

Project Risk Management



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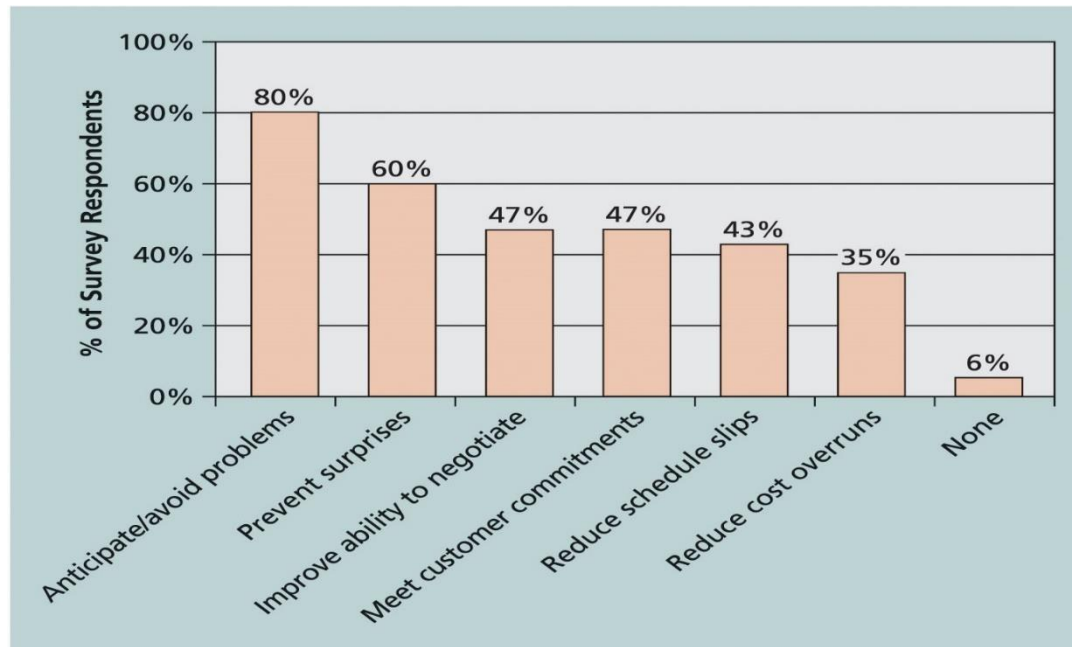
Project Risk Management

Importance of Project Risk Management

- Project risk management is the art and science of identifying, analyzing, and responding to risk throughout the life of a project and in the best interests of meeting project objectives.
- Risk management is often overlooked in projects, but it can help improve project success by helping select good projects, determining project scope, and developing realistic estimates.
- Research shows a need to improve project risk management
 - Study by Ibbs and Kwak shows risk management has the lowest maturity rating of all knowledge areas.
- Worldwide banking and insurance sectors will spend about \$78.6 billion on risk in 2015, growing to \$96.3 billion by 2018

Project Risk Management

KLCI study shows the benefits of following good risk management practices



Source: Kulik and Weber, KLCI Research Group

FIGURE 11-1 Benefits from software risk management practices

A dictionary definition of risk is “the possibility of loss or injury”

- General definition of a project risk: an uncertainty that can have a negative or positive effect on meeting project objectives.
- Managing negative risks involves a number of possible actions that project managers can take to avoid, lessen, change, or accept the potential effects of risks on their projects.
- Positive risk management is like investing in opportunities

Project Risk Management

Project Risk Management includes *the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project.*

The objectives of project risk management are *to increase the probability and/or impact of positive risks and to decrease the probability and/or impact of negative risks, in order to optimize the chances of project success.*

Project Risk Management

- **Plan Risk Management:** The process of defining how to conduct risk management activities for a project.
- **Identify Risks :** The process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics.
- **Perform Qualitative Risk Analysis :** The process of prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics.
- **Perform Quantitative Risk Analysis :** The process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives.
- **Plan Risk Responses:** The process of developing options, selecting strategies, and agreeing on actions to address overall project risk exposure, as well as to treat individual project risks.
- **Implement Risk Responses :** The process of implementing agreed-upon risk response plans.
- **Monitor Risks :** The process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and evaluating risk process effectiveness throughout the project.

Project Risk Management Overview

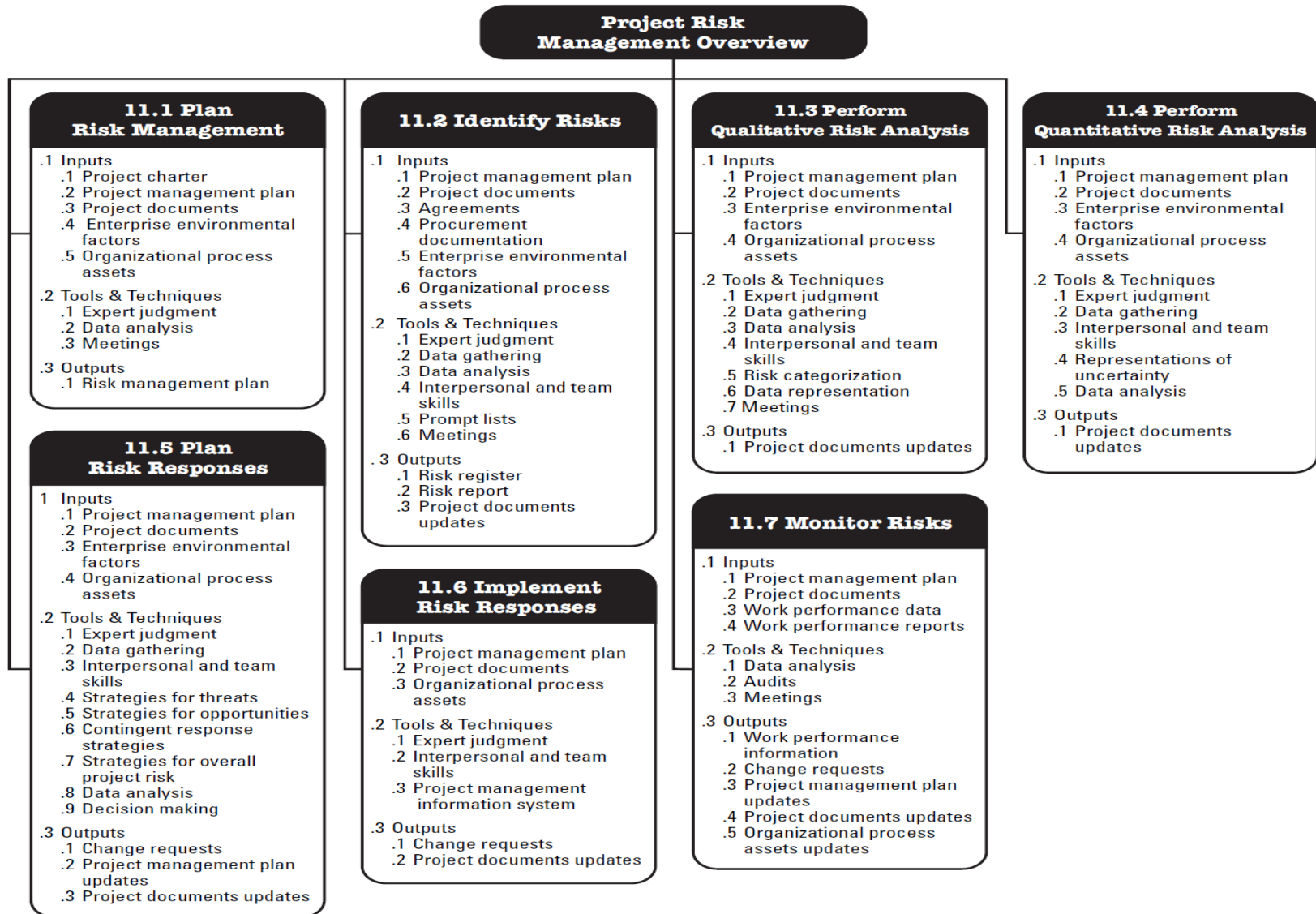


Figure 11-1. Project Risk Management Overview

Key Concepts

- All projects are risky since they are unique undertakings with varying degrees of complexity that aim to deliver benefits.
- They do this in a context of constraints and assumptions, while responding to stakeholder expectations that may be conflicting and changing.
- Organizations should choose to take project risk in a controlled manner in order to create value while balancing risk and reward.
- Project Risk Management aims to identify and manage risks that are not addressed by the other project management processes.
- When unmanaged, these risks have the potential to cause the project to deviate from the plan and fail to achieve the defined project objectives.
- Consequently, the effectiveness of Project Risk Management is directly related to project success.

Key Concepts

Project Risk Management processes address both levels of risk in projects, and these are defined as follows:

- **Individual project risk** is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives.
- **Overall project risk** is the effect of uncertainty on the project as a whole, arising from all sources of uncertainty including individual risks, representing the exposure of stakeholders to the implications of variations in project outcome, both positive and negative.

Project Risk Management aims to exploit or enhance positive risks (opportunities) while avoiding or mitigating negative risks (threats).

Key Concepts

- Risk is initially addressed during project planning by shaping the project strategy. Risk should also be monitored and managed as the project progresses to ensure that the project stays on track and emergent risks are addressed.
- In order to manage risk effectively on a particular project, the project team needs to know what level of risk exposure is acceptable in pursuit of the project objectives
- This is defined by measurable risk thresholds that reflect the risk appetite of the organization and project stakeholders.
- Risk thresholds express the degree of acceptable variation around a project objective.
- They are explicitly stated and communicated to the project team and reflected in the definitions of risk impact levels for the project

Impact of Risk on Projects

Failure to manage the Project risk can have diverse and serious implications to project outcomes, including:

- Exceeding project budgets
- Programme delays
- Failure to achieve required functional requirements
- Failure to achieve the required quality requirements
- Damage to the environment
- Forfeiting the health and safety of personnel involved in the project
- Exposure to litigation
- Damage to the reputation of Organisation

Common Sources of Project Risk

Potential negative risk conditions associated with each knowledge area. *Source: R.M. Wideman

Knowledge Area	Risk Conditions
Integration	Inadequate planning; poor resource allocation; poor integration management;
Scope	Poor definition of scope or work packages; incomplete definition
Time	Errors in estimating time or resource availability
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; poor sponsor engagement

Common Sources of Risk on IT Projects

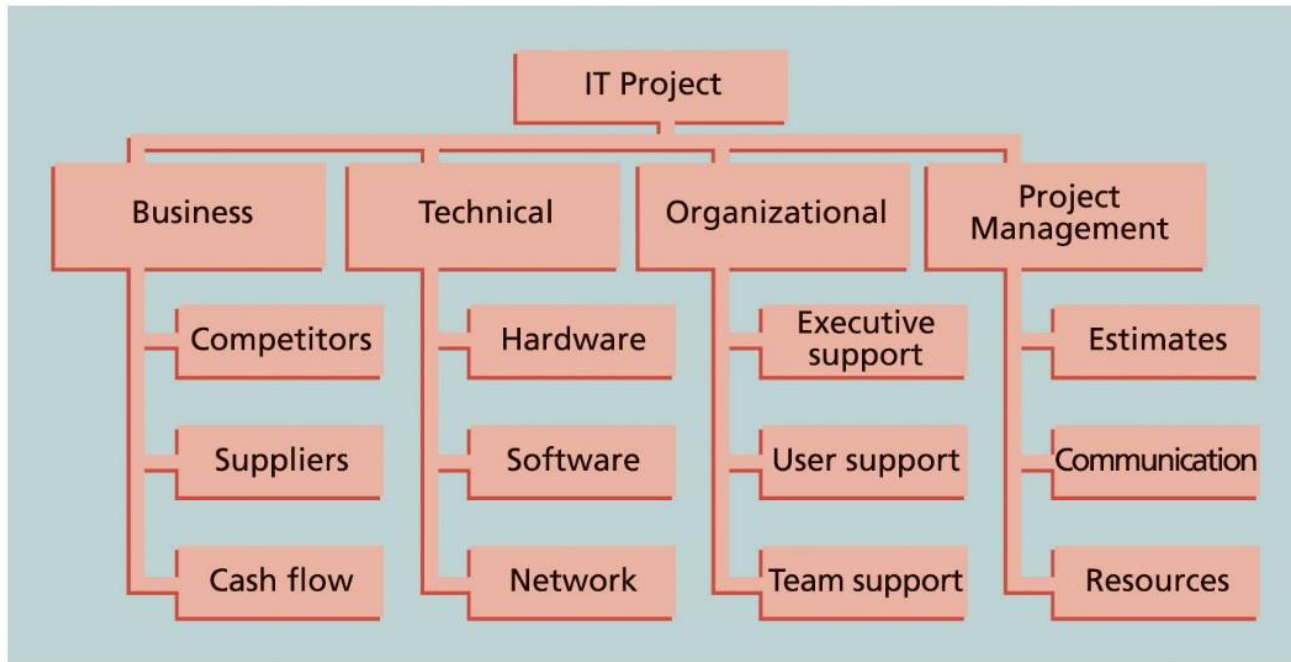
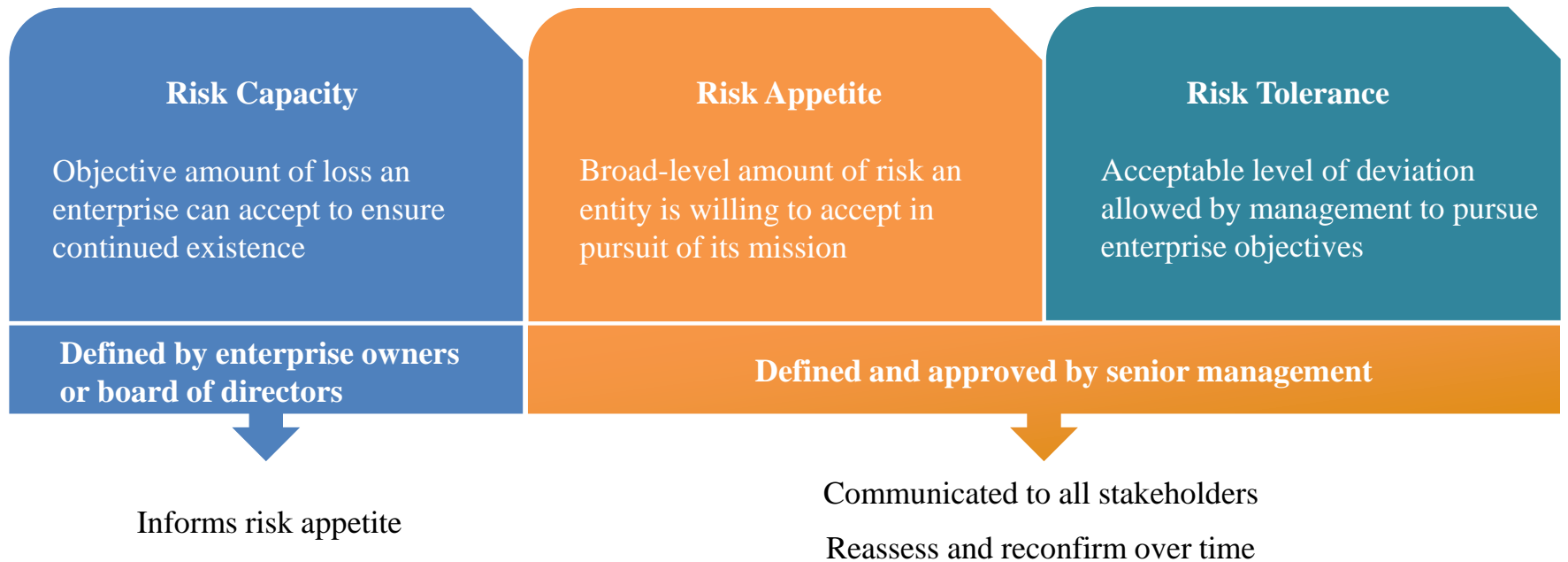


FIGURE 11-4 Sample risk breakdown structure

Risk Capacity, Appetite and Tolerance



Illustrating Risk Appetite, Tolerance and Capacity

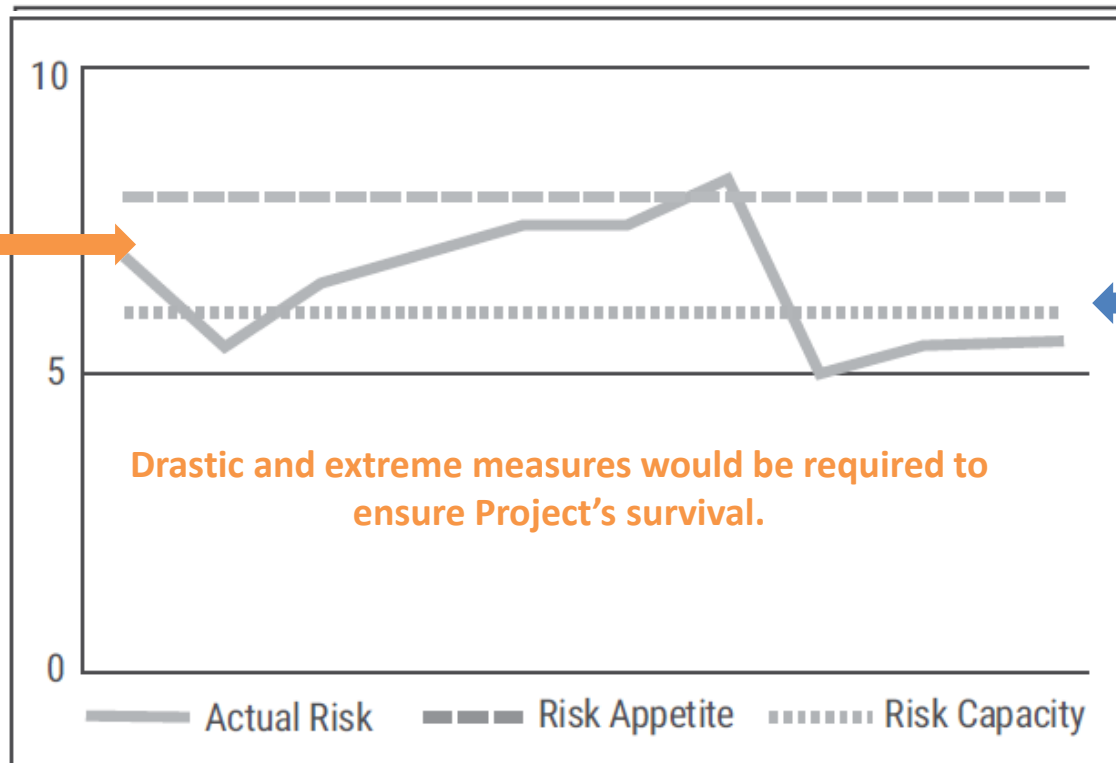
Risk Tolerance



Risk Appetite

Tolerance Criteria

(Amount & Duration)



Risk Capacity



Risk Appetite



Risk Capacity



A realized risk that exceeds the risk capacity threatens an enterprise's ability to continue operations

Key Concepts

- Project risk management intent is to ensure that all types of risk are considered, and that project risks are understood in a wider context.
- **Non-event risks:** *Most projects focus only on risks that are uncertain future events that may or may not occur.* Examples of event-based risks include: a key seller may go out of business during the project, the customer may change the requirement after design is complete, or a subcontractor may propose enhancements to the standard operating processes.
- There is an increasing recognition that non-event risks need to be identified and managed. There are two main types of non-event risks:
- **Variability risk.:** Uncertainty exists about some key characteristics of a planned event or activity or decision. Examples of variability risks include productivity may be above or below target, the number of errors found during testing may be higher or lower than expected, or unseasonal weather conditions may occur during the construction phase.
- **Ambiguity risk :** Uncertainty exists about what might happen in the future. Areas of the project where imperfect knowledge might affect the project's ability to achieve its objectives include: elements of the requirement or technical solution, future developments in regulatory frameworks, or inherent systemic complexity in the project.

Tailoring Considerations

- Every project is unique, it is necessary to tailor the way Project Risk Management processes are applied and include:
- **Project size** : Does the project's size in terms of budget, duration, scope, or team size require a more detailed approach to risk management? Or is it small enough to justify a simplified risk process?
- **Project complexity** : Is a robust risk approach demanded by high levels of innovation, new technology, commercial arrangements, interfaces, or external dependencies that increase project complexity? Or is the project simple enough that a reduced risk process will suffice?
- **Project importance** : How strategically important is the project? Is the level of risk increased for this project because it aims to produce breakthrough opportunities, addresses significant blocks to organizational performance, or involves major product innovation?
- **Development approach** : Is this a waterfall project, where risk processes can be followed sequentially and iteratively, or does the project follow an agile approach where risk is addressed at the start of each iteration as well as during its execution?

Tailoring of the Project Risk Management processes to meet these considerations is part of the Plan Risk Management process, and the outcomes of tailoring decisions are recorded in the risk management plan..

Considerations for Agile/ Adaptive Environments

High-variability environments, by definition, incur more uncertainty and risk.

- Use of frequent reviews of incremental work products and cross-functional project teams to accelerate knowledge sharing and ensure that risk is understood and managed.
- Risk is considered when selecting the content of each iteration, and risks will also be identified, analyzed, and managed during each iteration.
- Requirements are kept as a living document that is updated regularly, and work may be reprioritized as the project progresses, based on an improved understanding of current risk exposure.

Planning Risk Management

- Main output of this process is a risk management plan
 - Documents the procedures for managing risk throughout a project
- The project team should review project documents as well as corporate risk management policies, risk categories, lessons-learned reports from past projects, and templates for creating a risk management plan
 - It is also important to review the risk tolerances of various stakeholders
- Additional plans
 - Contingency plans: predefined actions that the project team will take if an identified risk event occurs
 - Fallback plans: 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: funds included in the cost baseline that can be used to mitigate cost or schedule overruns if known risks occur
 - Management reserves: funds held for unknown risks that are used for management control purposes

Planning Risk Management

Topic	Questions to Answer
Methodology	How will risk management be performed on this project? What tools and data sources are available and applicable?
Roles and responsibilities	Which people are responsible for implementing specific tasks and providing deliverables related to risk management?
Budget and schedule	What are the estimated costs and schedules for performing risk-related activities?
Risk categories	What are the main categories of risks that should be addressed on this project? Is there a risk breakdown structure for the project? (See the information on risk breakdown structures later in this chapter.)
Risk probability and impact	How will the probabilities and impacts of risk items be assessed? What scoring and interpretation methods will be used for the qualitative and quantitative analysis of risks? How will the probability and impact matrix be developed?
Revised stakeholders' tolerances	Have stakeholders' tolerances for risk changed? How will those changes affect the project?
Tracking	How will the team track risk management activities? How will lessons learned be documented and shared? How will risk management processes be audited?
Risk documentation	What reporting formats and processes will be used for risk management activities?

Common Sources of Risk on Projects

- Several studies show that projects share some common sources of risk.
- Broad categories of risk help identify potential risks
 - Market risk
 - Financial risk
 - Technology risk
 - People risk
 - Structure/process risk
- A risk breakdown structure is a hierarchy of potential risk categories for a project

What Went Wrong?

In a 2013 survey, risk management was a high priority

However, only 66 percent of companies said they often build it into their strategy planning decisions

Airline incidents cause concerns, especially when lives are lost

- The 2015 Germanwings crash resulted in 150 deaths, allegedly due to the co-pilot's poor mental state
- They responded immediately by implementing a rule that two people must be in the cockpit at all times and are considering changes to medical and psychological tests for pilots

Project Risk Management

Risk management process involves discovering and understanding answers to some key questions regarding the risk associated with the projects :

- 1. Where and what is the risk (risk identification)?**
- 2. How severe is the current level of risk (risk analysis)?**
- 3. Is the current level of risk acceptable (risk evaluation)?**
- 4. What needs to be done to bring the risk to an acceptable level (risk treatment)?**

Risk Planning Context

- Establish the external, internal and risk management context in which the rest of the process will take place.
- Establish criteria against which risk will be evaluated
- Project risk management should be conducted methodically, and the intent and structure of the risk management process specified within a Risk Management Plan.

The Risk Management Plan will include :

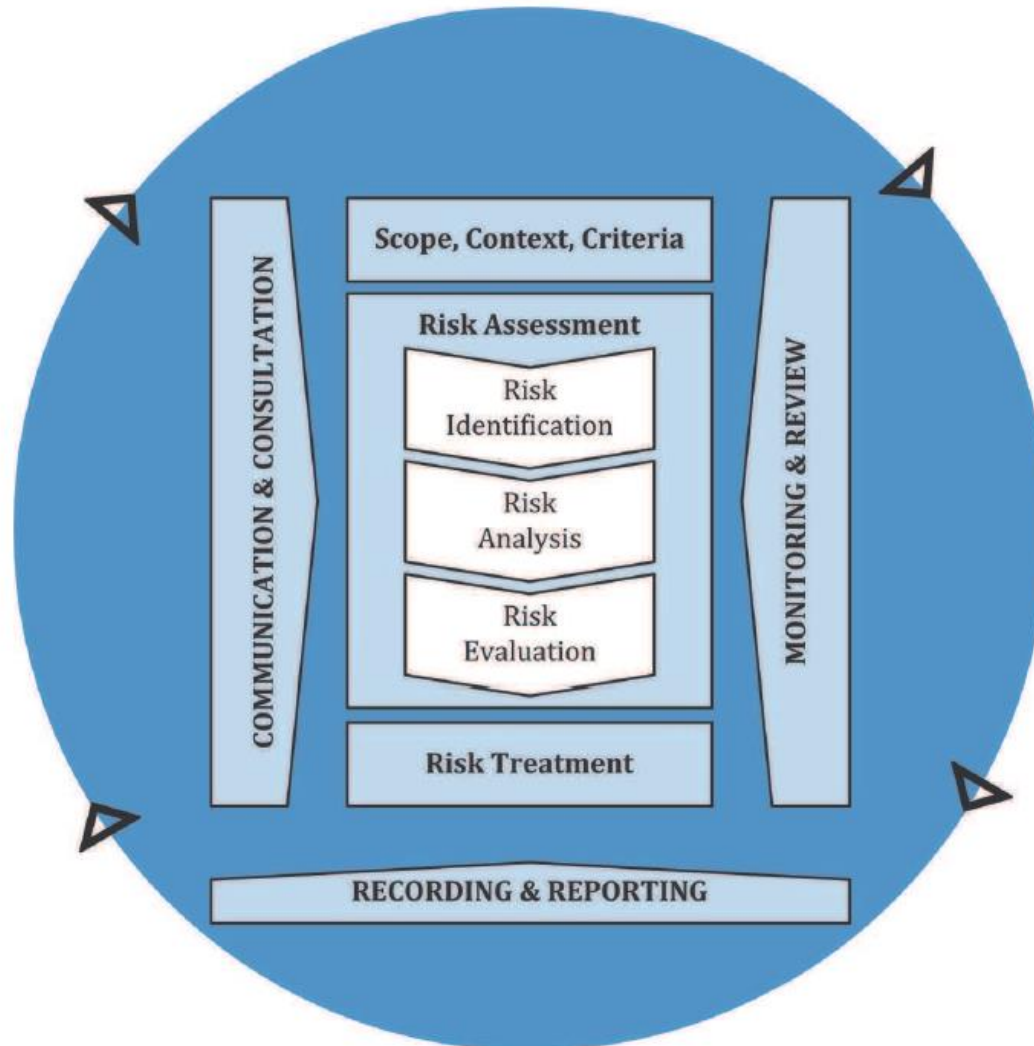
1. Responsibilities for implementing the risk management process
2. Resource requirements for administering the process
3. Proposed timing of key risk management activities

Planning Risk Management

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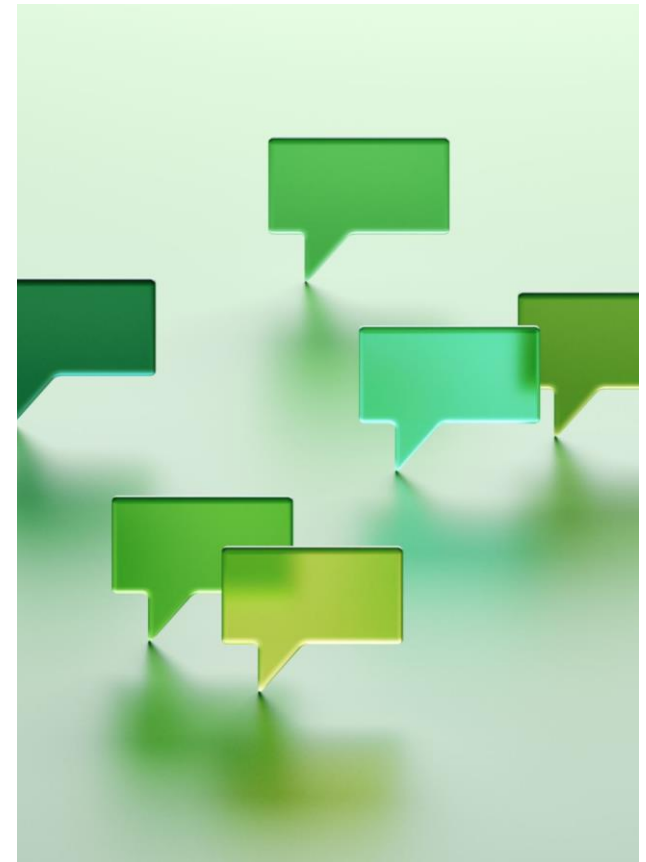
Risk Management Process

Risk Management is a key process for effective project delivery



Communication and Consultation

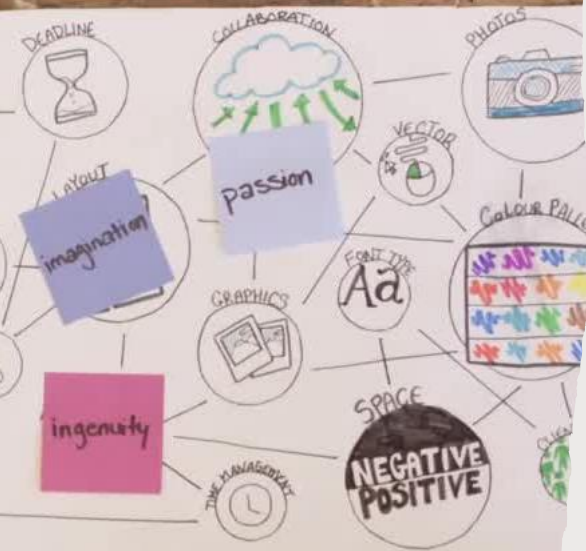
- The purpose of communication and consultation is to assist relevant stakeholders in understanding risk, the basis on which decisions are made and the reasons why particular actions are required.
- Communication seeks to promote awareness and understanding of risk, whereas consultation involves obtaining feedback and information to support decision-making



Aim of Communication and Consultation

- Bring different areas of expertise together for each step of the risk management process;
- Ensure that different views are appropriately considered when defining risk criteria and when evaluating risks; provide sufficient information to facilitate risk oversight and decision-making;
- Build a sense of inclusiveness and ownership among those affected by risk.

Risk Assessment



- Risk assessment is the overall process of *risk identification, risk analysis and risk evaluation*.
- Risk assessment should be conducted systematically, iteratively and collaboratively, drawing on the knowledge and views of stakeholders.
- It should use the best available information, supplemented by further enquiry as necessary.

Risk identification

The purpose of risk identification is to find, recognize and describe risks that might help or prevent an organization achieving its objectives. Relevant, appropriate and up-to-date information is important in identifying risks

The organization can use a range of techniques for identifying uncertainties that may affect one or more objectives.

- tangible and intangible sources of risk;
- causes and events;
- threats and opportunities;
- vulnerabilities and capabilities;
- changes in the external and internal context;
- indicators of emerging risks;
- the nature and value of assets and resources;
- consequences and their impact on objectives;
- limitations of knowledge and reliability of information;
- time-related factors;
- biases, assumptions and beliefs of those involved.

Identifying Risks

Interviewing

- Fact-finding technique for collecting information in face-to-face, phone, e-mail, or virtual discussions
- Interviewing people with similar project experience is an important tool for identifying potential risks

SWOT analysis

- Strengths, weaknesses, opportunities, and threats
- Helps identify the broad negative and positive risks that apply to a project

Identifying Risks



Brainstorming

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



Delphi Technique

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

Risk Register

Important output of the risk identification process

- List of identified risks and other information needed to begin creating a risk register
- Contains the results of various risk management processes and that is often displayed in a table or spreadsheet format
- 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



The Risk Register

Risk register contents :

- Identification number for each risk event
- Rank for each risk event
- Name of each risk event
- Description of each risk event
- Category under which each risk event falls
- Root cause of each risk
- Triggers for each risk; indicators or symptoms of actual risk events
- Potential responses to each risk
- Risk owner or person who will own or take responsibility for each risk
- Probability and impact of each risk occurring
- Status of each risk

The Risk Register

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

Sample risk register

- Risk report contents
 - Sources of overall project risk
 - Important drivers of overall project risk exposure
 - Summary information on risk events

Risk Analysis

Risk analysis involves a detailed consideration of uncertainties, risk sources, consequences, likelihood, events, scenarios, controls and their effectiveness.

An event can have multiple causes and consequences and can affect multiple objectives.

Risk analysis should consider factors such as:

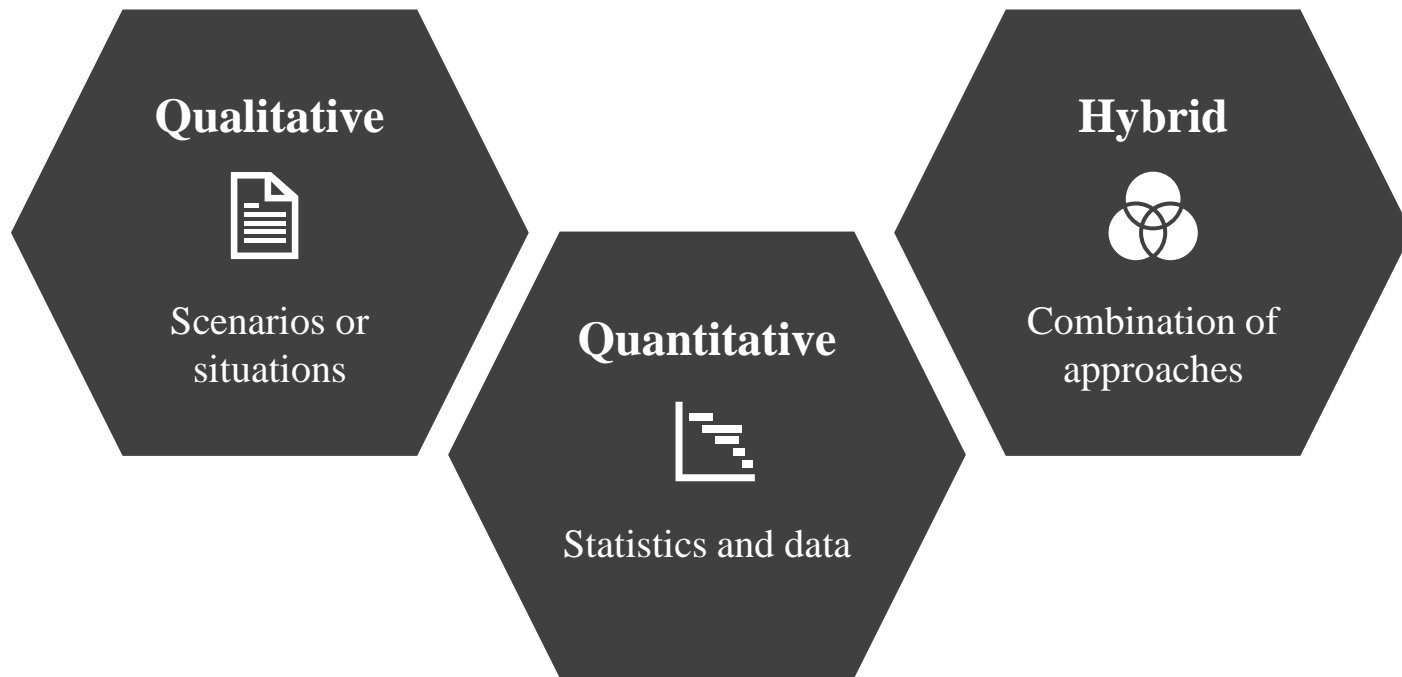
- the likelihood of events and consequences;
- the nature and magnitude of consequences;
- complexity and connectivity;
- time-related factors and volatility;
- the effectiveness of existing controls;
- sensitivity and confidence levels.

Techniques :

- Qualitative
- Quantitative
- Hybrid

Risk analysis provides an input to risk evaluation, to decisions on whether risk needs to be treated and how, and on the most appropriate risk treatment strategy and methods

Risk Analysis Methodologies



Performing Quantitative Risk Analysis



Most of the projects often follows qualitative risk analysis,



However, Large, complex projects often require extensive quantitative risk analysis



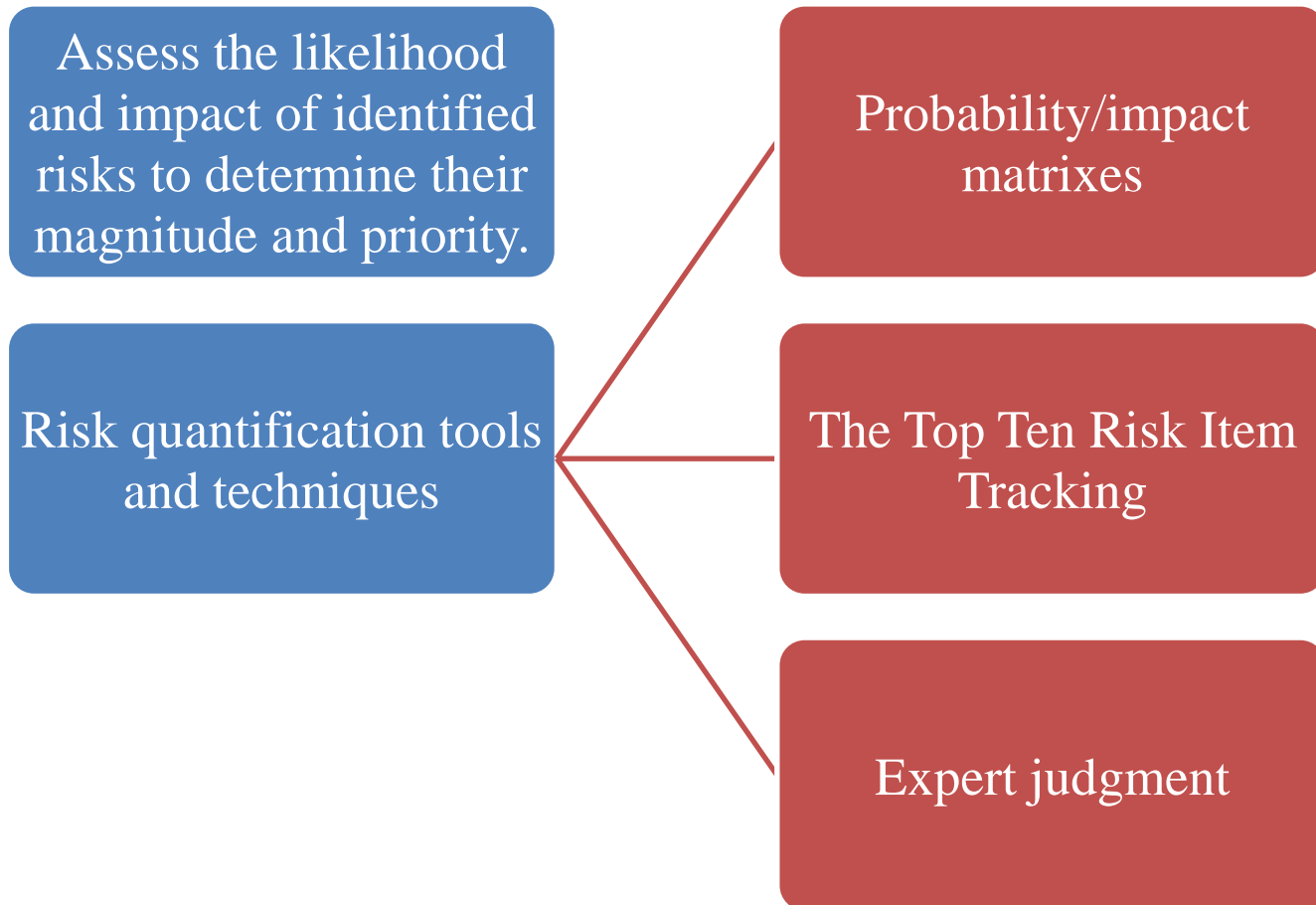
Main techniques

Decision tree analysis

Simulation

Sensitivity analysis

Performing Risk Analysis



Risk - Consequence Criteria (example)

Descriptor	Insignificant	Minor	Moderate	Major	Catastrophic
Financial (Costs & Revenue)	Negligible financial consequence (< 1% of budget or revenue)	Minor financial consequence (1 to 5% of budget or revenue)	Moderate financial consequence (5 to 10% of budget or revenue)	Major financial consequence (10 to 25% of budget or revenue)	Huge financial consequence (>25% of budget or revenue)
Programme	Little or no delay	Short delay (increases duration by >2.5%)	Significant delay (increases duration by >10%)	Major delay (increases duration by >25%)	Project halted or huge delay (increases duration by >100%)
Safety	No injuries	First aid treatment / out-patients	A number of injuries / hospitalisation	Extensive injuries / hospitalisation / long-term treatment	Fatality / significant irreversible effects to a number of persons
PR / Profile	Some complaints but project, client, stakeholder reputation intact	Adverse local publicity or media attention	Attention from media and/or significant concern by local community / criticism by NGOs	Significant adverse regional and State media coverage / community and NGO outcry	Serious adverse international and/or national coverage / community and NGO outrage
Relationships	Stakeholders irritated but no formal complaints	Resolved at working level	Resolved at senior management level	Legal recourse or Departmental Head intervention	Government level intervention
Build Quality	Cosmetic repairs / rectification	Minor repairs / rectification	Major repairs / rectification - including structural	Substantial re-build	Total replacement
Operational Impacts	Negligible impact / no significant impact on personnel	Minor change to operations / some inconvenience to personnel	Requires a change in operations, work routines and schedules	Major disruption to operations, work routines and practices - additional resources may be required	Operations not possible or facility closed / impact on the well-being of personnel
Environment	No effects or effects which are below levels of perception, within normal bounds of variation or within the margin of forecasting error.	These effects may be raised as local issues but are unlikely to be of importance in the decision making process. However, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation measures.	Important considerations at a local level but are not likely to be key decision making issues. Mitigation measures and detailed design may ameliorate some of the consequences upon the affected communities or interests.	Important considerations at a local or regional scale. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.	Associated with sites and features of national or state importance. Typically mitigation measures are unlikely to remove such effects.
Property / Assets	Negligible damage to or loss of assets	Minor damage to or loss of assets - some repairs may be required	Moderate to high damage to or loss of assets - requires specialist / contract equipment to repair or replace	Significant / permanent damage to assets and/or infrastructure	Widespread, substantial / permanent damage to assets and/or infrastructure
Social / Cultural Heritage	Negligible social or cultural impacts	Minor medium term social impacts on local population, mostly repairable with appropriate management/remediation	On-going social issues / permanent damage to structures or items of cultural significance	On-going, serious social impacts / significant damage to structures or items of cultural significance	Widespread, on-going, significant serious, irreversible social impacts
Legal	Some minor non-compliances and breaches of regulation	Minor legal issues, non-compliances and breaches of regulation with option for legal recourse	Serious breach of regulation with investigation or report to authority with prosecution and/or moderate fines possible	Major breach of regulation / major litigation	Significant prosecution and fines / very serious litigation including class actions
Systems, Information and Data	Negligible loss of or damage to IT and communications - no loss of data	Minor loss of or damage to IT and communications - some data retrieval may be required	Moderate to high loss / damage to IT and communications - some data may be permanently lost & workarounds may be required	Major loss / damage to IT and communications - data permanently lost, significant catch-up, business continuity plans required to be implemented	Extensive loss / damage to IT and communications assets and infrastructure - data permanently lost, widespread disruption to business

TABLE 1 – EXAMPLE CONSEQUENCE CRITERIA

Risk Likelihood and Frequency (example)

Descriptor	Description of Frequency
Rare	May occur only in exceptional circumstances - can be assumed not to occur during period of the project (or life of the facility)
Unlikely	Event is unlikely to occur, but it is possible during period of the project (or life of the facility)
Possible	Event could occur during period of the project (or life of the facility)
Likely	Event likely to occur once or more during period of the project (or life of the facility)
Frequent / Almost Certain	Event occurs many times during period of the project (or life of the facility)

TABLE 2 – EXAMPLE PROBABILITY (LIKELIHOOD) CRITERIA

Risk Analysis Matrix (example)

		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Probability (Likelihood)	Rare	Low	Low	Low	Medium	Medium
	Unlikely	Low	Low	Medium	Medium	High
	Possible	Low	Medium	Medium	High	High
	Likely	Medium	Medium	High	High	Very High
	Frequent	Medium	High	High	Very High	Extreme

TABLE 3 – EXAMPLE RISK ANALYSIS MATRIX

Using Probability/Impact Matrixes to Calculate Risk Factors

Lists 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

- 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

Calculates 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

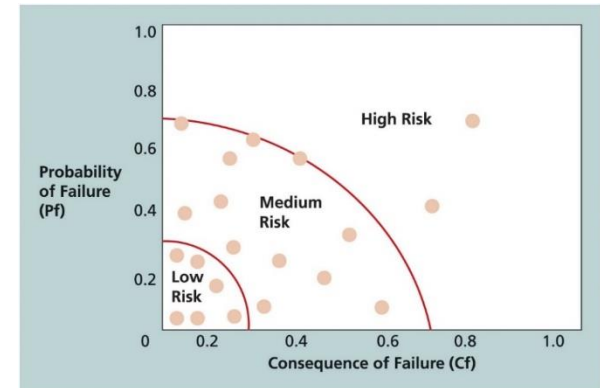


FIGURE 11-6 Chart showing high-, medium-, and low-risk technologies

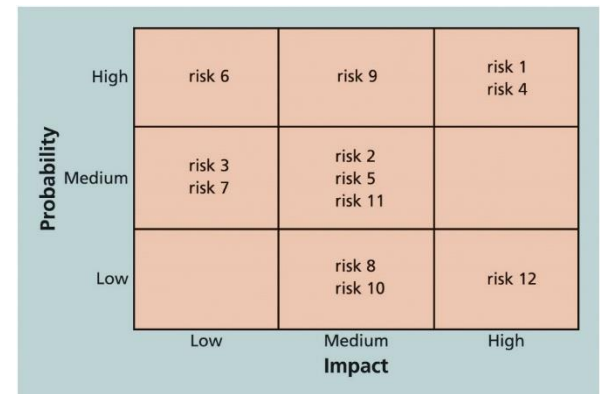


FIGURE 11-5 Sample probability/impact matrix

Top Ten Risk Item Tracking

Qualitative risk analysis tool helps to identify risks and maintain an awareness of risks

- Involves *establishing a periodic review of the top ten project risk items*
- Includes 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*

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 quantitatively

	Monthly Ranking	Monthly Ranking	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	Assigned a new project manager to lead the project after the previous one quit
Poor cost estimates	4	4	3	Revising cost estimates
Poor time estimates	5	5	3	Revising schedule estimates

Risk evaluation

The purpose of risk evaluation is to support decisions. Risk evaluation involves comparing the results of the risk analysis with the established risk criteria to determine where additional action is required.

This can lead to a decision to:

- do nothing further;
- consider risk treatment options;
- undertake further analysis to better understand the risk;
- maintain existing controls;
- reconsider objectives.

Risk Treatment

The purpose of risk treatment is to select and implement options for addressing risk.

Risk treatment involves an iterative process of:

1. formulating and selecting risk treatment options;
2. planning and implementing risk treatment;
3. assessing the effectiveness of that treatment;
4. deciding whether the remaining risk is acceptable;
5. if not acceptable, taking further treatment.

Risk treatment options

Selecting the most appropriate risk treatment option(s) involves balancing the potential benefits derived in relation to the achievement of the objectives against costs, effort or disadvantages of implementation.

Options for treating risk may involve one or more of the following:

- avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk;
- taking or increasing the risk in order to pursue an opportunity;
- removing the risk source;
- changing the likelihood;
- changing the consequences;
- sharing the risk (e.g. through contracts, buying insurance);
- retaining the risk by informed decision.





Planning Risk Responses

After identifying and quantifying risks, the organization must decide how to respond to them

Basic response strategies for risks

- Risk avoidance
- Risk acceptance
- Risk transference
- Risk mitigation

It's also important to identify residual risks

Residual risks: risks that remain after all the response strategies have been implemented

Risk Treatment Plans

The purpose of risk treatment plans is to specify how the chosen treatment options will be implemented, so that arrangements are understood by those involved, and progress against the plan can be monitored.

The information provided in the treatment plan should include:

- the rationale for selection of the treatment options, including the expected benefits to be gained;
- those who are accountable and responsible for approving and implementing the plan;
- the proposed actions;
- the resources required, including contingencies;
- the performance measures;
- the constraints;
- the required reporting and monitoring;
- when actions are expected to be undertaken and completed.

Monitoring and Review

- The purpose of monitoring and review is to assure and improve the quality and effectiveness of process design, implementation and outcomes.
- Ongoing monitoring and periodic review of the risk management process and its outcomes should be a planned part of the risk management process, with responsibilities clearly defined.
- Monitoring and review should take place in all stages of the process. Monitoring and review includes planning, gathering and analysing information, recording results and providing feedback.
- The results of monitoring and review should be incorporated throughout the organization's performance management, measurement and reporting activities.



Recording and Reporting

The risk management process and its outcomes should be documented and reported through appropriate mechanisms. Recording and reporting aims to:

- communicate risk management activities and outcomes across the organization;
- provide information for decision-making;
- improve risk management activities;
- assist interaction with stakeholders, including those with responsibility and accountability for risk management activities.

Thank You

Decision Trees and Expected Monetary Value (EMV)

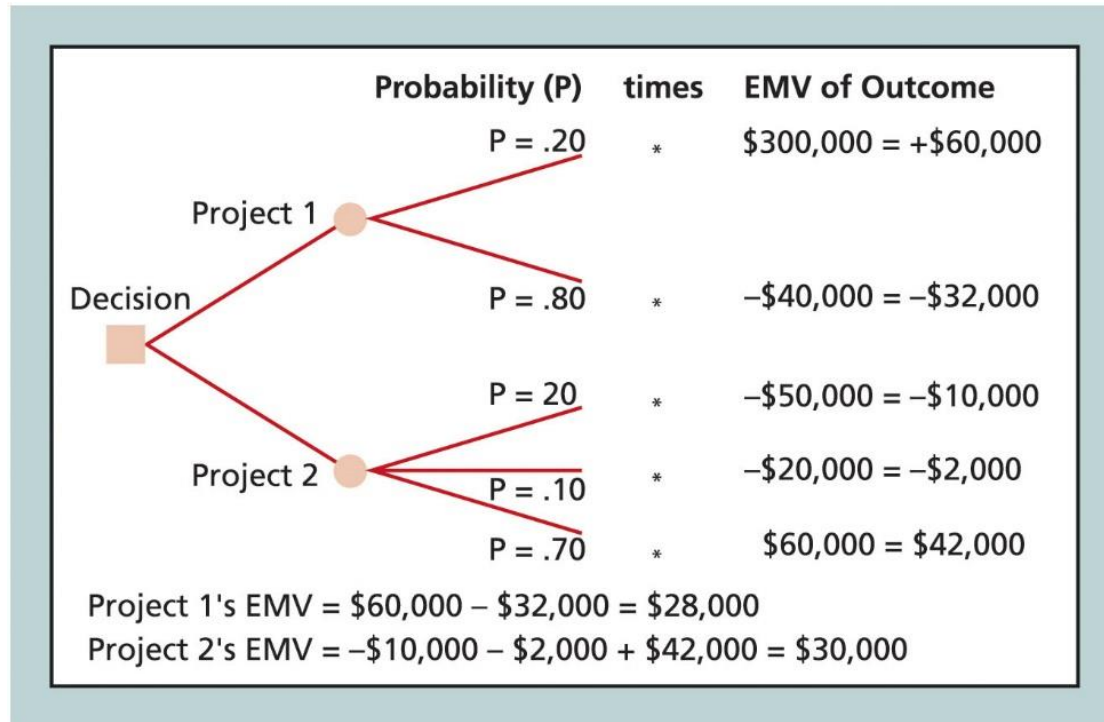


FIGURE 11-7 Expected monetary value (EMV) example

Simulation

Uses a representation or model of a system to analyze the expected behavior or performance of the system

Monte Carlo analysis simulates a model's outcome many times to provide a statistical distribution of the calculated results

Predict the probability of finishing by a certain date or the probability that the cost will be equal to or less than a certain value

You can use several different types of distribution functions when performing a Monte Carlo analysis

Simulation

Steps of a Monte Carlo analysis

Collect the most likely, optimistic, and pessimistic estimates for the variables in the model

Determine the probability distribution of each variable

Select a random value based on the probability distribution for each variable

Run a deterministic analysis or one pass through the model

Repeat steps three and four many times to obtain the probability distribution of the model's results

Simulation (3 of 3)

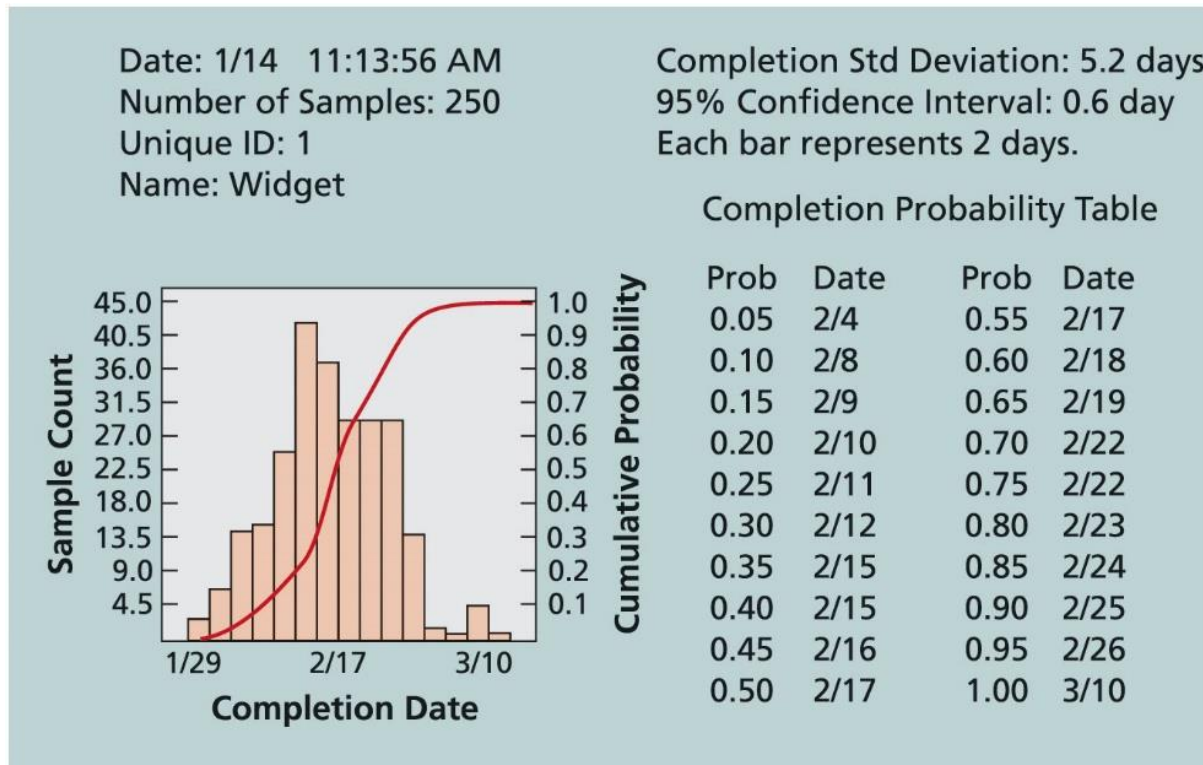


FIGURE 11-8 Sample Monte Carlo–based simulation results for project schedule

What Went Right?

Microsoft Excel is a common tool for performing quantitative risk analysis

General Motors uses simulation for forecasting its net income, predicting structural costs and purchasing costs of vehicles, and determining the company's susceptibility to different kinds of risk

Eli Lilly uses simulation to determine the optimal plant capacity that should be built for developing each drug

Procter & Gamble uses simulation to model foreign exchange risk

Monte Carlo simulation can also help reduce schedule risk on agile projects

Sensitivity Analysis (1 of 2)

Used to show the effects of changing one or more variables on an outcome

For example, many people use it to determine what the monthly payments for a loan will be given different interest rates or periods of the loan

Spreadsheet software, such as Microsoft Excel, is a common tool for performing sensitivity analysis

Sensitivity Analysis (2 of 2)

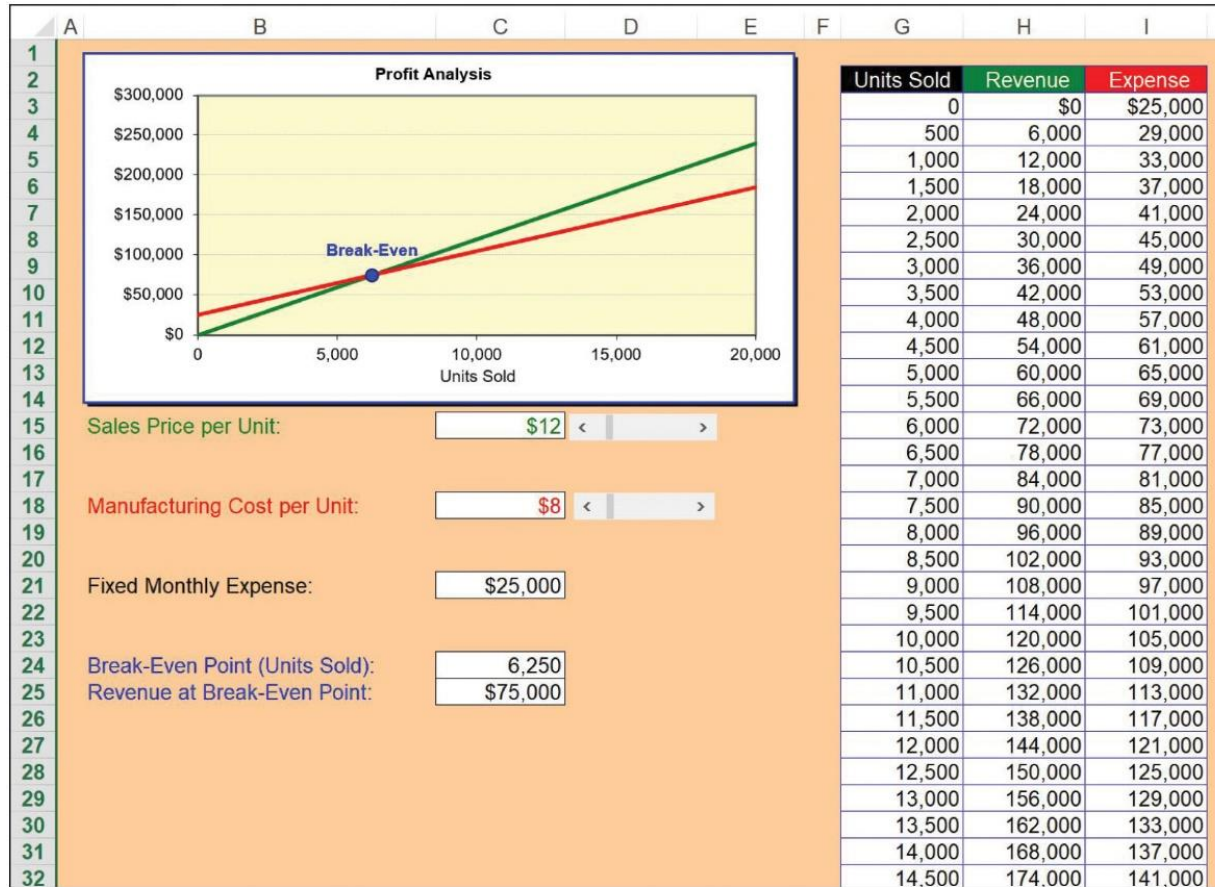


FIGURE 11-9 Sample sensitivity analysis for determining break-even point

Planning Risk Responses (1 of 3)

After identifying and quantifying risks, the organization must decide how to respond to them

Basic response strategies for negative risks

- Risk avoidance

- Risk acceptance

- Risk transference

- Risk mitigation

- Risk escalation

Basic response strategies for positive risks

- Risk exploitation

- Risk sharing

- Risk enhancement

- Risk acceptance

- Risk escalation

It's also important to identify residual and secondary risks

Residual risks: risks that remain after all the response strategies have been implemented

Secondary risks: direct result of implementing a risk response

Implementing Risk Responses

Main executing process performed as part of project risk management is implementing risk responses

Key outputs

Change requests

Project documents updates

Monitoring Risks

Involves ensuring the appropriate risk responses are performed, tracking identified risks, identifying and analyzing new risk, and evaluating effectiveness of risk management throughout the entire project

Project risk management does not stop with the initial risk analysis

Carrying out individual risk management plans involves monitoring risks based on defined milestones and making decisions regarding risks and their response strategies

Project teams sometimes use workarounds—unplanned responses to risk events—

Considerations for Agile/Adaptive Environments

All types of projects should share knowledge related to risks as quickly as possible and keep documents up to date

Risk is considered during each iteration for agile/adaptive projects, which does elevate its importance

Changing priorities can be addressed more easily by changing the product backlog for each iteration