Chapter 11:
Project Risk Management

Information Technology Project Management, Sixth Edition

Note: See the text itself for full citations.

Learning Objectives

* Understand what risk is and the importance of good project risk management

* Discuss the elements involved in risk management planning and the contents of a risk management plan

* List common sources of risks in information technology projects

Learning Objectives (continued)

* Describe the process of identifying risks and be able to create a risk register

* Discuss the qualitative risk analysis process and explain how to calculate risk factors, create probability/impact matrixes, and apply the Top Ten Risk Item Tracking technique to rank risks

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Learning Objectives (continued)

* Explain the quantitative risk analysis process and how to apply decision trees, simulation, and sensitivity analysis to quantify risks

* Provide examples of using different risk response planning strategies to address both negative and positive risks

* Discuss what is involved in monitoring and controlling risks

* Describe how software can assist in project risk management

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What is Project Risk?

* What is Project Risk?
  * Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective.

* What are the Project Risk Management objectives?
  * The objectives of project risk management is to minimize potential **negative risks** while maximizing potential **positive risks**.

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Negative Risk (Threat)

* Negative risk involves understanding potential problems that might occur in the project and how they might impede project success

* Examples:
  * The price for purchasing the computers rise higher than planned 2 months ago
  * The main programmer on the project quitting the job
  * A certain function or class will no longer be supported in the next version of Java programming language

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Risk Can Be Positive (Opportunity)

* Positive risks are risks that result in good things happening; sometimes called opportunities

* Examples:
    * The price for purchasing the computers falls lower than planned 2 months ago
    * A special offer for bulk purchase
    * The teacher unexpectedly postpones the deadline for project submission
    * There is a chance that you may get some highly skilled workers from another project at lower rates
    * Found a good open source module that spare the team a week that is otherwise needed for development

Possible Project Risks

1. The prices for computers rise higher than planned.
2. Found a good open source module that spare the team a week that is otherwise needed for development
3. The prices for computers fall lower than planned
4. A special offer for bulk purchase
5. The main programmer on the project quitting the job
6. The teacher unexpectedly postpones the deadline for project submission
7. A certain function or class will no longer be supported in the next version of Java programming language.

Possible Project Risks (Cont.)

7. There is a chance that you may get some highly skilled workers from another project at lower rates.
8. The suppliers may delay the delivery of the servers for building up our data center.
9. The coming Flu season may hit your team and key engineers might get sick.
10. Our neighbors may complain to the gov't about our construction.
11. Building a project that doesn't fit the users' needs

Possible Project Risks (Cont.)

13. The accidents caused by auto-pilot vehicles.
14. Software system may be hacked (during operation)
15. The delay of organ deliveries in the drone delivery system
16. Malfunctioning of a life-supporting medical system
17. User data stolen by hackers

*They should be considered as "**safety quality**" to be managed in Project Quality Management, and have a Cost implication.*

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

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Project Risk Management Processes (continued)

* **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

* **Monitoring and controlling risks:** monitoring identified and residual risks, identifying secondary risks, carrying out risk response plans, and evaluating the effectiveness of risk strategies throughout the life of the project

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Figure 11-3. Project Risk Management Summary

Planning
Process: **Plan risk management**
Output: Risk management plan
Process: **Identify risks**
Output: Risk register
Process: **Perform qualitative risk analysis**
Output: Risk register updates
Process: **Perform quantitative risk analysis**
Output: Risk register updates
Process: **Plan risk responses**
Outputs: Risk register updates, risk-related contract decisions, project management plan updates, project document updates
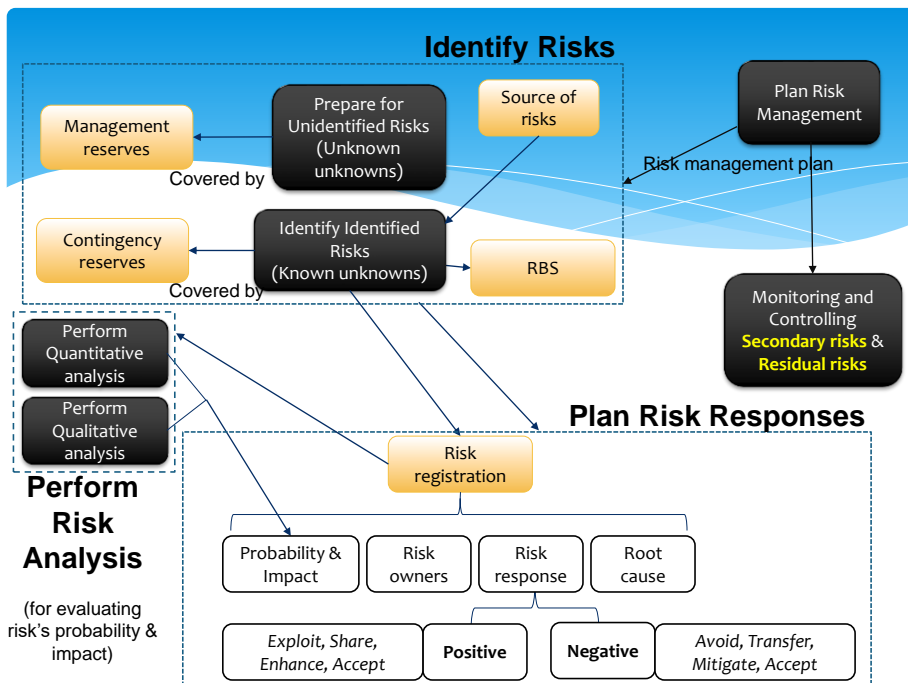
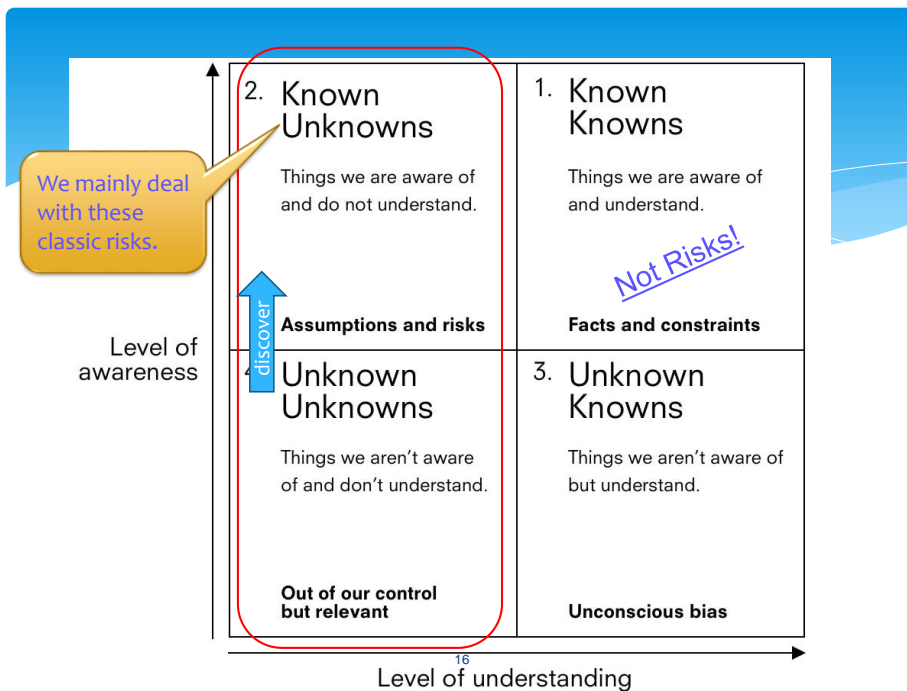**Monitoring and Controlling**
Process: **Monitor and control risks**
Outputs: Risk register updates, organizational process assets updates, change requests, project management plan updates, project document updates

Project Start ───────────────────────────→ Project Finish

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Identify Risks

Management reserves	
Covered by	
Prepare for Unidentified Risks (Unknown unknowns)	Source of risks
Plan Risk Management	

Risk management plan

Contingency reserves	Identify Identified Risks (Known unknowns)	RBS
Covered by		

Monitoring and Controlling
Secondary risks & **Residual risks**

Perform Quantitative analysis

Perform Qualitative analysis

Perform Risk Analysis

(for evaluating risk's probability & impact)

Plan Risk Responses

Risk registration

Probability & Impact	Risk owners	Risk response	Root cause

Exploit, Share, Enhance, Accept	**Positive**	**Negative**	*Avoid, Transfer, Mitigate, Accept*

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The diagram shows a 2x2 matrix with "Level of awareness" on the vertical axis and "Level of understanding" on the horizontal axis.

- 2. Known Unknowns — Things we are aware of and do not understand. Assumptions and risks
- 1. Known Knowns — Things we are aware of and understand. Facts and constraints. Not Risks!
- 4. Unknown Unknowns — Things we aren't aware of and don't understand. Out of our control but relevant
- 3. Unknown Knowns — Things we aren't aware of but understand. Unconscious bias

We mainly deal with these classic risks.

discover

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Risk Management Planning

*The **Plan Risk Management** defining how to conduct risk management activities for a project.*

* The main output of risk management planning 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 and attitudes to risk

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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 (Information gathering):

    * Brainstorming

    * The Delphi Technique

    * Interviewing

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Common Sources of Risk in Information Technology Projects

* **Sources of risk:**

    * The Standish Group developed an IT success potential scoring sheet based on potential risks

    * Other broad categories of risk help identify potential risks

    * Constraints & Assumptions

    * Categorization by each knowledge area

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Table 11-3. Information Technology Success Potential Scoring Sheet

Success Criterion	Relative Importance
User Involvement	19
Executive Management support	16
Clear Statement of Requirements	15
Proper Planning	11
Realistic Expectations	10
Smaller Project Milestones	9
Competent Staff	8
Ownership	6
Clear Visions and Objectives	3
Hard-Working, Focused Staff	3
Total	**100**

Broad Categories of Risk

* **Market risk**
  * deliverables useful, helpful, sellable, competitive?

* **Financial risk**
  * Affordable, worth doing the project, Benefit>Cost?

* **Technology risk**
  * Technically feasible, tech proven and available?

* **People risk**
  * Needed talents available, with senior management's and user's support?

* **Structure / process risk**
  * Maturity of the organization, complexity of the stockholder groups, adaptation to and interoperation with existing infrastructure

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Assumptions Analysis

* **Constraints** and **Assumptions** are common sources of risk
  * Constraint: Something limit your options
  * Assumption: You think they are true

Assumption or Constraint	Could this assumption/constraint prove false? (Y/N)	If false would it affect project? (Y/N)	Convert to a risk?

Constraints and Assumptions

Project constraints

- This must be finished before the commencement of the opening ceremony.
- The amount of funding is around 100,000.
- Use Paypal as the payment gateway.
- We do not have the domain knowledge and past experience for that project.
- We must use the Linux OS for the software.
- The software must support Java 1.12 or above.
- The core part of the system can only be revealed to a few appointed persons – biz secret.
- The weather in this region is rainy and windy quite often in this season.
- The network bandwidth is quite low for smooth video transmission.
- The delivery of the needed equipment will take at least 3 weeks.
- The effort relies on voluntary participation by multiple government agencies.

Project assumptions

- The weather in this region will be fine in this season.
- Customers will provide necessary business expertise as needed during development.
- The network bandwidth will be high enough for smooth video transmission.
- All imported data will be in XML format.
- Government regulation will not be changed in these 2 years.
- The 5G networks will be widespread in the region.
- Users will fully support the project.
- The sponsor really desires the project to finish with high quality and allows the high quality to justify the budget.

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Table 11-4. 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/workmanship; inadequate quality assurance program
Human Resources	Poor conflict management; poor project organization and definition of responsibilities; absence of leadership
Communications	Carelessness in planning or communicating; lack of consultation with key stakeholders
Risk	Ignoring risk; unclear analysis of risk; poor insurance management
Procurement	Unenforceable conditions or contract clauses; adversarial relations

Risk Breakdown Structure

* A **risk breakdown structure** (RBS) is a hierarchy of potential risk categories for a project

* Similar to a work breakdown structure but used to identify and categorize risks

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Figure 11-4. Sample Risk Breakdown Structure
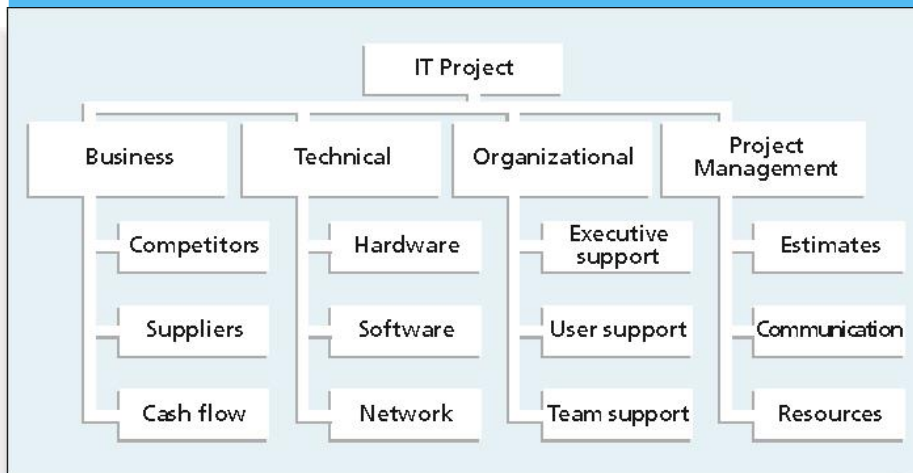
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Brainstorming

* **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
  * Psychology literature shows that individuals produce a greater number of ideas working alone than they do through brainstorming in small, face-to-face groups
  * Group effects often inhibit idea generation

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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

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

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Risk Register Contents

For each entry of the risk register, there are:

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

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Risk Register Contents (continued)

* **Triggers** for each risk**;** triggers are indicators or symptoms of actual risk events for triggering the risk responses
* 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

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Table 11-5. Sample Risk Register

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

Identified Risk: The computer equipment may not be delivered on time.
Root Cause: This kind of equipment is often short of supply.
Potential Responses: Order in advance; Identify alternative vendors.

Identified Risk: Loss of data
Root Cause : System down
Potential Responses: Backup frequently; Redundancy

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Performing Qualitative Risk Analysis

* Assess the likelihood and impact of all identified risks (in Risk Register) to determine their magnitude and priority
* It is a subjective analysis

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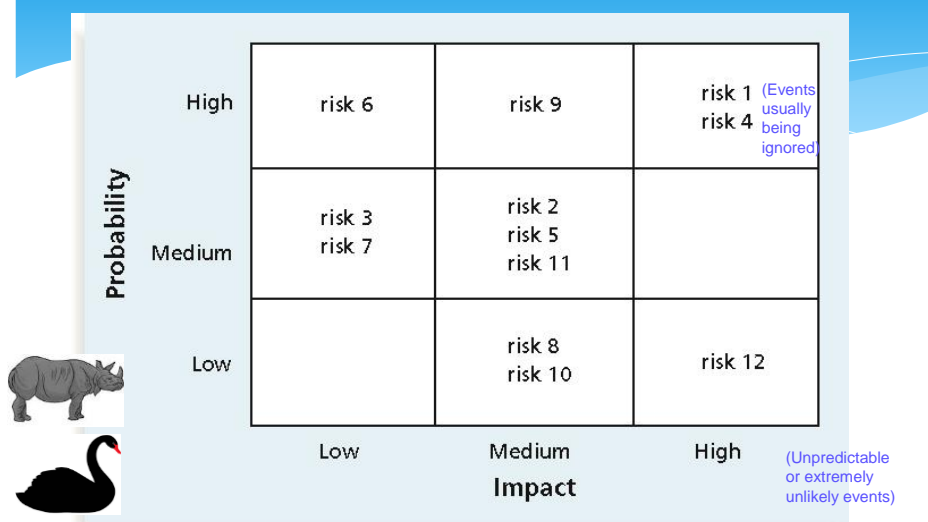   * The Top Ten Risk Item Tracking
    * Expert judgment

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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
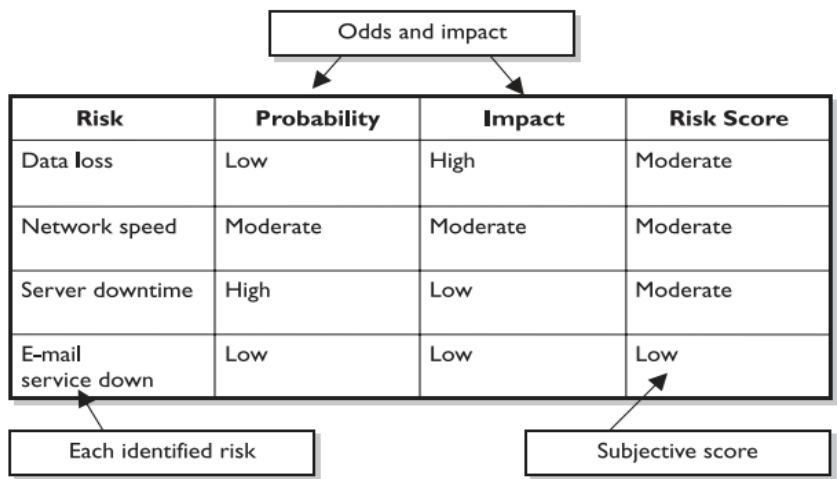
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Figure 11-5. Sample Probability/Impact Matrix

Probability	Low	Medium	High
High	risk 6	risk 9	risk 1 risk 4 (Events usually being ignored)
Medium	risk 3 risk 7	risk 2 risk 5 risk 11	
Low		risk 8 risk 10	risk 12

Impact

(Unpredictable or extremely unlikely events)

How to use a Probability/Impact Matrix?

Odds and impact

Risk	Probability	Impact	Risk Score
Data loss	Low	High	Moderate
Network speed	Moderate	Moderate	Moderate
Server downtime	High	Low	Moderate
E-mail service down	Low	Low	Low

Each identified risk

Subjective score

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

Table 11-6. 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

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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

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Performing Quantitative Risk Analysis

* Often follows qualitative risk analysis, but both can be done together

* Usually performed on risks that have been prioritized by the "Performing Qualitative Risk Analysis"

* Large, complex projects involving leading edge technologies often require extensive quantitative risk analysis

* Main techniques include:
  * Decision tree analysis and EMV
  * Simulation (Monte Carlos simulation)

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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

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Figure 11-7. Expected Monetary Value (EMV) Example

Probability (P)	times	Outcome = EMV
P=.20	*	$300,000 = +$60,000
P=.80	*	–$40,000 = –$32,000
P=.20	*	–$50,000 = –$10,000
P=.10	*	–$20,000 = –$2,000
P=.70	*	$60,000 = $42,000

Project 1's EMV = $60,000 – $32,000 = $28,000
Project 2's EMV = –$10,000 – $2,000 + $42,000 = $30,000

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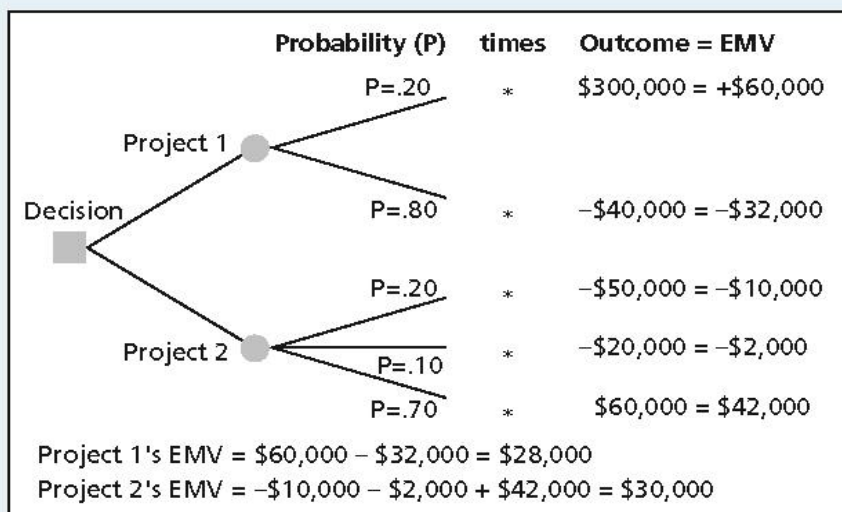
Planning Risk Responses

* 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

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Risk responses for negative risks (threats)

* **Avoid** - Changing the project management plan to eliminate the threat posed by an adverse risk, to isolate the project objectives from the risk's impact
  * Example: Cancel the delivery by ship due to the high probability of piracy, and choose lorry transportation instead
* **Transfer** - Shifting the negative impact of a threat, along with ownership of the response, to a third party
  * Examples : Insurance, warranties
* **Mitigate** - Implying a reduction in the probability and/or impact of an adverse risk event to an acceptable threshold
  * Examples: prototypes, system redundancy
  * Examples: Shipping partial goods in mulitple shipments to miminal the potential loss
* **Accept**–Some risk you can't avoid or mitigate or transfer
  * Do nothing, but just document it   46

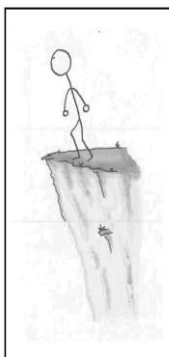# Risk responses for negative risks (threats)
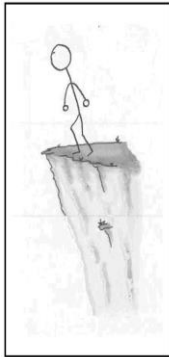
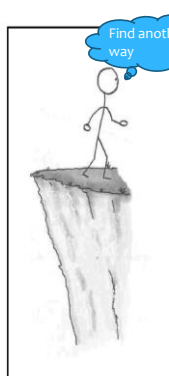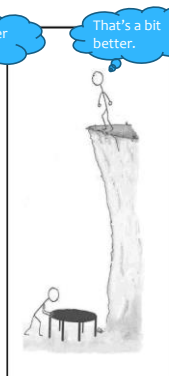Your project Avoid Mitigate Transfer Accept

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Risk responses for negative risks (threats)

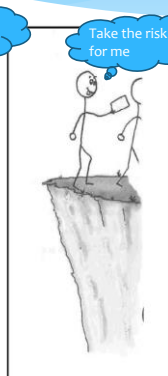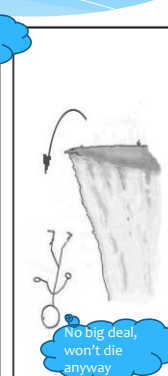Your project Avoid Mitigate Transfer Accept

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Risk Response for Positive Risks (Opportunities)

* Risk exploitation
* Risk sharing
* Risk enhancement
* Risk acceptance

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Risk Response for Positive Risks (Opportunities)

* **Exploit –** To do everything to make sure that to take advantage of an opportunity
  * Assign best resources to exploit it
* **Share –** Allocating ownership to a third party who is best able to capture the opportunity for the benefit of the project.
* **Enhance –** by increasing probability and/or positive impacts, and by identifying and maximizing key drivers of these positive impact risks
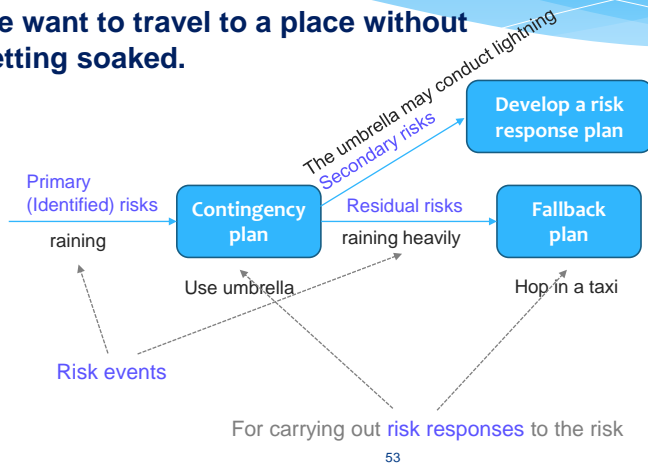
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Residual and Secondary Risks

* It's also important to identify residual and secondary risks

* **Secondary risks** are the risks that arise as a direct result of implementing a risk response

* **Residual risks** are the risks that remain after all of the response strategies have been implemented

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Contingency and Fallback Plans, Contingency Reserves

* **Contingency plans** are predefined actions that the project team will take if an identified risk event occurs

* **Fallback plans** are developed for risks that have a high impact on meeting project objectives and are put into effect if attempts to reduce the risk are not effective

* **Contingency reserves** or **allowances** are provisions held by the project sponsor or organization to reduce the risk of cost or schedule overruns to an acceptable level

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Example of Contingency and Fallback plans

We want to travel to a place without getting soaked.

The umbrella may conduct lightning

Primary (Identified) risks → **Contingency plan**

Secondary risks → **Develop a risk response plan**

Residual risks → **Fallback plan**

raining

Use umbrella

raining heavily

Hop in a taxi

Risk events

For carrying out risk responses to the risk

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Monitoring and Controlling Risks

* Involves executing the risk management process to respond to risk events
* **Workarounds** are unplanned responses to risk events that must be done when there are no contingency plans
* Main outputs of risk monitoring and control are:
  * Risk register updates
  * Organizational process assets updates
  * Change requests
  * Updates to the project management plan and other project documents

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