Project Risk Management

Head First PMP

&

Information Technology
PROJECT MANAGEMENT | 7e

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Project Management Maturity by Industry Group and Knowledge Area

KEY: 1 = LOWEST MATURITY RATING 5 = HIGHEST MATURITY RATING

Knowledge Area	**Engineering/ Construction**	**Telecommunications**	**Information Systems**	**Hi-Tech Manufacturing**
Scope	3.52	3.45	3.25	3.37
Time	3.55	3.41	3.03	3.50
Cost	3.74	3.22	3.20	3.97
Quality	2.91	3.22	2.88	3.26
Human Resources	3.18	3.20	2.93	3.18
Communications	3.53	3.53	3.21	3.48
Risk	**2.93**	**2.87**	**2.75**	**2.76**
Procurement	3.33	3.01	2.91	3.33

*Ibbs, C. William and Young Hoon Kwak. “Assessing Project Management Maturity,” *Project Management Journal* (March 2000).

Negative Risk

- A dictionary definition of risk is “the possibility of loss or injury”
- Negative risk involves understanding potential problems that might occur in the project and how they might impede project success
- Negative risk management is like a form of insurance; it is an investment.

Risk Can Be Positive

- Positive risks are risks that result in good things happening; sometimes called opportunities.
- A general definition of project risk is an uncertainty that can have a negative or positive effect on meeting project objectives
- The goal of project risk management is to minimize potential negative risks while maximizing potential positive risks.

If your project requires that you stand on the edge of a cliff, then there's a risk that you could fall.

If it's very windy out or the ground is slippery and uneven, then falling is more likely.

A risk is any uncertain event or condition that might affect your project.

Not all risks are negative.

Not all risks are negative

Some events (like finding an easier way to do an activity) or conditions (like lower prices for certain materials) can help your project! When this happens, we call it an **opportunity**… but it's still handled just like a risk.

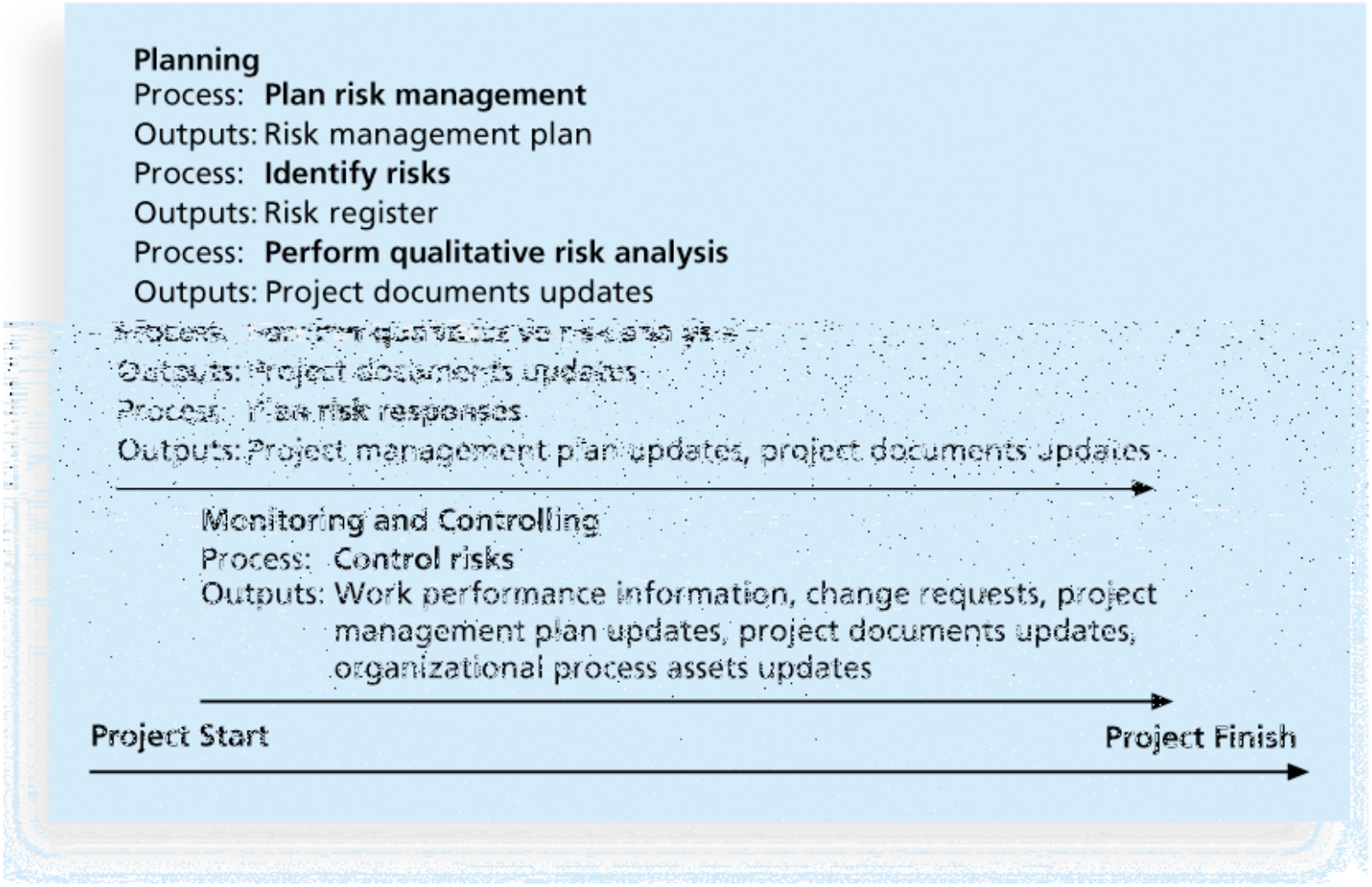
Project Risk Management Processes

- **Planning risk management** : Deciding how to approach and plan the risk management activities for the project
- **Identifying risks**: Determining which risks are likely to affect a project and documenting the characteristics of each
- **Performing qualitative risk analysis**: Prioritizing risks based on their probability and impact of occurrence

Project Risk Management Processes (cont'd)

- **Performing quantitative risk analysis**: Numerically estimating the effects of risks on project objectives
- **Planning risk responses**: Taking steps to enhance opportunities and reduce threats to meeting project objectives
- **Controlling risk**: Monitoring identified and residual risks, identifying new risks, carrying out risk response plans, and evaluating the effectiveness of risk strategies throughout the life of the project

Figure 11-3. Project Risk Management Summary



Planning Risk Management

- The main output of this process is a **risk management plan**—a plan that documents the procedures for managing risk throughout a project
- The project team should review project documents and understand the organization's and the sponsor's approaches to risk
- The level of detail will vary with the needs of the project

Topics Addressed in a Risk Management Plan

- Methodology
- Roles and responsibilities
- Budget and schedule
- Risk categories
- Risk probability and impact
- Revised stakeholders' tolerances
- Tracking
- Risk documentation

and Analysis

Outputs

The Risk Management Plan is the only output

It tells you how you're going to handle risk on your project—which you probably guessed, since that's what management plans do. It says how you'll assess risk on the project, who's responsible for doing it, and how often you'll do risk planning (since you'll have to meet about risk planning with your team throughout the project).

The plan has parts that are really useful for managing risk:

- ❑ It has a bunch of **categories** that you'll use to classify your risks. Some risks are technical, like a component that might turn out to be difficult to use. Others are external, like changes in the market or even problems with the weather.

- ❑ You might find a **Risk Breakdown Structure** (**RBS**) here. It's a great tool for managing your risk categories. It looks like a WBS, except instead of tasks it shows how the risks break down into categories.

- ❑ It's important to come up with **probability and impact guidelines** to help you figure out how big a risk's impact is. The impact tells you how much damage the risk will cause to your project. A lot of projects classify impact on a scale from minimal to severe, or from very low to very high.

- ❑ The plan should also give you a **scale** to help figure out the probability of the risk. Some risks are very likely; others aren't.

The Risk Management Plan is your guide to identifying and analyzing risks on your project.

Risk Management Plan

It tells you who identifies and analyzes the risks, how they do it, and how often it happens.

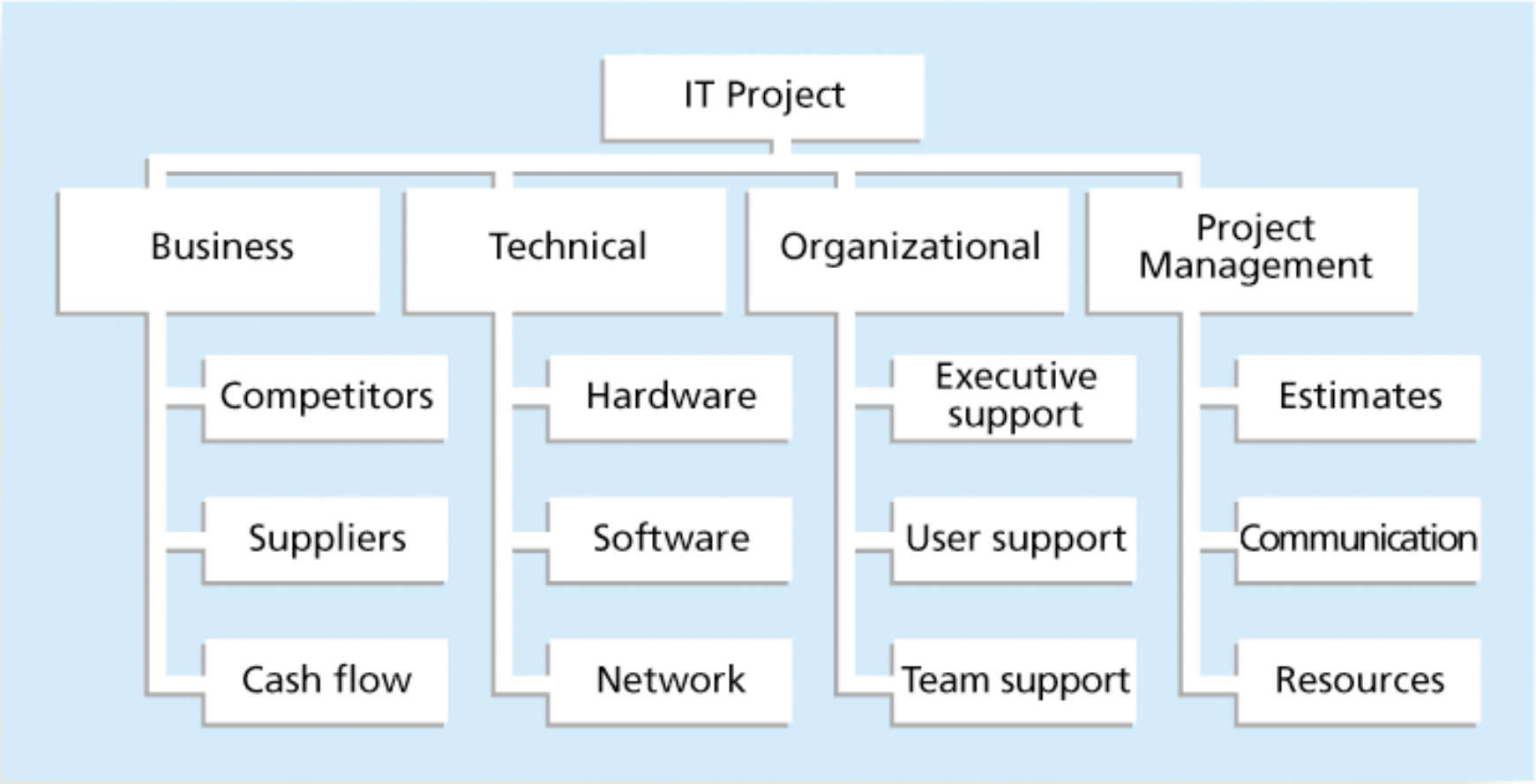
Broad Categories of Risk

- Market risk
- Financial risk
- Technology risk
- People risk
- Structure/process risk

Risk Breakdown Structure

- A **risk breakdown structure** is a hierarchy of potential risk categories for a project
- Similar to a work breakdown structure but used to identify and categorize risks

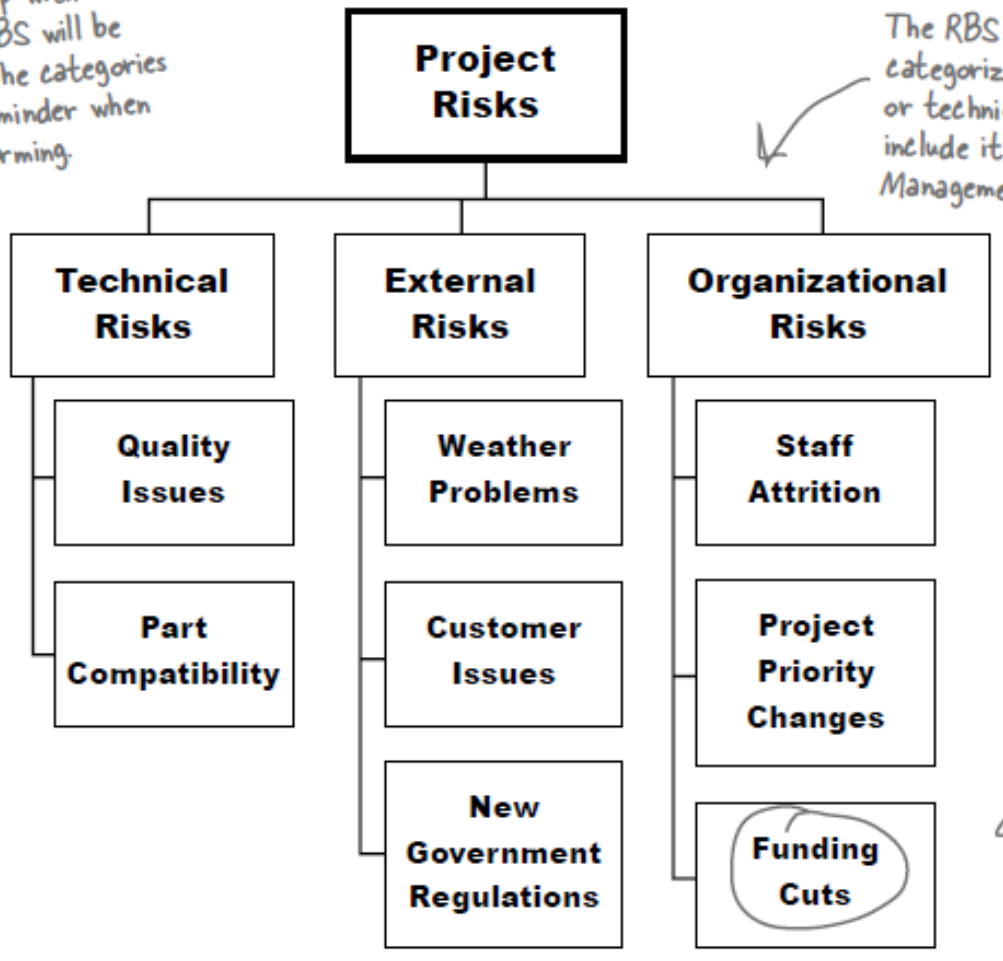
Sample Risk Breakdown Structure



When you sit down with the team to come up with a list of risks, the RBS will be really useful. The categories are a great reminder when you're brainstorming.

each risk and give it a category.

The RBS is just one way to categorize risks. It's not a tool or technique by itself; you'll include it as part of the Risk Management Plan.



Once you come up with a list of risks, you'll label each one of them with one of these categories. That will make it easier to figure out how to deal with the risks later.

Potential Negative Risk Conditions Associated With Each Knowledge Area

Knowledge Area	Risk Conditions
Integration	Inadequate planning; poor resource allocation; poor integration management; lack of post-project review
Scope	Poor definition of scope or work packages; incomplete definition
Time	Errors in estimating time or resource availability; errors in determining the critical path; poor allocation and management of float; early release of competitive products
Cost	Estimating errors; inadequate productivity, cost, change, or contingency
Quality	Poor attitude toward quality; substandard design, materials, and workmanship; inadequate quality assurance program
Human resource	Poor conflict management; poor project organization and definition of responsibilities; absence of leadership
Communications	Carelessness in planning or communicating
Risk	Ignoring risk; unclear analysis of risk; poor insurance management
Procurement	Unenforceable conditions or contract clauses; adversarial relations
Stakeholders	Lack of consultation with key stakeholder

Identifying Risks

- Identifying risks is the process of understanding what potential events might hurt or enhance a particular project.
- Risk identification tools and techniques include:
  - Brainstorming
  - The Delphi Technique
  - Interviewing
  - SWOT analysis

Brainstorming

- **Brainstorming** is a technique by which a group attempts to generate ideas or find a solution for a specific problem by amassing ideas spontaneously and without judgment
- An experienced facilitator should run the brainstorming session
- Be careful not to overuse or misuse brainstorming.

Delphi Technique

- The **Delphi Technique** is used to derive a consensus among a panel of experts who make predictions about future developments
- Provides independent and anonymous input regarding future events
- Uses repeated rounds of questioning and written responses and avoids the biasing effects possible in oral methods, such as brainstorming.

Interviewing

- **Interviewing** is a fact-finding technique for collecting information in face-to-face, phone, e-mail, or instant-messaging discussions

- Interviewing people with similar project experience is an important tool for identifying potential risks

SWOT Analysis

- SWOT analysis (strengths, weaknesses, opportunities, and threats) can also be used during risk identification

- Helps identify the broad negative and positive risks that apply to a project

Risk Register

- The main output of the risk identification process is a list of identified risks and other information needed to begin creating a risk register
- A **risk register** is:
  - A document that contains the results of various risk management processes and that is often displayed in a table or spreadsheet format
  - A tool for documenting potential risk events and related information
- **Risk events** refer to specific, uncertain events that may occur to the detriment or enhancement of the project

Risk Register Contents

- An identification number for each risk event
- A rank for each risk event
- The name of each risk event
- A description of each risk event
- The category under which each risk event falls
- The root cause of each risk

Risk Register Contents (cont'd)

- Triggers for each risk; **triggers** are indicators or symptoms of actual risk events
- Potential responses to each risk
- The **risk owner** or person who will own or take responsibility for each risk
- The probability and impact of each risk occurring.
- The status of each risk

Sample Risk Register

No.	Rank	Risk	Description	Category	Root Cause	Triggers	Potential Responses	Risk Owner	Probability	Impact	Status
R44	1										
R21	2										
R7	3										

- No.: R44
- Rank: 1
- Risk: New customer
- Description: We have never done a project for this organization before and don't know too much about them. One of our company's strengths is building good customer relationships, which often leads to further projects with that customer. We might have trouble working with this customer because they are new to us.
- Category: People risk
- Etc.

Now put it in the risk register

Outputs

The point of the Identify Risks process is to… well, identify risks. But what does that really give you? You need to know enough about each risk to analyze it and make good decisions about how to handle it. So when you're doing interviews, leading brainstorming sessions, analyzing assumptions, gathering expert opinions with the Delphi technique, and using the other Identify Risks tools and techniques, you're gathering exactly the things you need to add to the risk register.

Each risk that you and the team come up with should go here.

It's a good idea for your Identify Risks meetings to include a discussion of how to respond to the risks, but you'll really dive into this later in the Plan Risk Responses process.

This is where the results of your root cause analysis go.

Identified Risks	Potential Responses	Root Causes
Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby
High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National weather service predicts 35% chance of high winds
Truck rental is unavailable	Pay to reserve equipment at a second company	Higher than expected demand for equipment in the area this season
Equipment failure during project	No responses were found by the team	Recent industry report cites higher-than-expected failure rates for critical equipment

Risk Register

You might discover new risk categories, like "Equipment." If you do, you'll go back to the RBS and add them.

You'll get a chance to come up with more complete responses later.

Some risks do not have an obvious response.

You already created the Risk Management Plan in the last process. Now you're going back and updating it by adding the risk register.

The risk register is built into the Risk Management Plan. Updates to the risk register are the only output of the Identify Risks process.

Performing Qualitative Risk Analysis

- Assess the likelihood and impact of identified risks to determine their magnitude and priority

- Risk quantification tools and techniques include:
  - Probability/impact matrixes
  - The Top Ten Risk Item Tracking
  - Expert judgment

Probability/Impact Matrix

- A **probability/impact matrix** or **chart** lists the relative probability of a risk occurring on one side of a matrix or axis on a chart and the relative impact of the risk occurring on the other.
- List the risks and then label each one as high, medium, or low in terms of its probability of occurrence and its impact if it did occur.
- Can also calculate **risk factors**:
  - Numbers that represent the overall risk of specific events based on their probability of occurring and the consequences to the project if they do occur.

Sample Probability/Impact Matrix

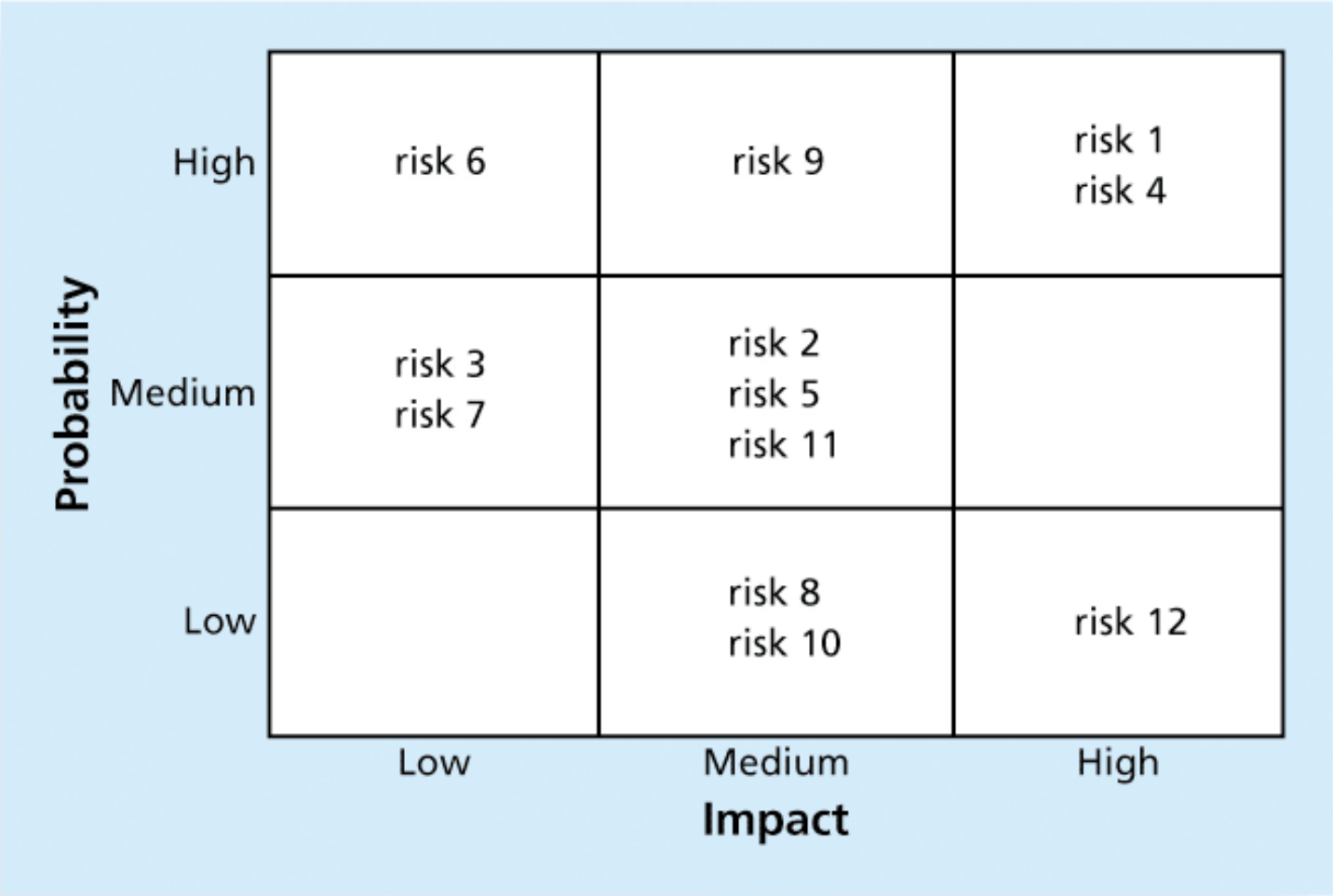
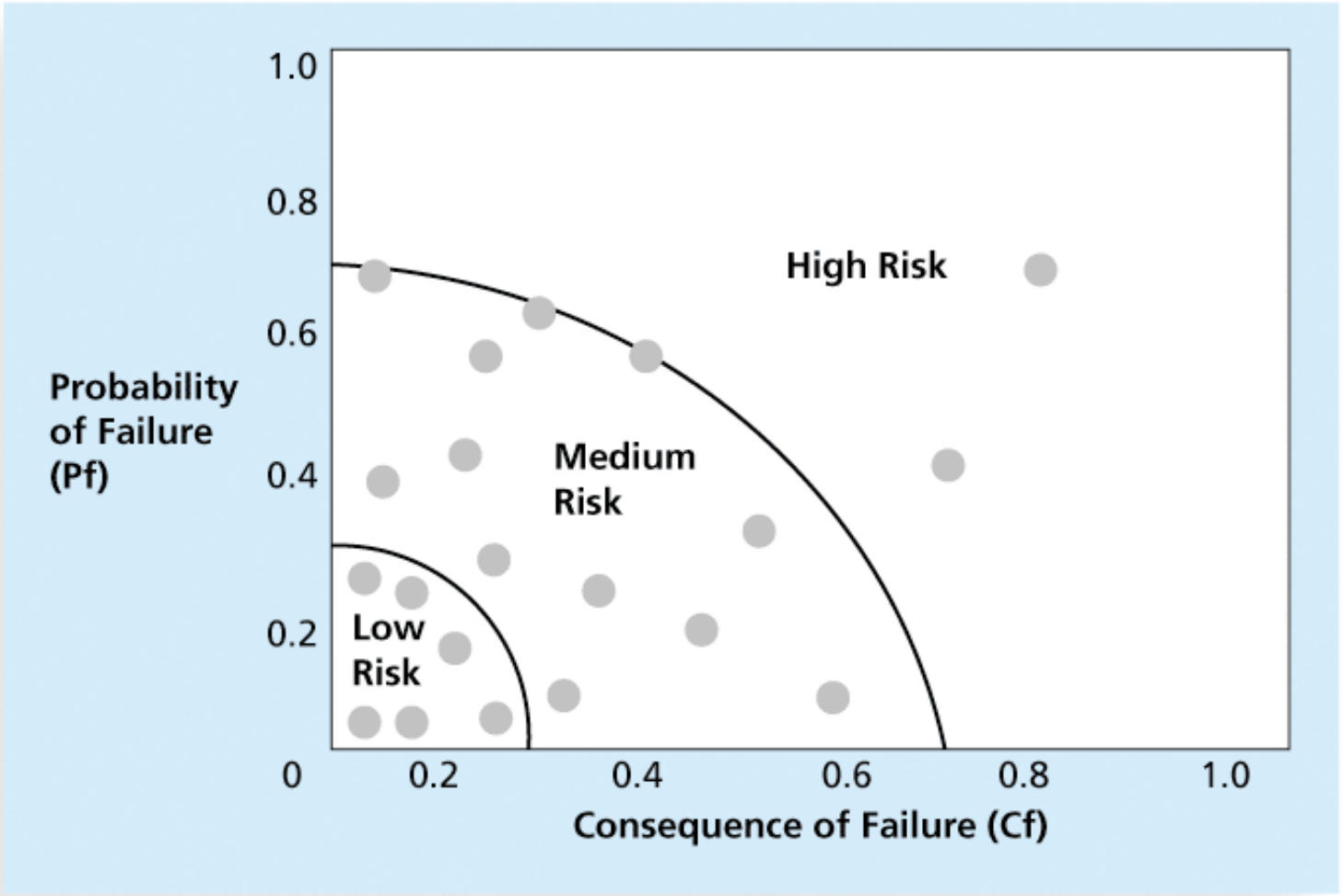


Figure 11-6. Chart Showing High-, Medium-, and Low-Risk Technologies



Top Ten Risk Item Tracking

- **Top Ten Risk Item Tracking** is a qualitative risk analysis tool that helps to identify risks and maintain an awareness of risks throughout the life of a project
- Establish a periodic review of the top ten project risk items
- List the current ranking, previous ranking, number of times the risk appears on the list over a period of time, and a summary of progress made in resolving the risk item

Example of Top Ten Risk Item Tracking

	MONTHLY RANKING			
Risk Event	Rank This Month	Rank Last Month	Number of Months in Top Ten	Risk Resolution Progress
Inadequate planning	1	2	4	Working on revising the entire project management plan
Poor definition	2	3	3	Holding meetings with project customer and sponsor to clarify scope
Absence of leadership	3	1	2	After previous project manager quit, assigned a new one to lead the project
Poor cost estimates	4	4	3	Revising cost estimates
Poor time estimates	5	5	3	Revising schedule estimates

Watch List

- A **watch list** is a list of risks that are low priority, but are still identified as potential risks
- Qualitative analysis can also identify risks that should be evaluated on a quantitative basis

Risk data quality assessment means making sure that the information you're using in your risk assessment is accurate. Sometimes it makes sense to bring in outside experts to check out the validity of your risk assessment data. Sometimes you can even confirm the quality of the data on your own, by checking some sample of it against other data sources.

Risk urgency assessment is checking out how soon you're going to need to take care of a particular risk. If a risk is going to happen soon, you'd better have a plan for how to deal with it soon, too.

Expert judgment definitely comes in handy when you're assesssing risks. Who better to help you come up with things that might go wrong than experts who have been through similar projects before?

Risk probability and impact assessment
One of the best ways to be sure that you're handling your risks properly is to examine how likely they are to happen, and how bad (or good) it will be if they do. This process helps you assign a probability to the likelihood of a risk occurring, and then figure out the actual cost (or impact) if it does happen. You can use these values to figure out which of your risks need a pretty solid mitigation plan, and which can monitored as the project goes on.

Probability and impact matrix is a table where all of your risks are plotted out according to the values you assign. It's a good way of looking at the data so you can more easily make judgments about which risks require response. The ones with the higher numbers are more likely to happen and will have a bigger impact on your project if they do. So you'd better figure out how to handle those.

Risk categorization is all about grouping your risks so that you can come up with a better strategy for dealing with them. You might group them by the phase of the project where you'll see them, or by the source of the risk. Or you could come up with a bunch of additional categories that would help you to organize your response better and be ready for the risk if it should happen.

Creating risk categories can help you deal with whole groups of risks in one response plan.

Perform Qualitative Risk Analysis helps you prioritize each risk and figure out its probability and impact.

Sometimes you'll find that some risks have obviously low probability and impact, so you won't put them in the main section of your register. Instead, you can add them to a separate section called the watchlist, which is just a list of risks. It'll include risks you don't want to forget about, but which you don't need to track as closely. You'll check your watchlist from time to time to keep an eye on things.

Probability	P&I				
.9	.09	.27	.45	.63	.81
.7	.07	.21	.35	.49	.63
.5	.05	.15	.25	.35	.45
.3	.03	.09	.15	.21	.27
.1	.01	.03	.05	.07	.09
Impact	.1	.3	.5	.7	.9

Sharpen your pencil

Here are some facts about the cliff project that were uncovered during qualitative analysis. Update the risk register on the facing page with the appropriate information.

Risk	Probability	Impact
1. Landslide	.1	.9
2. Winds	.7	.9
3. No truck	.3	.7
4. Storms	.5	.3
5. Supplies	.1	.5
6. Illness	.1	.7

During the Perform Qualitative Risk Analysis sessions, the team assigned a probability and impact number to each of the risks on the facing page.

Prob. & Impact Matrix

Probability					
.9	.09	.27	.45	.63	.89
.7	.07	.21	.35	.49	.63
.5	.05	.15	.25	.35	.45
.3	.03	.09	.15	.21	.27
.1	.01	.03	.05	.07	.09
	.1	.3	.5	.7	.9

Impact

This gives you a good picture of the threshold the company has set for evaluating risks.

You can figure out the priority of each risk based on its probability and impact. Low-priority risks have no shading, medium ones are light gray, and high ones are dark gray.

1. The Organizational Process Assets at your company set a high-priority risk as any risk with a Probability and Impact score higher than 0.20. Medium-priority risks are those between 0.10 and 0.19, and low-priority are those between 0–0.09. Low-priority risks can be monitored on a watchlist, but High and Medium ones must have a response strategy.
   Fill in the missing values in the Priority and Probability columns in the risk register on the right, using the Probability and Impact matrix to figure out which ones are low, medium, or high. For example, we filled in "High" under Priority for row #3 by looking up risk ("No truck") in the first table, finding the probability and impact values, and then using the Probability & Impact Matrix. The Probability is .3 and the Impact is .7, so you can find the corresponding box in the matrix. Since it's dark gray, its priority is "High."

2. After analyzing your data, you came up with three risk categories for the project: natural, equipment, and human.
   Fill in the missing values in the "Category" column of the risk register with either "Natural," "Equipment," or "Human." We started you out by filling in a few of them.

3. For this particular project, you'll need the equipment at the start of the project, so any equipment risks are considered high urgency. Natural and human risks are all medium urgency, except for ones that have to do with storms, which you consider low urgency for this project because of limited mitigation potential.
   Figure out the whether the urgency for each risk is "Low," "Medium," or "High" and fill in the "Urgency" column in the risk register.

	Identified Risks	Potential Response	Root Cause	Category	Priority	Urgency
1.	Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby			
2.	High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National weather service predicts 35% chance of high winds	Natural		Medium
3.	Truck rental is unavailable		Higher than expected demand for equipment this season	Equipment	High	
4.	Storms predicted through the first two weeks of project schedule time	Create reserves to account for time lost due to storms	El Niño weather pattern		Medium	Low
5.	Supply shortage if we don't accurately predict food needs		Nearest store is 30 miles away	Equipment		
6.	If someone gets sick, it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 50 miles away			

Outputs

Qualitative analysis helps you figure out which risks are most important to your project's success. When you've finished your analysis, you should have a risk register that tells you a lot more about what could go wrong.

The only output of Perform Qualitative Risk Analysis is the updated risk register.

	Identified Risks	Potential Response	Root Cause	Category	Priority	Urgency
1.	Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby	Natural	Low	Medium
2.	High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National weather service predicts 35% chance of high winds	Natural	High	Medium
3.	Truck rental is unavailable		Higher than expected demand for equipment this season	Equipment	High	High
4.	Storms predicted through the first two weeks of project schedule time	Create reserves to account for time lost due to storms	El Niño weather pattern	Natural	Medium	Low
5.	Supply shortage if we don't accurately predict food needs		Nearest store is 30 miles away	Equipment	Low	High
6.	If someone gets sick it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 50 miles away	Human	Low	Medium

Performing Quantitative Risk Analysis

- Often follows qualitative risk analysis, but both can be done together
- Large, complex projects involving leading edge technologies often require extensive quantitative risk analysis
- Main techniques include:
  - **Decision tree analysis (Important, CE72006)**
  - Simulation
  - Sensitivity analysis

Decision Trees and Expected Monetary Value (EMV)

- A **decision tree** is a diagramming analysis technique used to help select the best course of action in situations in which future outcomes are uncertain
- **Estimated monetary value (EMV)** is the product of a risk event probability and the risk event's monetary value
- You can draw a decision tree to help find the EMV

Calculate the Expected Monetary Value of your risks

Tools

Okay, so you know the probability and impact of each risk. How does that really help you plan? Well, it turns out that if you have good numbers for those things, you can actually figure out how much those risks are going to cost your project. You can do that by calculating the **Expected Monetary Value** (or EMV) of each risk:

You can find these in your risk register.

1. Start with the probability and impact of each risk.

Risk	Probability	Impact
High winds	35%	cost $48 to replace equipment
Mudslide	5%	lose $750 in damage costs
Wind generator is usable	15%	save $800 in battery costs
Truck rental unavailable	10%	cost $350 for last-minute rental

2. Take the first risk and multiply the probability by the impact. For opportunities, use a positive cost. For threats, use a negative one. Then do the same for the rest of the risks.

Even though the impact of a mudslide is big, the probability is low so the EMV is small.

High winds: 35% x -$48 = -$16.80

Mudslide: 5% x -$750 = -$37.50

Wind generator: 15% x $800 = $120.00

Truck rental: 10% x -$350 = -$35.00

The wind generator risk is an opportunity because you'll save money if it happens. So when you do the EMV calculation, you use a positive number for the impact

3. Now that you've calculated the EMV for each of the risks, you can add them up to find the total EMV for all of them.

EMV = -$16.80 + -$37.50 + $120.00 + -$35.00 = -$30.70

If you add $30.70 to the budget, then it should be enough to account for these risks.

Take a look at this table of risks.

Risk	Probability	Impact
Navigation equipment failure	15%	costs $300 due to getting lost
Unseasonably warm weather	8%	saves $500 in excavation costs
Wild animals eat rations	10%	costs $100 for replacements

1. Calculate the EMV for each of these three risks.

2. If these are the only risks on the project, calculate the total EMV.

3. The latest weather report came out, and there is now a 20% chance of unseasonably warm weather. What's the new EMV for the project?

4. Now the cost of replacement rations goes up to $150. What's the new EMV for the project?

Take a look at this table of risks.

Risk	Probability	Impact
Navigation equipment failure	15%	costs $300 due to getting lost
Unseasonably warm weather	8%	save $500 in excavation costs
Wild animals eat rations	10%	costs $100 for replacements

1. Calculate the EMV for each of these three risks.

Navigation equipment failure: 15% x -$300 = -$45.00

Unseasonably warm weather: 8% x $500 = $40.00

Wild animals eat rations: 10% x -$100 = -$10.00

Don't forget to use a positive value here because it's an opportunity, not a threat.

2. If these are the only risks on the project, calculate the total EMV.

Total EMV = -$45.00 + $40.00 + -$10.00 = -$15.00

You get the total EMV by adding up the EMV for each risk.

3. The latest weather report came out, and there is now a 20% chance of unseasonably warm weather. What's the new EMV for the project?

Unseasonably warm weather: 20% x $500 = $100.00

The new total EMV = -$45.00 + $100.00 + -$10.00 = $45.00

The EMV is now positive, which means the project should cost less than you originally budgeted.

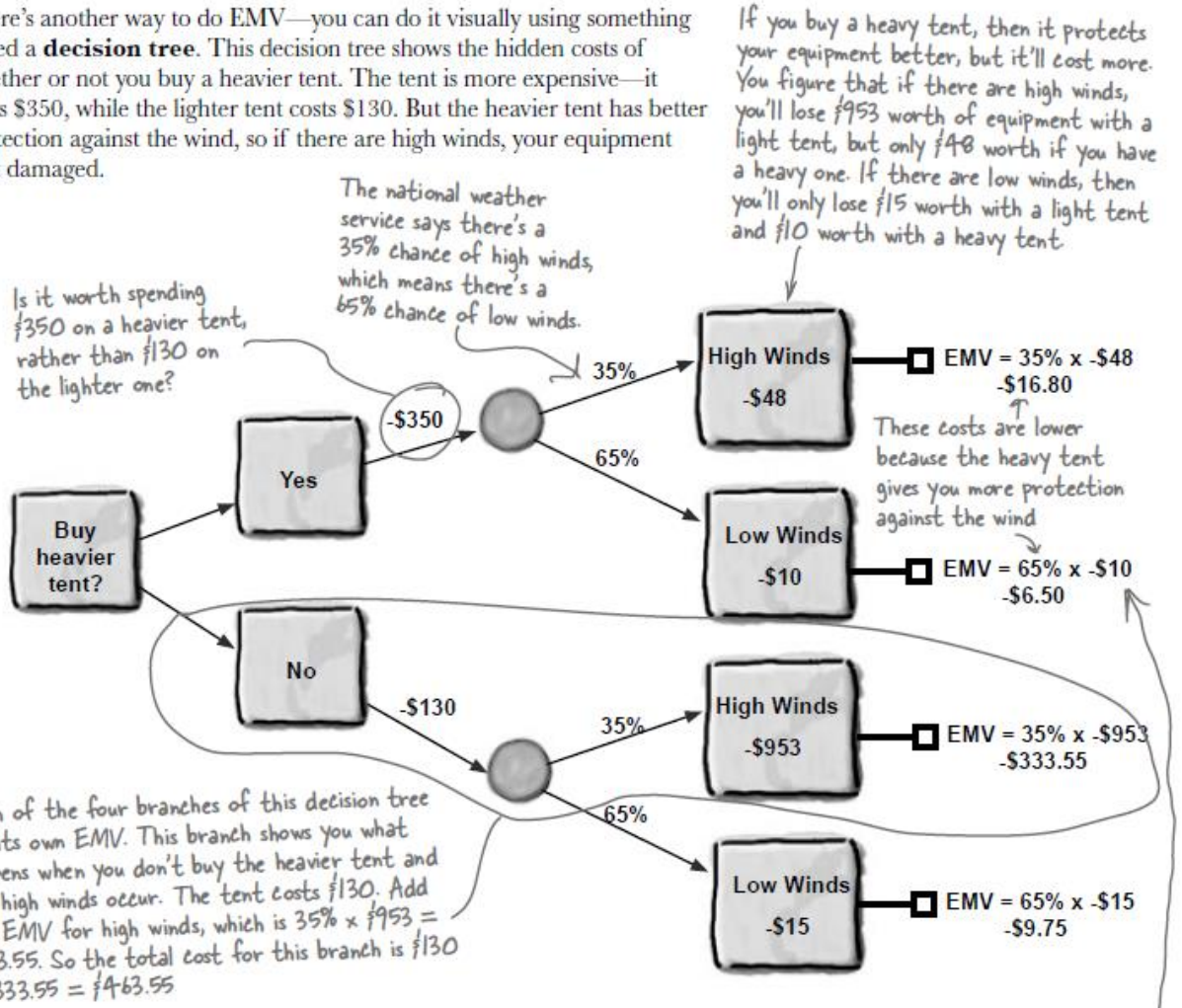
4. Now the cost of replacement rations goes up to $150. What's the new EMV for the project?

Wild animals eat rations: 10% x -$150 = -$15.00

The new total EMV = -$45.00 + $100.00 + -$15.00 = $40.00

Decision tree analysis uses EMV to help you make choices

There's another way to do EMV—you can do it visually using something called a **decision tree**. This decision tree shows the hidden costs of whether or not you buy a heavier tent. The tent is more expensive—it costs $350, while the lighter tent costs $130. But the heavier tent has better protection against the wind, so if there are high winds, your equipment isn't damaged.



What's the EMV – or how much it's likely to cost you – of choosing the heavier tent?

If we add the EMV for high winds plus the EMV for low winds to the cost of the tent, we'll figure out the "real" cost of choosing the heavier tent. So that's –$16.80 + –$6.50 + –$350 = –$373.30.

This is just the EMV of the low winds if you buy the heavier tent. The probability of low winds is 65%, and the cost is $10. So it's just like the other EMV calculations: 65% x –$10 = –$6.50.

Compare that with the EMV of choosing the lighter tent. Which decision makes sense?

We can do the same thing for the bottom two branches of the tree. The "cheaper" tent costs –$130 + –$333.55 + –$9.75 = $473.30. So it's actually more expensive!

Exercise

Looking at the decision tree on the facing page, see if you can figure out the expected monetary value depending on the decisions the team makes.

Hint: Figure out the new EMV for each branch—that will tell you if the decision makes sense.

1. You hear a weather report that says there's now a 45% chance of high winds. Does it still make sense to buy the heavier tent?

2. If you don't buy the heavier tent, then you have room to take along a wind generator that can power your equipment, and that will save you $1,100 in portable batteries if there's a heavy wind. If there's still a 45% chance of high winds, does it still make sense to buy the heavier tent?

Answers on page 591.

This is an opportunity. So it should have a POSITIVE value when you do the EMV calculation.

there are no Dumb Questions

Exercise Solution

Looking at the decision tree on the facing page, see if you can figure out the expected monetary value depending on the decisions the team makes.

1. You hear a weather report that says there's now a 45% chance of high winds. Does it still make sense to buy the heavier tent?

   EMV of choosing the heavier tent: -$350 plus (45% x -$48) plus (55% x -$10) = -$377.10

   EMV of choosing the lighter tent: -$130 plus (45% x -$953) plus (55% x -$15) = -$567.10

   It still makes sense to choose the heavier tent.

2. If you don't buy the heavier tent, then you have room to take along a wind generator that can power your equipment, and that will save you $1,100 in portable batteries if there's a heavy wind. If there's still a 45% chance of high winds, does it still make sense to buy the heavier tent?

   EMV of choosing the heavier tent: -$350 plus (45% x -$48) plus (55% x -$10) = -$377.10

   EMV of choosing the lighter tent: -$130 plus (45% x $147) plus (55% x -$15) = -$72.10

   Now it makes sense to choose the lighter tent.

So where did this $147 come from? Well, if there's a heavy wind, then the generator turns this into an opportunity. You'll still see $953 in equipment damage, but that's offset by the $1,100 in savings for portable batteries. That puts you ahead by $147—but only if there's a heavy wind!

Update the risk register based on your quantitative analysis results

Outputs

When you've finished gathering data about the risks, you change your priorities, urgency ratings and categories (if necessary), and you update your risk register. Sometimes modeling out your potential responses to risk helps you to find a more effective way to deal with them.

Analysis showed us that this would be the most expensive risk if it were to occur. So it got upgraded to a high priority.

	Identified Risks	Potential Response	Root Cause	Category	Priority	Urgency
1.	Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby	Natural	High	Medium
2.	High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National weather service predicts 35% chance of high winds	Natural	High	Medium
3.	Truck rental is unavailable	Pay to reserve equipment at a second company	Higher than expected demand for equipment this season	Equipment	High	High
4.	Storms predicted through the first two weeks of project schedule time	Create reserves to account for time lost due to storms	El Niño weather pattern	Natural	Medium	Low
5.	Supply shortage if we don't accurately predict food needs		Nearest store is 30 miles away	Equipment	Low	High
6.	If someone gets sick, it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 50 miles away	Human	Low	Low

Planning Risk Responses

- After identifying and quantifying risks, you must decide how to respond to them

- Four main response strategies for negative risks:
  - Risk avoidance
  - Risk acceptance
  - Risk transference
  - Risk mitigation

How you deal with risk

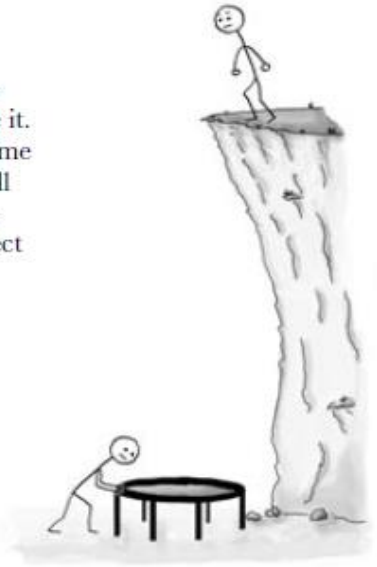
When you're planning your project, risks are still uncertain: they haven't happened yet. But eventually, some of the risks that you plan for *do* happen. And that's when you have to deal with them. There are four basic ways to handle a risk:

1 Avoid

The best thing that you can do with a risk is avoid it—if you can prevent it from happening, it definitely won't hurt your project.

2 Mitigate

If you can't avoid the risk, you can mitigate it. This means taking some sort of action that will cause it to do as little damage to your project as possible.

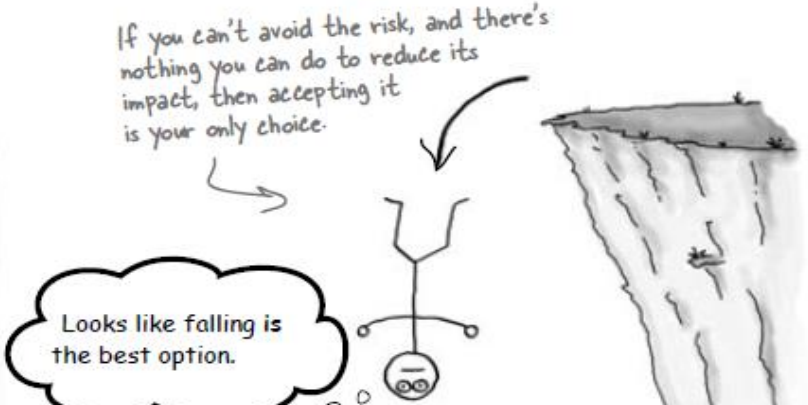


3 Transfer

One effective way to deal with a risk is to pay someone else to accept it for you. The most common way to do this is to buy insurance.

4 Accept

When you can't avoid, mitigate, or transfer a risk, then you have to accept it. But even when you accept a risk, at least you've looked at the alternatives and you know what will happen if it occurs.



1. Stormy weather and high winds could cause very slippery conditions, so you put up a tent and wear slip-resistant footwear to keep from losing your footing.

☐ Avoided ☐ Mitigated

☐ Transferred ☐ Accepted

2. You buy a surge protector to make sure a lightning strike won't blow out all of your equipment.

☐ Avoided ☐ Mitigated

☐ Transferred ☐ Accepted

3. Flooding could cause serious damage to your equipment, so you buy an insurance policy that covers flood damage.

☐ Avoided ☐ Mitigated

☐ Transferred ☐ Accepted

4. The manufacturer issues a warning that the safety equipment you are using has a small but nonzero probability of failure under the conditions that you'll be facing. You replace it with more appropriate equipment.

☐ Avoided ☐ Mitigated

☐ Transferred ☐ Accepted

5. A mud slide would be very damaging to your project, but there's nothing you can do about it.

☐ Avoided ☐ Mitigated

☐ Transferred ☐ Accepted

6. A team member discovers that the location you planned on using is in a county that is considering regulations that could be expensive to comply with. You work with a surveying team to find a new location.

☐ Avoided ☐ Mitigated

☐ Transferred ☐ Accepted

7. Surrounding geological features could interfere with your communications equipment, so you bring a flare gun and rescue beacon in case it fails.

☐ Avoided ☐ Mitigated

☐ Transferred ☐ Accepted

Answers: 1 - Mitigated 2 - Mitigated 3 - Transferred 4 - Avoided 5 - Accepted 6 - Avoided 7 - Mitigated

Response Strategies for Positive Risks

- Risk exploitation
- Risk sharing
- Risk enhancement
- Risk acceptance

It isn't always so bad

Remember the strategies for handling negative risks—avoid, mitigate, transfer, and accept—from earlier? Well, there are strategies for handling positive risks, too. The difference is that **strategies for positive risks** are all about how you can try to get the most out of them. The strategies for handling negative and positive risks are the tools and techniques for the Plan Risk Responses process.

The strategies for negative risks are also tools & techniques for this process. They're the ones you already learned: avoid, mitigate, transfer, and accept. Acceptance is a technique for both negative and positive risks.

1. **Exploit**

   This is when you do everything you can to make sure that you take advantage of an opportunity. You could assign your best resources to it. Or you could allocate more than enough funds to be sure that you get the most out of it.

2. **Enhance**

   This is when you try to make the opportunity more probable by influencing its triggers. If getting a picture of a rare bird is important, then you might bring more food that it's attracted to.

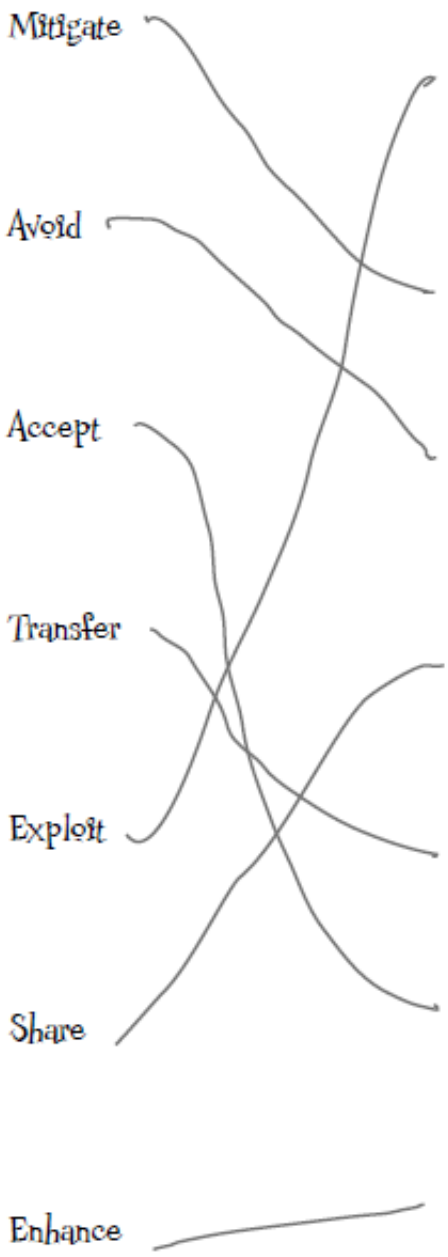
3. **Share**

   Sometimes it's harder to take advantage of an opportunity on your own. Then you might call in another company to share in it with you.

4. **Accept**

   Just like accepting a negative risk, sometimes an opportunity just falls in your lap. The best thing to do in that case is to just accept it!

Mitigate	If the weather's good, then there's a chance you could see a meteor shower. If the team gets a photo that wins the meteor photo contest, you can get extra funding. You have your team stay up all night with their telescopes and cameras ready.
Avoid	You hear that it's going to rain for the first three days of your trip, so you bring waterproof tents and indoor projects for the team to work on in the meantime.
Accept	You read that there's a major bear problem in the spring on the cliff where you are planning to work. You change your project start date to happen in the fall.
Transfer	On your way up the cliff, you meet another team that is looking to survey the area. You offer to do half of the surveying work while they do the other half and then trade your findings with one another.
Exploit	There's a high probability of water damage to some of your equipment, so you buy insurance to avoid losses.
Share	There's always the chance that someone could make a mistake and fall off the cliff. No matter how much you plan for the unexpected, sometimes mistakes happen.
Enhance	About 10 years ago a really rare bird, the black-throated blue warbler, was seen on this cliff. If you could get a picture of it, it would be worth a lot of money. So, you bring special seeds that you have read are really attractive to this bird, and you set up lookout points around the cliff with cameras ready to get the shot.



If the weather's good, then there's a chance you could see a meteor shower. If the team gets a photo that wins the meteor photo contest, you can get extra funding. You have your team stay up all night with their telescopes and cameras ready.

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Residual and Secondary Risks

- It's also important to identify residual and secondary risks
- **Residual risks** are risks that remain after all of the response strategies have been implemented
- **Secondary risks** are a direct result of implementing a risk response

Controlling Risks

- Involves executing the risk management process to respond to risk events and ensuring that risk awareness is an ongoing activity performed by the entire project team throughout the entire project
- **Workarounds** are unplanned responses to risk events that must be done when there are no contingency plans
- Main outputs of risk control are:
  - Work performance information
  - Change requests
  - Updates to the project management plan, other project documents, and organizational process assets