Guarantees
- Fixed-priced contracts

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You can remember the transference of a risk by using the same lunch outing analogy. If it's raining outside and you don't want to get wet at lunch, you can use transference by sending someone else out for lunch. Your co-worker may agree to go out in the rain if you'll pay for their lunch, too. Transferring a risk doesn't make the risk go away; the project still has the risk, but the ownership of the risk has been assigned to some other party.

Mitigating the Risk

Mitigating risks is an effort to reduce the probability and/or impact of an identified risk in the project. Mitigation is done—based on the logic—before the risk happens. The cost and time to reduce or eliminate the risks is more cost effective than repairing the damage caused by the risk. The risk event may still happen, but hopefully the cost and impact of the risk will both be very low.

Mitigation plans can be created so they are implemented should an identified risk cross a given threshold. For example, a manufacturing project may have a mitigation plan to reduce the number of units created per hour should the equipment's temperature cross a given threshold. The reduction is the number of units per hour that it may cost the project in time. Additionally, the cost of extra labor to run the equipment longer because the machine is now operating at a slower pace may be attributed to the project. However, should the equipment fail, the project would have to replace the equipment and be delayed for weeks while awaiting repairs.

Examples of mitigation include

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Want to mitigate the risk of getting wet at lunch? Bring an umbrella. The rain is still falling, but you won't get soaked with an umbrella.

- Adding activities to the project to reduce the risk probability or impact
- Simplifying the processes within the project
- Completing more tests on the project work before implementation
- Developing prototypes, simulations, and limited releases

Accepting the Risks

Risk acceptance is the process of simply accepting the risks because no other action is feasible, or the risks are deemed to be of small probability, impact, or both and that a formal response is not warranted. Passive acceptance requires no action; the project team deals with the risks as they happen. Active acceptance entails developing a contingency plan should the risk occur.

A contingency plan is a predefined set of actions the project team will take should the risk event occur. A contingency plan has also been called "a worst-case scenario" plan. A similar plan, a fallback plan, instructs the project team on how to unravel the project work back to an acceptable point in the project. Both fallback plans and triggers or thresholds within the project conditions instigate the plans.

Most risk acceptance policies rely on a contingency allowance for the project. A contingency allowance is an amount of money the project will likely need in the contingency reserve based on the impact, probability, and expected monetary value of a risk event.

exam Watch

Acceptance and the rainy lunch analogy can work a couple of different ways. You can use passive acceptance and get wet at lunch. Or you can use a contingency plan: order a pizza.

For example, Risk A has a 25 percent chance of happening and has a cost value of negative $2000. The probability times the impact equates to a negative $2000 expected monetary value (Ex$V). Another risk, Risk B, has a 40-percent chance of happening and has benefit value of $4000. The Ex$V for Risk B is $1600. If these were the only risks in the project, an ideal contingency reserve would be $400. This is calculated by adding the positive and negative risk values to predict the amount that the project is likely to be underfunded if the risks happen. Table 11-1 shows several risks and their Ex$V.

TABLE 11-1

Caption PLEASE!!!!!!!!!!

Risk	Probability	Impact: Cost Is Negative; Benefits Are Positive	Ex$V
A	20%	–$4000	–$800
B	45%	$3000	$1350
C	10%	$2100	$210
D	65%	–$2500	–$1625
		Contingency Reserve Fund	$865

Examining the Results of Risk Response Planning

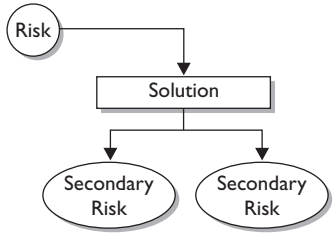
The major output of risk response planning is the risk response plan. This plan is also sometimes called the risk register since it includes all risks, their details, and the expected response for each. This plan describes the reaction to each identified risk and includes

- A description of the risk, what area of the project it may affect, the causes of the risk, and its impact on project objectives
- The identities of the risk owners and their assigned responsibilities
- The outputs of qualitative and quantitative analysis
- A description of the response to each risk, such as: avoidance, transference, mitigation, or acceptance
- The actions necessary to implement the responses
- The budget and schedule for risk responses
- Both the contingency and fallback plans

Working with Residual Risks

The risk response plan also acknowledges any residual risks that may remain after planning, avoidance, transfer, or mitigation. Residual risks are typically minor and have been acknowledged and accepted. Management may elect to add both contingency costs and time to account for the residual risks within the project.

Accounting for Secondary Risks



Secondary risks, however, are risks that stem from risk responses. For example, transference may elect to hire a third party to manage an identified risk. A secondary risk caused by the solution is the failure of the third party to complete their assignment as scheduled. Secondary risks must be identified, analyzed, and planned for, just as any another identified risk.

Creating Contracts for Risk Response

When multiple entities are involved in a project, contractual agreements may be necessary to identify the responsible parties for identified risks. The contract may be needed for insurance purposes, customer acceptance, or acknowledgement of responsibilities between the entities completing the project. Transference is an example of contractual agreements for the responsibility of risks within a project.

Establishing a Contingency Reserve

Through risk response planning a contingency reserve should be established for time and cost values to respond to given risks should the risks come into play. Identifying the probability of a risk and multiplying the value by its cost impact can calculate a contingency reserve. For example, a risk has a 20 percent chance of happening. Should the risk occur, it would cost $4000 to correct. The contingency amount needed for this risk is 20 percent of the $4000, which is $800.

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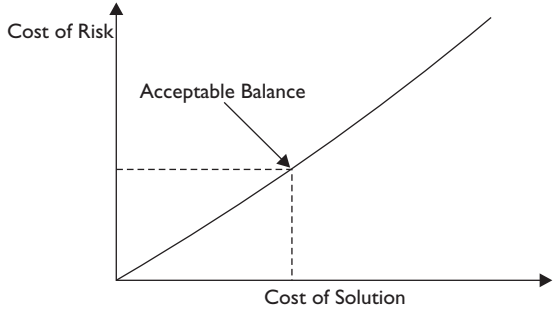
A contingency reserve may also be called a management reserve. Often, a management reserve deals with time while a contingency reserve deals with dollars. Some organizations lump time and money into the same reserve. You should know what nomenclature your organization uses—and what they anticipate the meaning of the reserves to be.

Justifying Risk Reduction

To reduce risk, additional time or monies are typically needed. The process and logic behind the strategies to reduce the risk should be evaluated to determine if the solution is worth the tradeoffs. For example, a risk may be eliminated by adding $7500 to a project's budget. However, the likelihood of the risk occurring is relatively low. Should the risk happen, it would cost, at a minimum, $8000 to correct and the project would be delayed by at least two weeks.

The cost of preventing the risk versus the cost of responding to it must be weighed and justified. If the risk is not eliminated with the $7500 cost, and the project moves forward as planned, it has, theoretically, saved $15,500 because the risk did not happen and the response to the risk did not need to happen.

III 11-10



However, if the risk does happen, the project will lose at least $8000 and be delayed at least two weeks. The cost inherent in the project delay may be more expensive than

the solution to the risk. The judgment of solving the risk to reduce the likelihood of delaying the project may be wiser than ignoring the risk and saving the cost by solving the risk problem.

Updating the Project Plan

The risk reactions, contingency plans, and fallback plans should all be documented and incorporated into the project plan—for example, updating the schedule, budget, and WBS to accommodate additional time, money, and activities for risk responses. The responses to the risks may change the original implementation of the project and should be updated to reflect the project plan and intent of the project team, management, and other stakeholders. A failure to update the project plan may cause risk reactions to be missed—and skew performance measurements.

Implementing Risk Monitoring and Control

Risks must be actively monitored and new risks must be responded to as they are discovered. Risk monitoring and control is the process of monitoring identified risks for signs that they may be occurring, controlling identified risks with the agreed responses, and looking for new risks that may creep into the project. Risk monitoring and control also is concerned with the documentation of the success or failure of risk response plans, and keeping records of metrics that signal risks are occurring, fading, or disappearing from the project.

Risk monitoring and control is an active process that requires participation from the project manager, the project team, key stakeholders, and, in particular, risk owners within the project. As the project progresses, risk conditions may change and require new responses, additional planning, or the implementation of a contingency plan.

There are several goals to risk monitoring and control

- To confirm risk responses are implemented as planned
- To determine if risk responses are effective or if new responses are needed
- To determine the validity of the project assumptions
- To determine if risk exposure has changed, evolved, or declined due to trends in the project progression
- To monitor risk triggers
- To confirm policies and procedures happen as planned
- To monitor the project for new risks

Preparing for Risk Monitoring and Control

Risk monitoring and control is an active process. There are several inputs the project team and the project manager must rely on to effectively monitor and control risks, such as:

- **The risk management plan**
- **The risk response plan**
- **Project communications** The results of project work can inform the project manager and the project team of new and pending risks. In addition, project team members may create reports to monitor or document risks. These reports are known as issue logs, action-items, jeopardy warnings, and escalation notices.
- **New risk identification** Throughout the project life cycle, new risks may surface that the project team and the project manager have not considered. These risks should be fed into the risk management process to identify valid responses.
- **Scope changes** Change requests should be analyzed for their impact on the project—and for any risks in the change that could affect the project objectives, as well as any new risks the increased scope presents.

Completing Risk Monitoring and Control

Risk monitoring and risk control happens throughout the project. It is not a solitary activity that is completed once and never revisited. The project manager and the project team must actively monitor risks, respond with the agreed actions, and scan the horizon for risks that have not been addressed. Risk monitoring and control is a recurring activity that requires input from all project participants. There are several tools available to implement risk monitoring and control as the following sections discuss.

Completing Risk Response Audits

A risk response audit examines the planned risk response, how well the planned actions work, and the effectiveness of the risk owner in implementing the risk response. The audits happen throughout the project to measure the effectiveness of mitigating, transferring, and avoiding risks. The risk response audit should measure the effectiveness of the decision and its impact on time and cost.

Completing Periodic Risk Reviews

Project risk should be on the agenda at every project team meeting. The periodic risk review is a regularly scheduled discussion throughout the project to ascertain the level of foreseeable risks, the success of risk responses in the project to date, and a review of pending risks. Based on circumstances within the project, risk rankings and prioritization may fluctuate. Changes to the project scope, team, or conditions may require qualitative and quantitative analysis.

Using Earned Value Analysis

Earned Value analysis measures project performance. When project performance is waning, the project is likely missing targeted costs and schedule goals. The results of earned value analysis can signal that risks are happening within the project—or that new risks may be developing.

For example, a schedule performance index (SPI) of .93 means the project is off schedule by seven percent. A risk based on this value could mean that the project team is having difficulty completing the project work as planned. Additional work will continue to be late, the project will finish late, and quality may suffer as the team attempts to rush to complete assigned tasks.

Measuring Technical Performance

Throughout the project, the project team's technical competence with the technology being used in the project should increase. The level of technical achievement should be in proportion to the expected level of technical performance within the project. If the project team is not performing at a level of expected technical expertise, the project may suffer additional risks due to the discrepancy. Technical performance can be measured by the success of completing activities throughout the project or through project phases.

Completing Additional Risk Planning

Most likely, new risks will become evident during the project implementation. The project team, project manager, and key stakeholders that discover the risks should communicate the risk. The risk must then be acknowledged, documented, analyzed, and planned for. The project team must be encouraged to communicate the discovery of new risks.

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Often, project team members don't want to share discovered risks with the project manager because the presence of a risk can be seen as bad news. The project manager must stress to the project team members that identified risks should be communicated so the risks can be planned for through avoidance, mitigation, transference, or even acceptance.

Examining the Results of Risk Monitoring and Control

Risk monitoring and control helps the project become more successful. Risk monitoring and control measures the planned responses to risks—and creates reactions to unplanned risks. The outputs of risk monitoring and control also aim to help the project reach its objectives. There are six outputs of the process:

- **Workaround plans** Workarounds are documented in the project plan and the risk response plan. Workarounds are unplanned reactions to risks that were not identified or that were accepted.
- **Corrective actions** As risks come to fruition, corrective actions are needed to bypass the risk. The two types of corrective action are workarounds and contingency plans. Corrective actions are actions taken to bring the project back into compliance with the project plan.
- **Change requests** As workarounds and contingency plans are used, they require changes to the project plan. The changes to the project plan due to the risks are completed through integrated change control. The changes are documented, approved, and incorporated into the project plan.
- **Risk response plan updates** As risks occur, the responses to those risks should be documented and updated in the risk response plan. Should risk rankings change during the project, the change in ranking, the logic behind the change, and the results of the risk rank change should be documented in the risk response plan. For the risks that do not occur, the risks should be documented and considered closed in the risk response plan.
- **Risk database** A database of recognized risks, the planned response, and the outcome of the risk should be documented and recorded in an organization-wide risk database. This risk database can serve other project managers as historical information. Over time, the risk database can become a risk lessons learned program.

- **Checklist updates** Checklists of identified risks will help future projects recognize and manage identified risks.

CERTIFICATION SUMMARY

PMP candidates will need a firm grasp on how to plan for, monitor, and control projects risks. To effectively handle risks, the project manager will need to begin with risk management planning. A large, complex project will likely have more risks than a smaller project. In any situation, however, risks must be identified and planned for. The performing organization will often have risk management policies that dictate how the risk planning sessions are to be performed, and what level of risks call for additional planning.

Some stakeholders—and organizations—will be more tolerant to accept risks than others. A person's willingness to accept risk is called the *utility function*. A perfect example of the utility function is the stock market. Some people will only invest in solid, reliable stocks—but with little return on their investment. Other people will invest in startups, low-dollar stocks, and other high-risk companies—but will receive a higher yield if their investments pay off. The same is true with projects: some risks are worth taking while others are not. Risk planning and the utility function help the project manager determine which risks are acceptable.

As risks are identified the project manager can use the Delphi Technique to build consensus on which risks have the highest impact on the project. This anonymous approach allows participants to speak freely on the risks. Participants aren't hindered by the opinion of other stakeholders. The comments on the identified risks are distributed to all of the participants allowing participants to comment, concur, or dismiss opinions on the identified risks. Through rounds of discussion consensus on the risks are reached.

Qualitative risk analysis qualifies identified risks and creates a prioritization of the risks. Each risk is considered for its impact and likelihood of occurring. Once the risks have passed through qualitative risk analysis, quantitative risk analysis is needed. Quantitative risk analysis assesses the probability and impact of the risks and determines a risk score based on further analysis, discussion, expert judgment, simulations, and interviews with stakeholders.

Key Terms

If you're serious about passing the PMP exams, memorize these terms and their definitions. For maximum value, create your own flashcards based on these definitions and review daily. You can find additional information on these terms in the project glossary.

acceptance
avoidance
brainstorming
cause-and-effect diagrams
contingency reserve
decision tree analysis
Delphi Technique, the
Ex$V
influence diagram
interviewing
mitigation
qualitative risk analysis
quantitative risk analysis
residual risks
risk
risk categories
risk database
risk management plan
risk owners
scales of probability and impact
secondary risks
sensitivity analysis
simulation
system or process flowcharts
transference
triggers
utility function
workarounds

TWO-MINUTE DRILL

- ❑ Risk management planning is determining how the risk management activities within the project will take place. It is not the response or identification of risks, but the determination of how to manage project risks.
- ❑ Risk management planning is accomplished through planning meetings with the project team, management, customers, and other key stakeholders.
- ❑ Utility function is a person's willingness to accept risks
- ❑ The output of risk management planning is the risk management plan.
- ❑ Risks are uncertain events that can affect a project's objectives for good or bad.
- ❑ Risks can be placed into four different categories:
- ❑ Technical, quality, or performance risks
- ❑ Project management risks
- ❑ Organizational risks
- ❑ External risks
- ❑ Project files from published information and previous projects can serve as input to risk identification.
- ❑ The Delphi Technique allows participants to identify risk anonymously without fear of embarrassment. A survey allows results to be shared with all participants for comments on each other's anonymous input. Rounds of surveying and analysis can create consensus on the major project risks.
- ❑ Triggers are warning signs that a risk is about to happen or has happened.
- ❑ Risks are evaluated for their impact and likelihood.
- ❑ Risks can be ranked by ordinal ranking by using such indicators as very low, low, moderate, high, and very high.
- ❑ Risks can also be analyzed using a cardinal ranking system of numerical values that are assigned to each risk based on its impact and probability.
- ❑ An overall project risk ranking can be used to compare the current projects with other projects in the organization.
- ❑ The risks can be moved into quantitative analysis for further study.
- ❑ Risks are assigned numeric values. Such as: there is a 50 percent likelihood that the risk will occur, causing a $10,000 cost.
- ❑ The Monte Carlo simulation can determine the likelihood of the project's success, predict the costs of a specific risk exposure, and identify realistic time, scope, and cost objectives.

- ❑ Interviews with stakeholders and subject matter experts are an excellent start for quantitative risk analysis.
- ❑ Decision trees help determine the cost, benefit, and value of multiple decisions. They are based on the cost of the decision and the probability of completing an objective.
- ❑ Risk response planning focuses on reducing threats and increasing opportunities as a result of risks. Risk thresholds, defined in risk management planning, describe the acceptable level of risk within a company.
- ❑ Risk owners are the individuals or groups that are responsible for a risk response, and should participate in the risk response planning
- ❑ Risk avoidance changes the project plan to avoid the risk, as well as conditions that promote the risk, or it attempts to reduce the risk's impact on the project's success.
- ❑ Risk transference moves the risk consequence to a third party. The risk doesn't go away, just the responsibility of the risk. Though ultimately, the performing organization still retains the ultimate accountability and results of the risk event.
- ❑ Risk mitigation involves actions designed to reduce the likelihood of a risk occurring, reduce the impact of a risk on the project objectives, or both.
- ❑ Risk acceptance acknowledges the risk exists but the risk is not worthy of a more in-depth response, or a more in-depth response is not available for the risk.
- ❑ Residual risks are risks that remain after avoidance, transference, mitigation, and acceptance. Secondary risks are new risks that arise from a risk response.
- ❑ Identified risks must be tracked, monitored for warning signs, and documented. The responses to the risks are monitored and documented as successful or less successful than expected.
- ❑ Issue logs, action-item lists, jeopardy warnings, and escalation notices are all types of communication reports the project team and risk owners must use to document and track identified risks.
- ❑ Risk response audits measure the success of the responses and the effectiveness of the cost, scope, and quality values gained or lost by the risk responses.
- ❑ Earned value analysis can measure project performance, but it can also predict and signal pending risks within the project.
- ❑ As unexpected risks arise, the project team may elect to use workarounds to diminish the impact and probability of those risks. Workarounds, however, should be documented and incorporated into the project plan and risk response plan as they occur.

SELF TEST

1. Which of the following is not an input to risk management planning?
   A. The project charter
   B. Risk identification
   C. Defined roles and responsibilities
   D. WBS
2. Frances is the project manager of the LKJ Project. Which of the following techniques will she use to create the risk management plan?
   A. Risk tolerance
   B. Status meetings
   C. Planning meetings
   D. Variance meetings
3. Which of the following is the output of risk management planning?
   A. Roles and responsibilities
   B. Operational transfer issues
   C. Risk response plan
   D. Risk management plan
4. You are the project manager of the GHK Project. You and the manufacturer have agreed to substitute the type of plastic used in the product to a slightly thicker grade should there be more than a seven percent error in production. The thicker plastic will cost more and require the production to slow, but the errors should diminish. This is an example of which of the following?
   A. Threshold
   B. Tracking
   C. Budgeting
   D. JIT manufacturing
5. A person's willingness to tolerate risk is known as _____.
   A. The utility function
   B. Herzberg's Theory of Motivation
   C. Risk acceptance
   D. The risk-reward ratio

6. A risk trigger is also called which of the following?

A. A warning sign
B. A delay
C. A cost increase
D. An incremental advancement of risk

7. The customers of the project have requested additions to the project scope. The project manager brings notice that additional risk planning will need to be added to the project schedule. Why?

A. The risk planning should always be the same amount of time as the activities required by the scope change.
B. Risk planning should always occur whenever the scope is adjusted.
C. Risk planning should only occur at the project manager's discretion.
D. The project manager is incorrect; risk planning does not need to happen at every change in the project.

8. The risks of financial gain or loss are called _____.

A. Business risks
B. Financial risks
C. Organizational risks
D. Functional risks

9. _____ include(s) fire, theft, or injury, and offer(s) no chance for gain.

A. Business risks
B. Pure risks
C. Risk acceptance
D. Life risks

10. Complete this sentence: a risk is a(n)_____ occurrence that can affect the project for good or bad.

A. Known
B. Potential
C. Uncertain
D. Known unknown

11. When should risk identification happen?

A. As early as possible in the initiation process
B. As early as possible in the planning process

C. As early as possible in the controlling process
D. As early as possible in the execution process

12. You are the project manager of the KLJH Project. This project will last two years and has 30 stakeholders. How often should risk identification take place?

A. Once at the beginning of the project
B. Throughout the execution processes
C. Throughout the project
D. Once per project phase

13. Risk identification is considered to be _____. (Choose the best answer.)

A. Iterative
B. Self-led
C. Mandatory
D. Optional

14. You are the project manager for a project that will create a new and improved web site for your company. Currently, your company has over eight million users around the globe. You would like to poll experts within your organization with a simple, anonymous form asking for any foreseeable risks with the design, structure, and intent of the web site. With the collected information, subsequent anonymous polls are submitted to the group of experts. This is an example of _____.

A. Risk identification
B. A trigger
C. An anonymous trigger
D. The Delphi Technique

15. Which of the following describes SWOT?

A. Analysis of: strengths, weakness, options, and timing
B. Analysis of: strengths, weakness, opportunities, and threats
C. An elite project team that comes in and fixes project risks and threats
D. Ratings of 1 to 100

16. Which risk analysis provides the project manager with a risk ranking?

A. Quantifiable
B. Qualitative
C. The utility function
D. SWOT analysis

17. A table of risks, their probability, impact, and a number representing the overall risk score is called a _____.

A. Risk table
B. Risk matrix
C. Quantitative matrix
D. Qualitative matrix

18. You are presented with the following table:

Risk Event	Probability	Impact Cost/Benefit	Ex$V
1	.20	–4000	
2	.50	5000	
3	.45	–300	
4	.22	500	
5	.35	–4500	

What is the Ex$V for Risk Event 3?

A. $135
B. –$300
C. $45
D. –$135

19. You are presented with the following table:

Risk Event	Probability	Impact Cost/Benefit	Ex$V
1	.35	–4000	
2	.40	50000	
3	.45	–300000	
4	.30	50000	
5	.35	–45000	

Based on the preceding table, what is the amount needed for the contingency fund?

A. Unknown with this information
B. 249,000

C. 117,150
D. 15750

20. The water sanitation project manager has determined the risks associated with handling certain chemicals are too high. He has decided to allow someone else to complete this portion of the project, and so has outsourced the handling and installation of the chemicals and filter equipment to an experienced contractor. This is an example of which of the following?

A. Avoidance
B. Acceptance
C. Mitigation
D. Transference

21. A project manager and the project team are actively monitoring the pressure gauge on a piece of equipment. Sarah, the engineer, recommends a series of steps to be implemented should the pressure rise above 80 percent. The 80-percent mark represents what?

A. An upper control limit
B. The threshold
C. Mitigation
D. A workaround

22. You are presented with the following table:

Risk Event	Probability	Impact Cost/Benefit	Ex$V
1	.20	-4000	
2	.50	5000	
3	.45	-300	
4	.22	500	
5	.35	-4500	
6			

Complete Risk 6 based on the following information: Marty is 60 percent certain that he can get the facility needed for $45,000, which is $7000 less than what was planned for.

A. .60, 45,000, 27,000
B. .60, 52,000, 31,200
C. .60, 7,000, 4200
D. .60, -7,000, -4200

23. How can a project manager determine whether it is better to make or buy a product?

A. Decision Tree Analysis
B. Fishbone model
C. Ishikawa diagram
D. ROI Analysis

24. Which of the following can determine multiple scenarios with risk and probability of impact?

A. Decision trees
B. Monte Carlo simulations
C. Pareto charts
D. Gantt charts

25. A project can have many risks with high-risk impact scores, but have an overall low risk score. How is this possible?

A. The risk scores are graded on a bell curve.
B. The probability of each risk is low.
C. The impact of each risk is not accounted for until it comes to fruition.
D. The risks are rated HML.

SELF TEST ANSWERS

1. ☑ **B.** Risk identification is not an input to risk management planning.
   ☒ **A, C,** and **D** are all incorrect. The project charter, defined roles and responsibilities, and the WBS are all inputs to risk management planning.

2. ☑ **C.** Planning meetings are used to create the risk management plan. The project manager, project team leaders, key stakeholders, and other individuals with the power to make decisions regarding risk management attend the meetings.
   ☒ Choices **A, B,** and **D** are incorrect as these choices do not fully answer the question.

3. ☑ **D.** The only output of risk management planning is the risk management plan.
   ☒ **A** is incorrect; roles and responsibilities are an input to the risk management planning process. **B**, operational transfer issues, may have associated risks, but they are not an output of the risk management planning process. **C**, the risk response plan, is not an output of risk management planning. It is an output of risk response planning.

4. ☑ **A.** An error value of seven percent represents the threshold the project is allowed to operate under. Should the number of errors increase beyond seven percent, the current plastic will be substituted.
   ☒ **B** is incorrect since tracking is the documentation of a process through a system or workflow, or the documentation of events through the process. **C,** budgeting, is incorrect. **D,** JIT manufacturing, is a scheduling approach to ordering the materials only when they are needed in order to keep inventory costs down.

5. ☑ **A.** The utility function describes a person's willingness to tolerate risk.
   ☒ **B,** is incorrect; Herzberg's Theory of Motivation is an HR theory that describes motivating agents for workers. **C** is also incorrect; risk acceptance describes the action of allowing a risk to exist because it is deemed low in impact, low in probability, or both. **D,** the risk-reward ratio, is incorrect. This describes the potential reward for taking a risk in the project.

6. ☑ **A.** Risk triggers can also be known as warning signs. Triggers signal that a risk is about to happen or has happened.
   ☒ **B, C,** and **D** are all incorrect, as these answers do not properly describer a risk trigger.

7. ☑ **B.** When the scope has been changed, the project manager should require risk planning to analyze the additions for risks to the project success.
   ☒ **A** is incorrect; the scope changes may not require the same amount of time as the activities needed to complete the project changes. **C** is incorrect because risk planning should not occur at the project manager's discretion, but instead should be based on evidence within the project and the policies adopted in the risk management plan. **D** is also incorrect; when changes are added to the project scope, risk planning should occur.

8. ☑ **A.** Business gains are directly tied to the risk of financial gains or loss.
☒ Choices **B, C,** and **D** are not relevant terms.

9. ☑ **B.** Pure risks are the risks that could threaten the safety of the individuals on the project.
☒ Choice **A** is incorrect because business risks affect the financial gains or loss of a project. **C** and **D** are incorrect since these terms are not relevant.

10. ☑ **C.** Risks are not planned, they are left to chance. The accommodation and the reaction to a risk can be planned, but the event itself is not planned. If risks could be planned, Las Vegas would be out of business.
☒ **A, B,** and **D** are all incorrect since these terms do not accurately complete the sentence.

11. ☑ **B.** Risk identification is a planning process and should happen as early as possible to allot adequate time for risk reaction planning.
☒ **A, C,** and **D** are all incorrect because risk identification does not happen as part of the initiation, controlling, or execution processes.

12. ☑ **C.** Risk identification happens throughout the project. Recall that planning is iterative; as the project moves towards completion, new risks may surface that call for identification and planned responses.
☒ **A** is incorrect; risk identification should happen throughout the project, not just at the beginning. **B** is incorrect because risk identification is part of planning. **D** is incorrect because the nature of the project phase may require and reveal more than one opportunity for risk identification.

13. ☑ **A.** Risk identification is an iterative process that should happen throughout the project life.
☒ **B** is incorrect since risk identification often requires intense analysis, team involvement, and experts to lead the process. **C** is incorrect; while risk identification may be considered mandatory, iterative is a better description because risk identification happens over and over. **D** is incorrect; risk identification is not optional.

14. ☑ **D.** An anonymous poll allowing experts to freely submit their opinion without fear of backlash is an example of the Delphi Technique.
☒ **A, B,** and **C** are incorrect; these choices do not accurately answer the question.

15. ☑ **B.** SWOT analysis is part of risk identification and examines the strengths, weakness, opportunities, and threats of the project to make certain all possibilities for risk identification are covered.
☒ **A** is incorrect because SWOT examines all four perspectives. **C** and **D** are incorrect because these ratings are part of quantitative-qualitative risk analysis.

16. ☑ **B.** The risk ranking is based on the *very high*, *high*, *medium*, *low*, and *very low* attributes of the identified risks.

☒ **A** is incorrect because it is not relevant to the questions. **C** is incorrect; utility function describes an organization's tolerance for risk. **D,** SWOT analysis, is part of risk identification.

17. ☑ **B.** A table of risks, their probability, and impact equate to a risk score in a risk matrix.
☒ **A** is incorrect since it does not fully answer the questions. **C** and **D** are incorrect because a risk matrix can be used in both quantitative and qualitative risk analysis.

18. ☑ **D.** Risk Event 3 has a probability of 45 percent and an impact cost of –$300, which equates to –$135.
☒ **A, B,** and **C** are all wrong because the values are incorrect answers for the formula.

19. ☑ **C.** The calculated amount for each of the risk events is shown in the following table:

Risk Event	Probability	Impact Cost/Benefit	Ex$V
1	0.35	–4000	–1400
2	0.4	50000	20000
3	0.45	–300000	–135000
4	0.3	50000	15000
5	0.35	–45000	–15750
			–117150

☒ **A, B,** and **D** are incorrect answers because they do not reflect the contingency amount needed for the project based on the preceding table.

20. ☑ **D.** Because the risk is not eliminated but transferred to someone else or another entity, it is considered transference.
☒ **A** is incorrect because the risk still exists, but it is handled by another entity. **B** is incorrect because the project manager has not accepted the risk, deciding instead to allow another entity to deal with it. **C** is incorrect; the risk has not been mitigated in the project.

21. ☑ **B.** The 80-percent mark is a threshold.
☒ **A** is incorrect; an upper control limit is a boundary for quality in a control chart. **C** is incorrect; mitigation is a planned response should a risk event happen. **D** is incorrect; a workaround is an action to bypass the risk event.

22. ☑ **C.** Marty is 60 percent certain he can save the project $7000. The $4200 represents the 60-percent certainty of the savings.
☒ **A, B,** and **D** are all incorrect since these values do not reflect the potential savings of the project.

23. ☑ **A.** A decision tree model can separate the pros and cons of buying versus building.
☒ B and C are incorrect; a fishbone diagram and an Ishikawa diagram show cause and effect. D is incorrect; ROI analysis does not answer the question as fully as a decision tree.

24. ☑ **B.** Monte Carlo simulations can reveal multiple scenarios and examine the risks and probability of impact.
☒ **A,** decision trees, help guide the decision making process. **C,** a Pareto chart, helps identify the leading problems in a situation. **D,** Gantt charts, compare the lengths of activities against a calendar in a bar chart format.

25. ☑ **B.** A risk can have a very high impact on the project, but inversely have an extremely low probability score.
☒ **A** is incorrect and not relevant to the scenario. **C** is not a true statement. **D** is also incorrect; a model using high, medium, low versus a numbering system would not alter the overall high or low risk score of the project.