

Project Risk Management

Heerkens Chapter 9

PMBOK Chapter 11

Uncertainty and Risk

Uncertainty as an *absence* of information, knowledge, or understanding regarding a situation, condition, action, decision, or event.

Risk refers to the *ability to predict* a particular outcome with precision and certainty- a reflection of the amount of uncertainty that exists in a particular situation and is proportional to the amount of information available

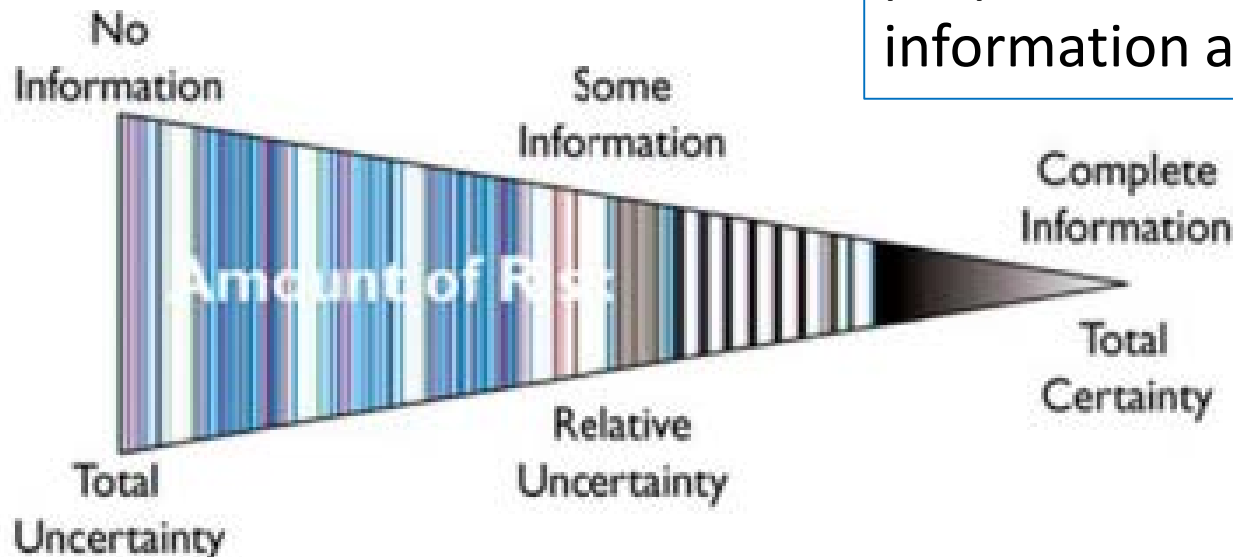


Figure 10-1. Relationship among information, uncertainty, and risk

PMBOK definition (p238)

- Project risk is an uncertain event or condition
- If it occurs, has a positive or a negative effect on at least one project objective, such as time, cost, scope, or quality
- A risk may have one or more causes and, if it occurs, one or more impacts.

Project Risk Management

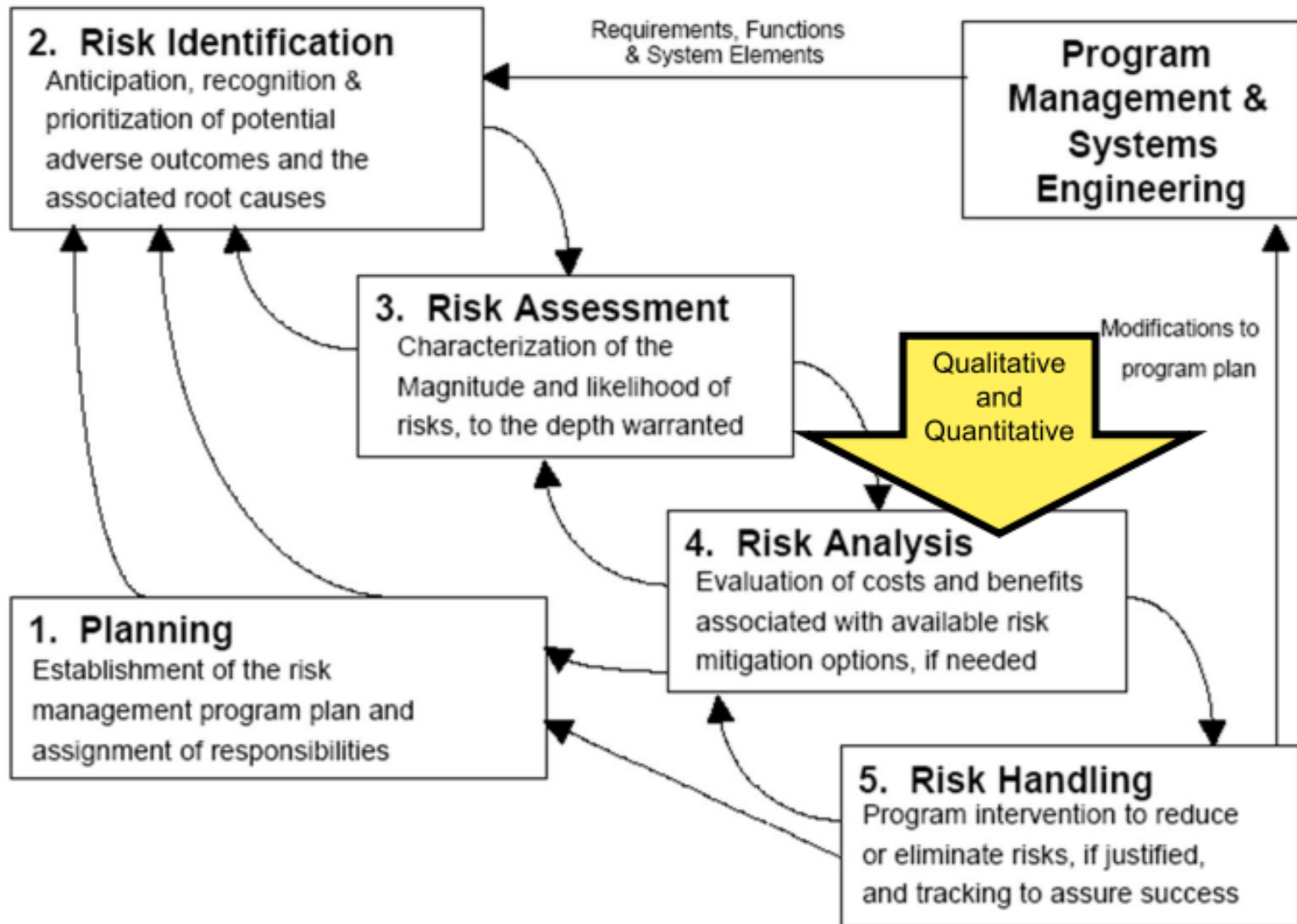


Figure 4-30. Five Steps in the Risk Management Process

11.1 Risk Management Planning

.1 Inputs

- .1 Enterprise environmental factors
- .2 Organizational process assets
- .3 Project scope statement
- .4 Project management plan

.2 Tools and Techniques

- .1 Planning meetings and analysis

.3 Outputs

- .1 Risk management plan

11.2 Risk Identification

.1 Inputs

- .1 Enterprise environmental factors
- .2 Organizational process assets
- .3 Project scope statement
- .4 Risk management plan
- .5 Project management plan

.2 Tools and Techniques

- .1 Documentation reviews
- .2 Information gathering techniques
- .3 Checklist analysis
- .4 Assumptions analysis
- .5 Diagramming techniques

.3 Outputs

- .1 Risk register

The Process - Risk Identification

Rather than look at each risk independently and randomly, it is much more effective to

- **identify risks and then group them into categories**, or,
- to draw up a list of categories and then to identify potential risks within each category.

This way, common influences, factors, causes, potential impacts and potential preventative and or corrective actions, can be discussed and agreed on.

Categorising risks is a way to **systematically identify the risks** and provide a foundation for awareness, understanding and action.

Each project will have its own structure and differences, but here are some categories that are common to most projects (to which you can add your own local, sector, or project specific, categories).

The Process - Risk Identification

Categories may be:

- **Human** – from individuals or organizations, illness, death, etc.
- **Operational** – from disruption to supplies and operations, loss of access to essential assets, failures in distribution, etc.
- **Reputational** – from loss of business partner or employee confidence, or damage to reputation in the market.
- **Procedural** – from failures of accountability, internal systems and controls, organization, fraud, etc.
- **Project** – risks of cost over-runs, jobs taking too long, of insufficient product or service quality, etc.
- **Financial** – from business failure, stock market, interest rates, unemployment, etc.
- **Technical** – from advances in technology, technical failure, etc.
- **Natural** – threats from weather, natural disaster, accident, disease, etc.
- **Political** – from changes in tax regimes, public opinion, government policy, foreign influence, etc.
- **Others**
 - This analysis of threat is important because it is so easy to overlook important threats. One way of trying to capture them all is to use a number of different approaches:
 - Firstly, run through a list such as the one above, to see if any apply.
 - Secondly, think through the systems, organizations or structures you operate, and analyze risks to any part of those.
 - See if you can see any vulnerabilities within these systems or structures.
 - Ask other people, who might have different perspectives.

Area	Description
Scope	Estimated extent of the work, ability to clearly define work, design errors and omissions, customer-driven scope change
Time	Estimated project duration, estimated activity duration, time-to-market, launch date, timing of management reviews and approvals
Cost	Estimated project costs, downstream manufacturing costs, downstream maintenance costs, inflation, currency exchange, budget limitation
Technology	Customer expectations, probability of success, ability to scale-up, product manufacturability, design success
Resources	Quantity, quality, availability, skill match, ability to define roles and responsibilities
Organizational	Client's priorities and knowledge, coordination among departments
Marketability	User expectations, sales volume, pricing, share, demographics, quality, geography, economy
Outside factors	Competitor actions or reactions, regulations

For more risk Identification Checklists – see Appendix to this presentation

Heerkens Fig 10-2 Typical areas of high uncertainty on projects

<p>Project Scope</p> <ul style="list-style-type: none"> ___ Client adds scope or features ___ Work cannot be accurately defined ___ Scope is underestimated ___ Project objectives change <p>Project Schedule</p> <ul style="list-style-type: none"> ___ Project duration underestimated ___ End date shifts during project ___ End date is unrealistic ___ Project approvals are late ___ Management reviews delay project <p>Marketing</p> <ul style="list-style-type: none"> ___ Unrealistic user expectations ___ Market requirements shift ___ Price point changes ___ Sales volume goes down ___ Sales volume goes up <p>Material</p> <ul style="list-style-type: none"> ___ Source(s) and availability ___ Poor integration w/ existing ___ Poor supplier reliability ___ Poor material reliability ___ Substandard quality ___ High price 	<p>Facilities and Equipment</p> <ul style="list-style-type: none"> ___ Lack of availability ___ Poor reliability ___ Incompatibility w/ existing ___ Competing uses or users ___ Proprietary limitations ___ Poor flexibility/adaptability ___ Undesirable location ___ Space (lack of, wrong type) <p>Resources</p> <ul style="list-style-type: none"> ___ Team members change ___ Funding shifts or freezes ___ Uncertain costs/expenses ___ Unavailability of resources ___ Misaligned priorities <p>Organizational</p> <ul style="list-style-type: none"> ___ Unclear roles/responsibilities ___ Poor delegation ___ Poor relationships among units ___ Lack of proper coordination ___ Potential turf wars ___ Policy limitations ___ Poor communications ___ Line versus staff issues ___ Reorganization issues 	<p>Personal</p> <ul style="list-style-type: none"> ___ Vacations/illnesses ___ Family/other issues ___ Conflicting interests ___ Outside distractions ___ Ethics issues ___ Moral issues <p>People/Interpersonal</p> <ul style="list-style-type: none"> ___ Performance/productivity ___ Interpersonal conflict ___ Development and growth ___ Poor motivation and attitudes ___ Poor skills fit ___ Health and safety issues ___ Diversity issues <p>External Influences</p> <ul style="list-style-type: none"> ___ Weather, natural disasters ___ Government regulations ___ Health/Safety/OSHA ___ Patent, copyright issues ___ Cultural barriers ___ Political tensions ___ Economic trend shifts ___ Poor company image ___ Unfavorable legal position
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Heerkens Fig 10-3 Checklist of specific potential problems

Risk Register

Step 1: Risk Identification	Step 2: Risk Assessment			Step 3: Risk Management			
List of Possible Risks	Likelihood H/M/L	Impact H/M/L	What are we already doing about it? (mitigating factors)	What more can we do about it?	Timescale	Person Responsible	Reviewed Level of Risk

Date to be reviewed	
Person/Group responsible for review	

Risk Assessment

11.3 Qualitative Risk Analysis

.1 Inputs

- .1 Organizational process assets
- .2 Project scope statement
- .3 Risk management plan
- .4 Risk register

.2 Tools and Techniques

- .1 Risk probability and impact assessment
- .2 Probability and impact matrix
- .3 Risk data quality assessment
- .4 Risk categorization
- .5 Risk urgency assessment

.3 Outputs

- .1 Risk register (updates)

11.4 Quantitative Risk Analysis

.1 Inputs

- .1 Organizational process assets
- .2 Project scope statement
- .3 Risk management plan
- .4 Risk register
- .5 Project management plan
 - Project schedule management plan
 - Project cost management plan

.2 Tools and Techniques

- .1 Data gathering and representation techniques
- .2 Quantitative risk analysis and modeling techniques

.3 Outputs

- .1 Risk register (updates)

Risk Assessment

- A risk is **something that may happen** and if it does, will have **an adverse impact** on the project.
- "that may happen" implies **a probability of less than 100%**.
 - If it has a **probability of 100%** - in other words it will happen - **it is an issue**.
 - *An issue is managed differently to a risk* – issues management
- A risk must also have **a probability above 0%** - It must have a chance of happening or it is not a risk.
- **"will have an adverse impact"**. If it will not have an adverse impact, it is not a risk
- One way of putting figures to risk is to calculate a value for it as:

risk = probability of event x impact (cost) of event

Heerkens Fig 10-3 Graphical representation of threat ratings

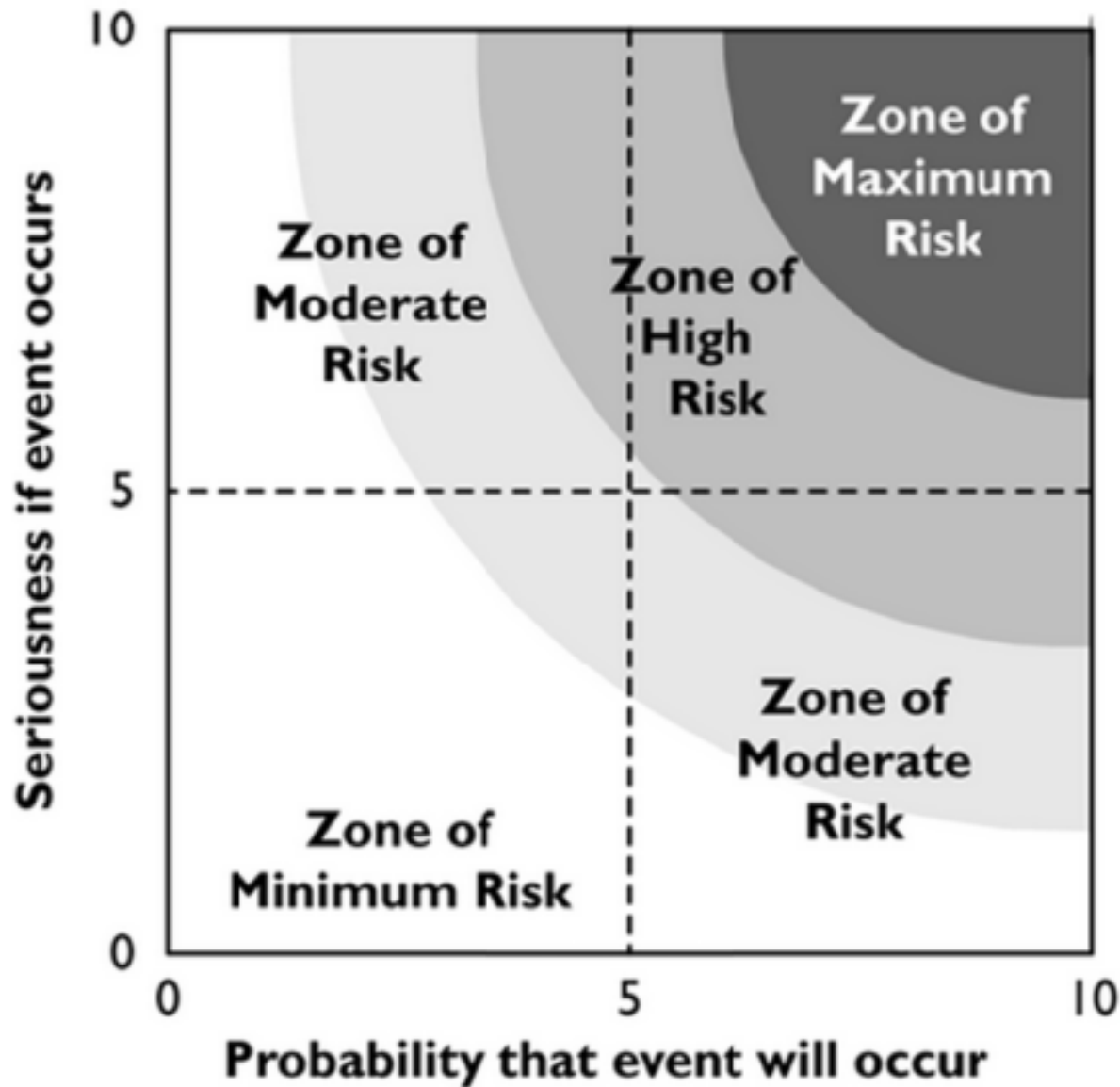


Table 4-1. Risk Assessment Matrix

impact CONSEQUENCES	probability			
	FREQUENT (HIGH)* 0.7 < P < 1.0	PROBABLE (MEDIUM)* 0.4 < P < 0.7	IMPROBABLE (LOW)* 0 < P < 0.4	IMPOSSIBLE P = 0
CATASTROPHIC 1.0 - 0.9	0.9 HIGH	0.7	0.4	0.0
CRITICAL 0.8 - 0.7	0.8	0.6 MEDIUM	0.3	0.0 NONE
MARGINAL 0.6 - 0.4	0.6	0.4	0.2 LOW	0.0
NEGLIGIBLE 0.3 - 0.0	0.3	0.2	0.1	0.0

* Additional terminology, not in US Air Force Guide on Software Risk Abatement

Note: Risk rating is consistent with $R = P * C$

Table 4-3. Performance Consequence Scale

CATEGORY	PERFORMANCE CONSEQUENCES	RATING
CATASTROPHIC	Failure to meet the requirement would result in mission failure. Significant degradation/non-achievement of technical performance.	0.9
CRITICAL	Failure to meet the requirement would degrade system performance to a point where mission success is questionable. Some reduction in technical performance.	0.7
MARGINAL	Failure to meet the requirement would result in degradation of the secondary mission. Minimal to small reduction in technical performance.	0.5
NEGLIGIBLE	Failure to meet the requirement would create inconvenience or non-operational impact. No reduction in technical performance.	0.1

From INCOSE Handbook

Risk	Causes	Probability	Impact	Mitigation
Technology – On-Street				
Failure related to hardware (ordering, delivery, installation, set up, configuration, testing)	Hardware malfunction, vendor staff shortages, delivery problems, incorrect hardware delivered	3	3	Ensure sufficient lead times, write liquidated damages in contracts with vendors, provide clear specifications, ensure thorough verification process, have back up systems and spare parts
Failure related to infrastructure (networking, integration)	Broken switches, ripped cables, telecommunications outages, equipment failure	3	2	Provide for hardware replacement, alternative routing, redundant design, write liquidated damages in contracts with vendors, provide clear specifications, ensure thorough verification process, have back up systems and spare parts
Unable to develop desired technology	Market has not yet developed the product	1	3	Keep design/scope simple, work with as many off the shelf standardized products as possible
Loss of project data control	Vendors not willing to relinquish data ownership	3	3	Negotiate acceptable agreement that is mutually beneficial to City and vendors
Vendors/Contractors – On-Street				
Lack of inter-vendor cooperation	Lack of willingness to share proprietary information	2	4	Include provision in contracts that require full disclosure and access to all parking related data
Non-compatibility with vendor equipment	Technology not available to integrate data and equipment functions	1	3	Keep scope of work and user requirements simple; use proven approaches as much as possible
Vendor staffing issues	Insufficient staff planning	1	3	Request staffing plan
Equipment Deliveries				
Delay in meters	Manufacturing delays, shipment issues, insufficient lead time	2	2	Provide ample lead time for delivery, clarify time expectation, have liquidated damages clauses in contracts for late delivery
Delay in sensors	Manufacturing delays, shipment issues, insufficient lead time	2	3	Provide ample lead time for delivery, clarify time expectation, have liquidated damages clauses in contracts for late delivery
Delay in enforcement handhelds	Manufacturing delays, shipment issues, insufficient lead time	1	2	Provide ample lead time for delivery, clarify time expectation, have liquidated damages clauses in contracts for late delivery
Delay in enforcement vehicles	Manufacturing delays, shipment issues, insufficient lead time	3	1	Provide ample lead time for delivery, clarify time expectation, have liquidated damages clauses in contracts for late delivery
Technology – Off-Street				
Disseminate unreliable information to the public	The parking guidance system will likely rely on real time data extracted from the PARC subsystems. However, the existing PARC subsystem relies on the garage operators to manually reset the counters in order to provide accurate output counting data.	3	3	Develop and enforce procedures and/or offer incentives to the garage operators to diligently reset the counters on a daily basis while the existing PARC system is in place Investigate options that would make manual reset unnecessary Investigate getting real time data directly from sensors and gates instead of from PARC system
Failure to develop a migration path in order to accommodate for subsystem (PARC) upgrades	The SFMTA consultant responsible for investigating and designing the upgrade of the PARC subsystem fails to work with relevant SFMTA staff to develop a migration path parking guidance.	3	3	Ensure that the new PARC subsystem will minimize and mitigate the changes in order to provide data output to the parking guidance system by working with the consultant early in the PARC upgrade design process

11.5 Risk Response

Risk Handling

Planning

.1 Inputs

- .1 Risk management plan
- .2 Risk register

.2 Tools and Techniques

- .1 Strategies for negative risk or threats
- .2 Strategies for positive risks or opportunities
- .3 Strategy for both threats and opportunities
- .4 Contingent response strategy

.3 Outputs

- .1 Risk register (updates)
- .2 Project management plan (updates)
- .3 Risk-related contractual agreements

Value of risks determined ->

Ways of managing them

Choose cost effective

approaches – no point in spending more to eliminating a risk than the cost of the event if it occurs

Often better to accept the risk than to use excessive resources to eliminate it

Risk may be managed in a number of ways:

Avoidance: is not ignoring the problem or threat=> choose a course of action whereby you are no longer exposed to the threat.

Transfer: shift the consequence of the threat. E.g. insurance. Risk transfer does not address the actual risk—it makes another party responsible for the impact of the risk.

Prevention: actions taken to reduce the probability of occurrence of a problem -> identifying the root causes of potential problems => revise the project plan to incorporate any preventive actions

Mitigation of impact: reduce the negative effects of a potential problem.

Contingency planning : specific actions that will be taken if a potential problem occurs

- should be developed in advance to ensure a coordinated, effective, and timely response
- may require backup resources that need to be arranged for in advance
- done only for the high-threat problems that remain after you've taken preventive measures.

Assumption/Acceptance : aware of the risk, but choose to take no action on it i.e. agreeing to accept its consequences or to simply deal with them if the problem happens.

Risk Register

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List of Possible Risks	Likelihood H/M/L	Impact H/M/L	What are we already doing about it? (mitigating factors)	What more can we do about it?	Timescale	Person Responsible	Reviewed Level of Risk

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Person/Group responsible for review	

11.6 Risk Monitoring and Control

.1 Inputs

- .1 Risk management plan
- .2 Risk register
- .3 Approved change requests
- .4 Work performance information
- .5 Performance reports

.2 Tools and Techniques

- .1 Risk reassessment
- .2 Risk audits
- .3 Variance and trend analysis
- .4 Technical performance measurement
- .5 Reserve analysis
- .6 Status meetings

.3 Outputs

- .1 Risk register (updates)
- .2 Requested changes
- .3 Recommended corrective actions
- .4 Recommended preventive actions
- .5 Organizational process assets (updates)
- .6 Project management plan (updates)

The final step is to continually monitor risks to identify any change in the status, or if they turn into an issue.

- An issue is a risk realised
- It is best to hold regular risk reviews to identify actions outstanding, risk probability and impact, remove risks that have passed, and identify new risks.

Appendix

INCOSE Risk Categories (p95-96)

4.2.4.1.3 Risk Categories

- There are at least four categories of risk that can be distinguished:

1. Technical

- is the possibility that a technical requirement of the system may not be achieved in the system life cycle. Technical risk exists if the system may fail to achieve performance requirements

2. cost

- is the possibility that available budget will be exceeded.

3. schedule

- is the possibility that the program will fail to meet scheduled milestones

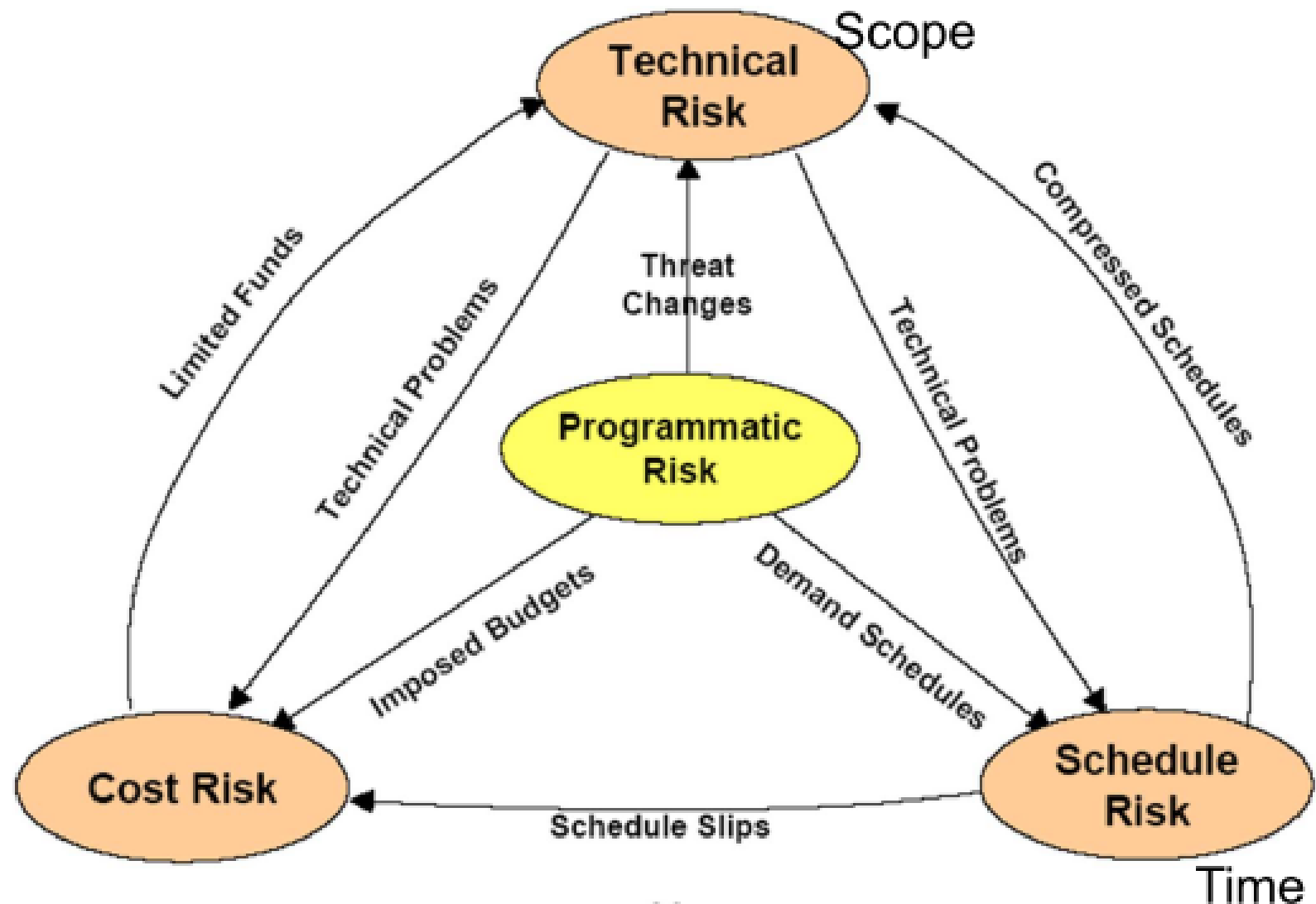
4. programmatic

- is produced by events which are beyond the control of the program manager. These events often are produced by decisions made by personnel at higher levels of authority. Programmatic risks can be produced by reductions in program priority, by delays in receiving authorization to proceed with a program, by changes in national objectives, etc. Programmatic risk can be a source of risk in any of the other three risk categories.

Often there is an additional category:

5. Supportability

Figure 4-32 illustrates major relations among the four risk categories. The arrow names indicate typical risk relations; others certainly are possible.



Risk Identification by Life-cycle phase

PREPROPOSAL		PROPOSAL		CONCEPTUAL		DEM/VAL		DEVELOP		PRODUCTION		SUPPORT		DISPOSAL	
<ul style="list-style-type: none"> • Win Probability • Contract Type • Profit/Loss Potential • Technology/Resource Base • Corporate Objectives & Development Plans • Follow-On Possibilities 		<ul style="list-style-type: none"> • Ability to Meet Reqments • Competitors Approaches • Risk Management Plan • Credibility • Contingency Plans • Optimism vs. Realism • Extent of Recognition of Risk Areas 		<ul style="list-style-type: none"> • Trade-offs (Performance vs. Degree of Risk) • Subcontractor Performance • Assessing Technology (Identifying, Measuring, Forecasting) • Requirements Allocation 		<ul style="list-style-type: none"> • Testing with Limited Resources • Flight Tests with Austere Ground Test Program • State-of-Art • Subcontractor Response • Software Development • Maintaining Config Control 		<ul style="list-style-type: none"> • Maintaining Design Margins (Weight, Computer Memory, etc.) • Test Results Show Problems • Cost/ Schedule Impacts May be Realized • Subcontractor Problems Surface 		<ul style="list-style-type: none"> • Transition Risks (Quality Control, Manufacturing) • Unanticipated Operational Problems • DTUPC Goals • Meeting Training Curves • Material Delivery Schedules • Subcontractor Quality • Change Control • Environmental Effects 		<ul style="list-style-type: none"> • R & M Shortfalls • Contract Structure (Data, Services, etc.) • Deferred Logistics Concerns • Piece- Part Obsolescence • Industrial Base Maintenance • Programming Language Obsolescence • Environmental Effects 		<ul style="list-style-type: none"> • Environmental Effects • Revised Environment Regulations • Inadequate Preparation • Availability of Skilled Personnel 	

Figure 4-33. Risk Considerations By Program Phase