فرآیند جامع مدیریت ریسک در پروژه

به همراه آموزش نرم افزار

Risk Analysis

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شناسایی ریسک ها از نگاه

CMAA

Risk Identification (CMAA)

- Risk identification is the process of evaluating a prospective project to discover its potential risks.
- These risks relate to **scope**, **cost**, and **schedule**.
- Risk managers, consultants, owners, and insurance companies use **lists**, **surveys**, **audit forms**, and other methods to identify and document a project's risks.

Risk Identification (CMAA)

The CM should do the following when assessing risk:

- **Make realistic project assumptions**

Do not allow project assumptions to be interpreted too **idealistically**, and do **not think** all will go **according to plan**.

- **Gather expert judgments**

Collect **unbiased judgements** from a variety of **experts**. These experts should know a great deal about the project.

Risk Identification (CMAA)

- **Clearly understand risk elements and their impacts**

Develop a thorough understanding of each of risk element and its potential impact during the **early phases** of project planning and **update** through subsequent phases.

- **Be objective**

A project's anticipated results, in terms of cost and schedule, should be objective and realistic.

Risk Identification (CMAA)

- The CM should **facilitate** risk identification **meetings** in order to **identify** project risks **as early as possible**.
- The **first** meetings should be held during the later stages of the **pre-design phase**.
- Additional meetings to identify, analyze, and manage risks should occur **during each project phase**.

Risk Register-CMAA

Risk Register(CMAA)

- The **risk register** has been coined as the name of the **worksheet** that is used to collect information on the **risks identified** by the **project team**.
- A **risk register** also acts as a **body of knowledge**, from which firms can draw when assessing **future projects**.
- A risk register is a **spreadsheet** used to **collect** and **organize** information about each risk.
- Information about each risk should be **continuously** updated throughout **a project's lifecycle**.

Risk Register(CMAA)

- More sophisticated projects collect information in a **database** rather than a simple spreadsheet.
- During risk evaluation, information from a risk register is used to create a risk rating for each risk. A risk rating is used to order all risks from **most** to **least** critical.
- Next table only captures a simplified version of a risk register. Some projects may require a more in depth, or advanced risk register be created.

Risk Register(CMAA)

Project Name

Project Risk Register

REV: 0

DATE:

Risk Rating
High
Medium
Low

Risk ID	Retain/ Transfer	RBS	Risk Description	Notes/Mitigation	Risk Rating
13	R	Design	Scope changes by owner during construction.		HIGH
6	R	Construction	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/RFIs/claims than expected.	Have the CM and PM review theh drawings in detail before bid.	HIGH
2	R	Design	Delay with design approvals by owner.	Adhere to time table due to the tight schedule with strong project management.	HIGH
1	T	Procurement	Long lead of the curtain wall system could impact the completion date.	Prepurchase curtain wall system with an early procurement package.	HIGH
8	T	Procurement	Competitive construcion market could result in higher than expected bid prices due to market conditions.		MEDIUM
3	T	Construction	Construcion logistics are a challenge due to the tight confines of the work area.	Coordinate with the other adjacent projects to reduce logistic issues.	MEDIUM
4	R	Permit	Permitting process with city could be delayed.	Expedite the permitting process.	MEDIUM
7	R	Legal	Complaints by neighbors could result in reduced workhours, site access, etc.	Work with adjacent projects on community outreach program.	MEDIUM
12	R	Procurement	Design is not to the owner's liking. Could result in resdesign.		MEDIUM
10	T	Construction	Certificate o Occupancy signoff at the end of the project could take longer than expected.	Pre-plan inspection schedule.	LOW
9	T	Third Party	Agreements with utility companies take longer to coordinate for service.		LOW
11	T	Construction	Geotech-soil condition is worse than expected resulting in deeper piles.		LOW
5	R	Construction	Extreme weather events, such as heavier than expected winters.		LOW
14	T	Construction	Current design does not take into account tenant needs, which could result in additional design changes.	CLOSED: Meeting with tenants was held.	CLOSE

Risk Analysis - CMAA

Risk Analysis - CMAA

- Developing a risk register by **identifying** and **logging** risks and opportunities is only the **beginning** of risk management.
- Once **risks** and **opportunities** have been **identified**, they can be **analyzed** to provide a project team and stakeholders with an assessment of a **risk's potential** to **impact** a project.

- This allows a team to **focus** on those risks with the **greatest potential impact** and/or the **highest likelihood** of occurrence.
- As a project risk process is developed, there is a natural progression from **qualitative** risk analysis in the early stages to **quantitative** analysis as the project, and thus information, develops.

Qualitative Risk Analysis - CMAA

Qualitative Risk Analysis - CMAA

- The objective of qualitative risk analysis is to **evaluate** the **probability** and **impact** of each risk in the risk register to determine the **top risks** to the project.
- Qualitative analysis is the **identification**, **classification**, and **organization** of risks into a **risk register**.
- This analysis helps a team **quickly** identify those risks that pose the **greatest threat** to productivity.
- During the **conception phase** of a project, qualitative analysis is the **only** form of assessment able to be performed. This is because **little information** about the project exists during the conception phase.

Qualitative Risk Analysis - CMAA

- Qualitative analysis is a **subjective evaluation** based on the **expertise** of project team members.
- Qualitative analyses use a **qualitative matrix** to **categorize** risks.
- During the conceptual phase, **no figures** are **estimated**. Instead, the project team categorizes risk from **minor** to **critical** to help identify where to devote time to project risks.

Qualitative Risk Analysis - CMAA

Quantitative Risk Analysis – CMAA

Quantitative Risk Analysis - CMAA

- Quantitative analysis uses **measurable data** to estimate the **severity** and **likelihood** of each risk.
- Results of quantitative analysis are also stored in a risk register.
- There are alternatives to performing all analyses in a risk register. Some entities include a **separate** calculation sheet for **quantitatively** analyzing each risk.

Quantitative Risk Analysis - CMAA

- Data generated from this calculation sheet is fed back into the risk register. Risk facilitators can **tailor** their **process** for capturing quantitative to their project.
- One recommendation is to keep **all information** contained on a **single spreadsheet**, so the basis for the quantitative analysis can be **easily reviewed** and **understood**.

Quantitative Risk Analysis - CMAA

- In quantitative analysis, a risk facilitator uses a **risk's estimated potential** for **occurrence** and the **impact** the risk will have if it occurs, as variables to calculate a risk's range of impact.
- This calculation is performed using is a **Monte Carlo** probability analysis.
- The risk evaluation process naturally progresses from **qualitative** to **quantitative**, as information needed to perform a quantitative analysis becomes available.

Advanced Risk Registers

Determining Overall Risk Score

Determining Overall Risk Score

- Unlike a simple risk register, an advanced register contains several **additional fields**, with **specific quantitative** definitions, and a **formula** for **scoring** the overall risk. The new fields include:

- **Probability Score**
- **Time/Schedule Impact**
- **Cost Impact**
- **Quality Impact**
- **Overall Risk Score**

ACEMI

Project Name

Project Risk Register

REV: 0

DATE:

Score	1	2	3	4	5
Probability	< 10%	< > 10-50%	< > 50-75%	< > 75-90%	> 90%
Cost	< $30k	< > $30-100k	< > $100-300k	< > $300k-1m	> $1m
Time	< 2 weeks	< > 2 wks-1mth	< > 1-2 mths	< > 2-4 mths	> 4 months
Quality	minimal shortfall	some shortfall	shortfall	significant shortfall	unacceptable

Rating	< 3 (low)	3 > < 9.5 (medium)	> 9.5 (high)

Risk ID	Retain/ Transfer	RBS	Risk Description	Notes/Mitigation	Probability Score	Cost Impact Rating	Time Impact Rating	Quality Impact Rating	Overall Risk Rating
13	R	Design	Scope changes by owner during construction.		5	5	4	3	20
6	R	Construction	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/RFIs/claims than expected.	Have the CM and PM review theh drawings in detail before bid.	3	4	4	3	11
2	R	Design	Delay with design approvals by owner.	Adhere to time table due to the tight schedule with strong project management.	4	4	4	0	11
1	T	Procurement	Long lead of the curtain wall system could impact the completion date.	Prepurchase curtain wall system with an early procurement package.	4	5	3	0	11
8	T	Procurement	Competitive construcion market could result in higher than expected bid prices due to market conditions.		3	5	3	0	8
3	T	Construction	Construcion logistics are a challenge due to the tight confines of the work area.	Coordinate with the other adjacent projects to reduce logistic issues.	5	2	2	0	7
4	R	Permit	Permitting process with city could be delayed.	Expedite the permitting process.	5	2	2	0	7
7	R	Legal	Complaints by neighbors could result in reduced workhours, site access, etc.	Work with adjacent projects on community outreach program.	4	2	2	0	5
12	R	Procurement	Design is not to the owner's liking. Could result in resdesign.		1	3	3	5	4
10	T	Construction	Certificate o Occupancy signoff at the end of the project could take longer than expected.	Pre-plan inspection schedule.	2	2	2	0	3
9	T	Third Party	Agreements with utility companies take longer to coordinate for service.		2	2	2	0	3
11	T	Construction	Geotech-soil condition is worse than expected resulting in deeper piles.		1	3	3	0	2
5	R	Construction	Extreme weather events, such as heavier than expected winters.		1	1	1	0	1
14	T	Construction	Current design does not take into account tenant needs, which could result in additional design changes.	CLOSED: Meeting with tenants was held.	0	0	0	0	0

Determining Overall Risk Score

Score	1	2	3	4	5
Probability	< 10%	< > 10-50%	< > 50-75%	< > 75-90%	> 90%
Cost	< $30k	< > $30-100k	< > $100-300k	< > $300k-1m	> $1m
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This matrix shows how each risk can be defined and scored. The overall risk score is used to qualitatively order risks in the risk register from highest to lowest. To calculate the overall risk score, multiply the risk's **probability score** by the **average** of the its **cost**, **time**, and **quality** scores.

$$Overall\ Risk\ Score = P \times [(C + T + Q) \div 3]$$

Determining Overall Risk Score -Example

A risk manager identifies a single risk with the following attributes, the overall risk score is nine. A score of nine would make this a medium (yellow) risk.

- The risk's probability of occurrence is 60% Probability (P) = 3
- The risk's cost impact is $500,000 Cost (C) = 4
- The risk's time impact is a 3-week delay Time (T) = 2
- The risk will cause a quality to shortfall Quality (Q) = 3

$$\textit{Overall Risk Score} = 3 \times [(C + T + Q) \div 3] = 9$$

Determining Overall Risk Score -Example

- Risks in an advanced risk register should be ordered from **highest** to **lowest** based on their overall risk score.
- A risk's ID number is only used for reference; it has no bearing on the risk's order.

Comprehensive Risk Register

- A comprehensive risk register includes information about **mitigation measures**, **responsibilities**, and **due dates** for **each** risk.
- It also visually separates information about each risk into two categories: **pre-mitigation** and **post-mitigation.**

Mitigation

- **Mitigation** is possibly the **most important** part of the **risk management** process.
- The **risk owner** is responsible for providing a **risk mitigation plan.**
- This plan is a set of **action items** with **responsibilities** and **required dates**, with the intent that these actions enacted by those responsible will provide the best **possibility** of **mitigating** the risk to **reduce** the **impact** to the project.

Mitigation

- The risk register's pre-and post- mitigation scores indicate a risk's severity before and after mitigation measures have been performed and demonstrates how effective the mitigation measures are on the risks.

Mitigation

Project Name

Project Risk Register

REV: 0

DATE:

Score	1	2	3	4	5
Probability	< 10%	< > 10-50%	< > 50-75%	< > 75-90%	> 90%
Cost	< $30k	< > $30-100k	< > $100-300k	< > $300k-1m	> $1m
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				Pre-Mitigation								Post Mitigation				
Risk ID	Retain/ Transfer	RBS	Risk Description	Probability Score	Cost Impact Rating	Time Impact Rating	Quality Impact Rating	Overall Risk Rating	Notes/Mitigation	Risk Owner	Due Date	Probability Score	Cost Impact Rating	Time Impact Rating	Quality Impact Rating	Overall Risk Rating
13	R	Design	Scope changes by owner during construction.	5	5	4	3	20		Bob N.		5	5	4	3	20
6	R	Construction	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/RFIs/claims than expected.	3	4	4	3	11	Have the CM and PM review theh drawings in detail before bid.	Larry F.	8/30/2020	2	3	3	2	5
2	R	Design	Delay with design approvals by owner.	4	4	4	0	11	Adhere to time table due to the tight schedule with strong project management.	David C.	4/9/2019	3	4	4	0	8
1	T	Procurement	Long lead of the curtain wall system could impact the completion date.	4	5	3	0	11	Prepurchase curtain wall system with an early procurement package.	David C.	8/30/2020	1	2	3	0	2
8	T	Procurement	Competitive construcion market could result in higher than expected bid prices due to market conditions.	3	5	3	0	8		Bob N.	8/30/2020	3	5	3	0	8
3	T	Construction	Construcion logistics are a challenge due to the tight confines of the work area.	5	2	2	0	7	Coordinate with the other adjacent projects to reduce logistic issues.	Bob N.	8/30/2020	4	2	2	0	5
4	R	Permit	Permitting process with city could be delayed.	5	2	2	0	7	Expedite the permitting process.	JoAnn C.	8/30/2020	4	2	2	0	5
7	R	Legal	Complaints by neighbors could result in reduced workhours, site access, etc.	4	2	2	0	5	Work with adjacent projects on community outreach program.	Eric H.	9/7/2020	3	2	2	0	4
12	R	Procurement	Design is not to the owner's liking. Could result in resdesign.	1	3	3	5	4		Bob N.	9/7/2020	1	3	3	5	4
10	T	Construction	Certificate o Occupancy signoff at the end of the project could take longer than expected.	2	2	2	0	3	Pre-plan inspection schedule.	JoAnn C.	9/7/2020	1	2	2	0	1
9	T	Third Party	Agreements with utility companies take longer to coordinate for service.	2	2	2	0	3		Eric H.	9/7/2020	1	1	1	0	1
11	T	Construction	Geotech-soil condition is worse than expected resulting in deeper piles.	1	3	3	0	2		Clint S.	9/7/2020	1	3	3	0	2
5	R	Construction	Extreme weather events, such as heavier than expected winters.	1	1	1	0	1		Clint S.	9/7/2020	1	1	1	0	1
14	T	Construction	Current design does not take into account tenant needs, which could result in additional design changes.	0	0	0	0	0	CLOSED: Meeting with tenants was held.	Larry F.	9/7/2020	0	0	0	0	0

Risk Attitudes and Appetites

Risk Attitudes and Appetites

- Project risk response and treatment options are influenced by the risk profile or risk attitude of the decision maker.
- In organizations, decision making is carried out by people on behalf of the organization.

Risk Attitudes and Appetites

- Project risk response and treatment options are influenced by the risk profile or risk attitude of the decision maker.

- These attitudes and profiles are culturally, socially, and psychologically conditioned. This conditioning applies to individuals and organizations and, to some extent, societies.

- In organizations, decision making is carried out by people on behalf of the organization.

اشتهای ریسک چیست؟

- اشتها ریسک، میزان ریسک میزان ریسکی است که یک سازمان برای پذیرش آن آماده است.
- اشتهای ریسک یک تعادل بین مزایای احتمالی و تهدیدها را نشان می دهد.

Risk Attitudes and Appetites

- هر سازمان می تواند سطوح مختلف ریسک را تحمل کند. با این وجود این مهم است که سازمان درک مشترکی از ریسک ایجاد کند و برای احتمال و تأثیر تهدیدهای شناخته شده آماده شود.
- سازمانها قبل از اقدام باید حداکثر میزان تحمل ریسک را در هر منطقه از ریسک تعریف کنند.

Risk Attitudes and Appetites

- سازمان‌ها گاهی اوقات اشتها ریسک را طی سندی را ابراز می‌کنند، سندی که به راهنمایی فعالیت‌های مدیریت ریسک سازمانی کمک می‌نماید.

- این بیانیه باید مبتنی بر بررسی دیدگاه‌ها و نگرانی‌های کلیه ذینفعان کلیدی باشد و به پیامدهای استراتژی‌ها و شیوه‌های فعلی سازمان بپردازد.

Risk Attitudes and Appetites

- استاندارد مدیریت ریسک ISO ۳۱۰۰۰ اشتهای ریسک را اینگونه تعریف می‌کند: **مقدار و نوع ریسکی است که یک سازمان برای پیگیری ، حفظ یا پذیرفتن آمادگی دارد.**
- این مفهوم به راهنمایی رویکرد سازمان در مدیریت ریسک و ریسک کمک می‌نماید.
- اشتهای ریسک بیانگر میزان ریسکی است که سازمان حاضر به قبول آن جهت نیل به اهداف کسب و کار خود می باشد.

Risk Attitudes and Appetites

- اشتها یا آستانه تحمل ریسک، به میزانی از ریسک پذیری گفته می‌شود که مدیریت ارشد برای دستیابی به اهداف استراتژیک سازمان آن را می‌پذیرد.
- آستانه ریسک‌پذیری سازمان برای ایجاد تعادل در بهره برداری از عدم قعطیتهای محیطی و مواجهه با خطرات ناشی از آن معین می‌گردد.
- سازمانها های مختلف حسب نوع کسب و کار، استراتژی ها والبته گرایش ذینفعان خود، از درجات مختلفی از ذائقه ریسک برخوردارند.

کدام نوع از ریسک ها در سازمان قابل پذیرش و کدام یک غیرقابل پذیرش است؟

مثال:

- ریسک مربوط به اتلاف موجودی کالا قابل پذیرش اما ریسک خطرات جانی در هر حدی غیرقابل پذیرش است.
- چه سطحی از اتلاف منابع در اثر مخاطرات مربوط به ریسک پذیری قابل پذیرش است؟
- ریسک مربوط به کدام یک از حوزه های اهداف استراتژیک قابل پذیریش است؟
- ریسک مربوط به نوآوری در محصولات و خدمات قابل پذیرش است.

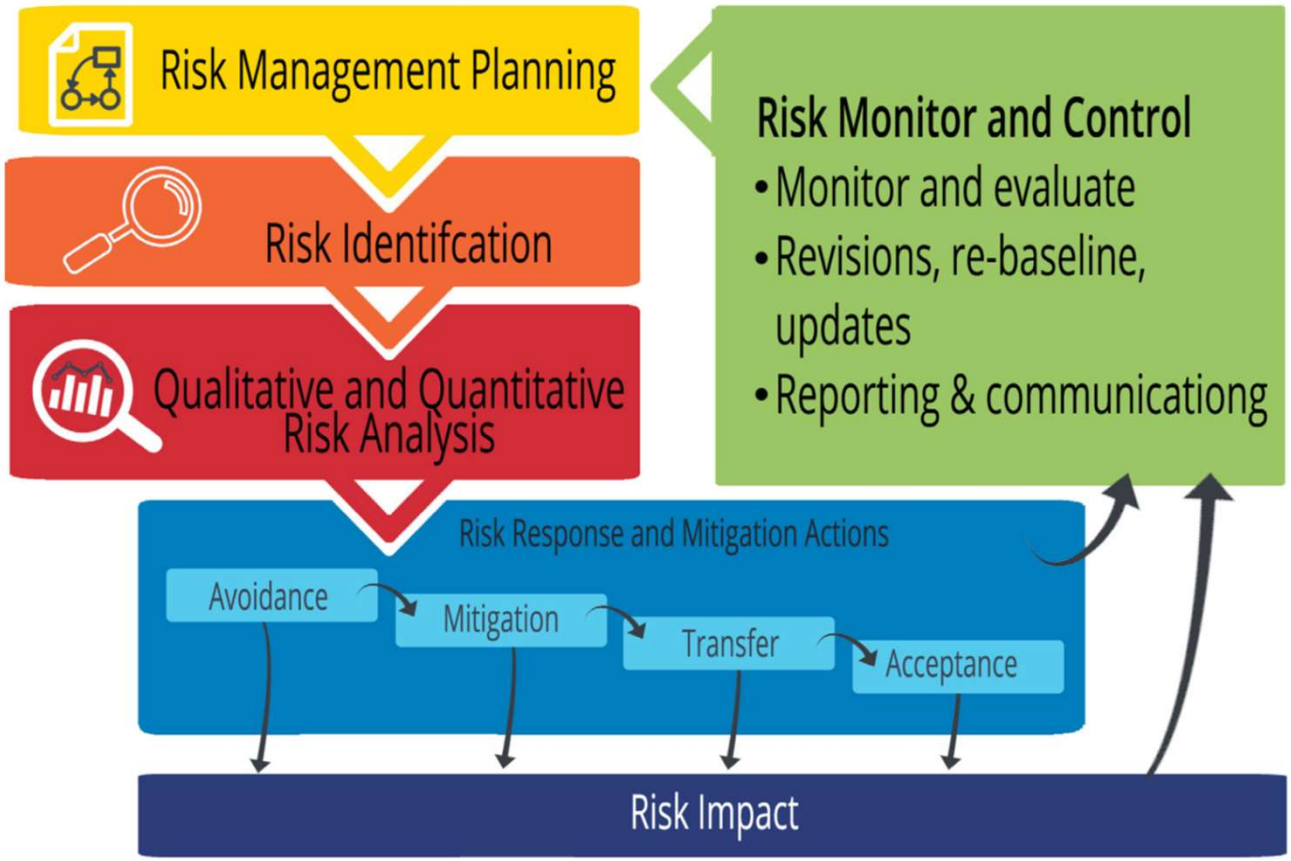
Risk Attitudes and Appetites

- آیا حوزه‌هایی از ریسک وجود دارد که به هیچ عنوان قابل پذیرش نباشد؟
- مثل مسوولیت در برابر قانون، منشور اخلاقی و ارزش‌های سازمان یا الزامات ذی‌نفعان.
- ریسک کاهش کیفیت در برابر قیمت رقابتی تر قابل پذیرش ولی ریسک ایمنی غیرقابل پذیرش.
- گاهی اشتهای ریسک بر اساس سطح پاسخگویی تعیین میشه. پاسخگویی در برابر کارفرما قابل قبول ولی در برابر رییس اداره محیط زیست منطقه غیرقابل پذیرش.

Risk Response and Treatment Options

Risk Response and Treatment Options

- Any **response to**, and **treatment of**, a project risk is likely to incur **costs** to the project stakeholder organization at some point.



Risk Response:

There are basically four types of response to threat risks:

- Avoidance
- Transfer
- Reduce / Mitigate
- Retain residual risk, and retention

Risk Response

- The **strategic** risk management **policies** of an organization may provide **direction** as to **which** project risk **responses** are preferred and should be **adopted**.
- The cost of treating a risk must be **balanced** against the **financial** magnitude of any consequences of the risk event.

Risk Response Options

بررسی گزینه های پاسخ به ریسک

Risk Response Options

Four types of response to project threat risks are encountered:

- Avoidance
- Transfer
- Reduce / Mitigation
- Retain residual risk

Risk Response Options

- **Combinations** of **transfer** and **reduction** are possible.
- Risks are **rarely eliminated**. Even where this is possible, they are almost invariably **replaced** by **other risks** and, should it become.

Risk Avoidance

- **Avoiding** a risk means deliberately taking **another** course of **action** so that it cannot arise in the **new** circumstances.
- **Abandoning** a project is **seldom** a **response** to one project risk factor in isolation.
- Such a decision should only be made **after** the more important risk issues have been **reconsidered** and their **overall influence** on the **project** assessed.

Risk Avoidance

Example: A construction project, such as a multi-store residential apartment building, has been designed with a basement parking level.

However, the site has a history of occasional flooding following periods of exceptionally heavy rain. The risk is the likelihood that a heavy rainstorm will occur and flood the basement, causing damage to the vehicles parked there, damage to electrical and other services at that level, and inconvenience to the residents.

Risk Avoidance

In this case, a risk avoidance treatment might be to redesign the building to omit the basement level and replace it with ground level and above-ground level parking.

The risk is thus avoided, since there is no longer a basement to flood. Instead, however, the risk of flooding occurring at ground level is now increased – although the impact of this might not be as serious as that for the basement.

Risk Transfer

In electing to **transfer** risk, a project organization is seeking to **shift** the **potential** burden of a particular risk to **another party** or **parties** who may be **directly** or **indirectly** involved with the project.

Risk Transfer

This is a common response in project situations where stakeholder **supply chains** or **networks** are easily **distinguished**, often under contractual agreements.

Attempts will be made to transfer risks progressively along the supply chain or to the more distant extremities of the network. For example, a project client will **transfer risks** to the **head contractor**, who in turn will transfer them to **subcontractors** or **suppliers**.

Risk Transfer

- The mechanisms typically used to transfer risks in such situations include head **contract agreement** clauses subcontracts, and **supplier agreements**.
- Risk transfer often forms the distinguishing characteristic between many alternative forms of **project** or **service procurement** and **delivery**, such as **joint ventures**, **public–private partnerships**, **franchises**, and **agencies**.

Risk Transfer

- In the construction industry, it is noticeable in building procurement systems such as
  - Design and Build (D & B)
  - Design-Build-Finance-Operate (DBFO)
  - Build-Own-Operate (BOO)
  - Build-Own-Operate-Transfer (BOOT)
  - …

Common to most of these is the intention to **transfer risk** away **from** the **client** stakeholder and towards the **contractor**.

Risk Transfer

- **Insurance** is a transfer mechanism for risks that are insurable such as **theft**, **injury**, **damage** to property or equipment, and some **third-party** liabilities.
- This introduces another stakeholder to the project, albeit indirectly.

Risk Transfer

- The **direct costs** of risk transfer may be obvious.
- **Indirect costs** can occur when, for example, a risk is passed to a project subcontractor who does not manage it effectively and is then affected by the impact of a risk event.

Risk Transfer

- If the **subcontractor** survives the risk impact, but cannot recoup its losses from the main contractor, it will attempt to do this on other future projects.
- If the **subcontractor** does not survive the risk impact, the losses are eventually borne by the relevant industry and finally by society itself.

Risk Avoidance

- **No risk** should be **avoided**, transferred, or retained **without** first checking to see if it is possible to first reduce it to a more acceptable level and then retain the residual risk.
- Risk reduction exploration may continue **iteratively** until the point is reached where the residual amount of a risk is **acceptable** (in terms of a strategically determined level) and can be **retained** by the project stakeholder organization.
- This means that **more than one** return to the risk analysis stage may be required.

Risk Retention

- A decision to **retain** a threat risk **without** any **mitigating** action should only be made upon an **informed basis**, after appropriate **investigation** has been carried out and it is found that any treatment is unlikely to be effective or delivers a **negative** benefit–cost ratio.
- There are likely to be risks **unwittingly retained** by the organization because they have **not been identified**.

Risk Retention

Examples of the ‘risk/reward’

1.An excavation subcontractor tendering for a construction project retains the risk of stormwater flooding the excavations but rewards itself by increasing the unit price rate for the work.

2. A financier increases its loan interest rate as a reward for retaining the risk of payment default on a loan

Risk Retention

‘risk/reward’

- The ‘risk and reward’ approach, however, must be carefully balanced as it introduces its own additional risks. The excavation subcontractor might find that its bid is unsuccessful because competitors have submitted lower prices.
- The financier might find its share of the loan finance market diminishes as borrowers seek alternative loan sources at lower rates.

Risk Retention

- While the **principle of risk retention**, therefore, is that it should be done on an **informed basis**, the principle of seeking certain compensatory reward should always be on the basis that the stakeholder is **not thereby exposed** to other, more severe risks.

Combination Responses to Risk

- **Combinations** of risk **transfer** and risk **reduction** and **retention** are possible.
- The most common example of combination risk responses is the transfer of risk through insurance, while at the same time retaining a share in the potential impact by accepting liability for a fixed excess sum in the insurance policy agreement.

Combination Responses to Risk

- For example the insurance company requires the transferor to carry out mitigating action as well as imposing an excess liability.
- For burglary insurance, an insurance company might require the policy holder to fit special window and door locks, and install an alarm system.

Risk Treatment Options

- In seeking to reduce or mitigate a threat risk, the decision maker plans deliberate action to **reduce** one or more components of the risk and then **retains** the residual risk.
- Deliberate risk mitigation treatment aims to:
  - Lower the **probability** (likelihood of occurrence) of the threat risk event.
  - Lower the **impact** (consequence) of the event should it occur.
  - Shorten the **exposure period** (duration) to the risk event or its consequences.
  - Carry out some combination of any or all of these.

Risk Treatment Options

- **Example1:** A construction site manager instructs scaffold fixers to erect additional horizontal guard rails and higher toe boards (the low vertical boards along the external edges of scaffolding platforms) on scaffolding to upper floors, to reduce the chance of 'falling from height' accidents. This reduces the likelihood that something or someone will fall from the scaffolding. It is a treatment that may go beyond existing legal safety compliance requirements. However, if a 'falling' incident should occur (person or object), the consequences are not thereby reduced. Suitably strong catch nets strung from the scaffolding would be one way of reducing the impact of an accident, but note too that this alone would not minimize the chance of the accident happening. Note that none of the additional precautions addresses the root causes of scaffolding accidents. **Better safety training and safety motivation for workers are the only things likely to do this**.

Risk Treatment Options

Example2: In another construction example, it is sometimes necessary to disturb or remove the foundations of an existing building, in order to deepen them or replace them with new foundations (perhaps for a new adjoining building). This operation is known as underpinning and is regarded as a risky process since it involves the temporary removal of structural support from the existing building. Where the existing building is situated on an adjacent property title with different ownership, the adjoining owner's entitlement to joint structural support may substantially increase the severity of the risk. A common risk reduction treatment in this case is to carry out the work in small sections at a time (each perhaps no greater than 1 or 2 meters in length), with each one executed in a strictly planned sequence so that no two adjoining sections in the linear length of the existing foundation are exposed or removed at the same time. This underpinning technique reduces the likelihood that a foundation collapse will occur, and the addition of temporary lateral support (such as angle shoring) will reduce that likelihood even further.

Risk Treatment Options

- The important learning from these examples is that the **nature of the risk** itself usually provides **guidance** for choosing the best treatment alternative.
- The **mitigation** treatment is intentionally **planned** and not haphazard or coincidental.
- The **examples** and other **experiences** may also allow us to **detect** some principles for risk **reduction**.

Risk Mitigation Principles

- A principle detectable is that **reducing** the likelihood of occurrence of a risk event generally means **doing things better** or doing them **differently**.
- **Value management** techniques can be useful in these investigations, since these are intended to explore alternative solutions to delivering required functions.

Risk Mitigation Principles

- Attempts by stakeholder organizations to reduce the likelihood (chance/probability) of occurrence of a threat risk event on a project tend to **focus** upon **implementing** or **increasing** the **effectiveness** of other management techniques.

Measures might include:

- More stringent safety precautions (occupational health and safety management)
- More frequent financial audits (financial management)
- More frequent stock checks (logistics management)
- More stringent or more frequent inspection of finished work (quality management)
- Regular or advanced training for staff (human resource management).

Risk Mitigation Principles

- **Reducing** the impact of a risk event calls for a **different approach**.
- Risk impact reduction usually depends upon the prudent provision of **extra resources**, so that the potentially adverse consequences of a risk event are diluted in some way.
- The old financial investment adage about ***'not keeping all your eggs in one basket'*** is a typical example of risk impact reduction.

Risk Mitigation Principles

- The tools of risk impact reduction, precautionary measures such as **backup resources** and **recovery planning**, **contingency allocations**, **reserve funds**, public relations expertise, and portfolio investment.

Risk Mitigation Principles

- Contingency sums deserves are sums of money set aside in project budgets and estimates in order to cover, at least in part, the financial impacts of events that cannot be foreseen in the earliest stages of a project.
- Some stakeholders reduce the contingency to match the decline in uncertainty as the project proceeds (unknown unknowns) and information increases.

Risk Mitigation Principles

- Trying to reduce the period of exposure to a risk can be a complicated process.
- The tool most appropriate is **rescheduling** and shorter periods for **guarantees** and **warranties** offered to customers.
- **Rescheduling** seeks to **accelerate progress** or at least **reduce progress uncertainty**.
- Introducing shorter warranty and guarantee periods attempts to **minimize** periods of **liability**.

Risk Mitigation Principles

- For many **natural risks** it may be **difficult** to **reduce** the **likelihood** of **occurrence** or **duration** of exposure.
- **Planning** a project to avoid adverse seasonal weather is one approach for weather risks. Possible treatments for natural risks are therefore more likely to be found by exploring the consequences more fully.

Risk Mitigation Principles

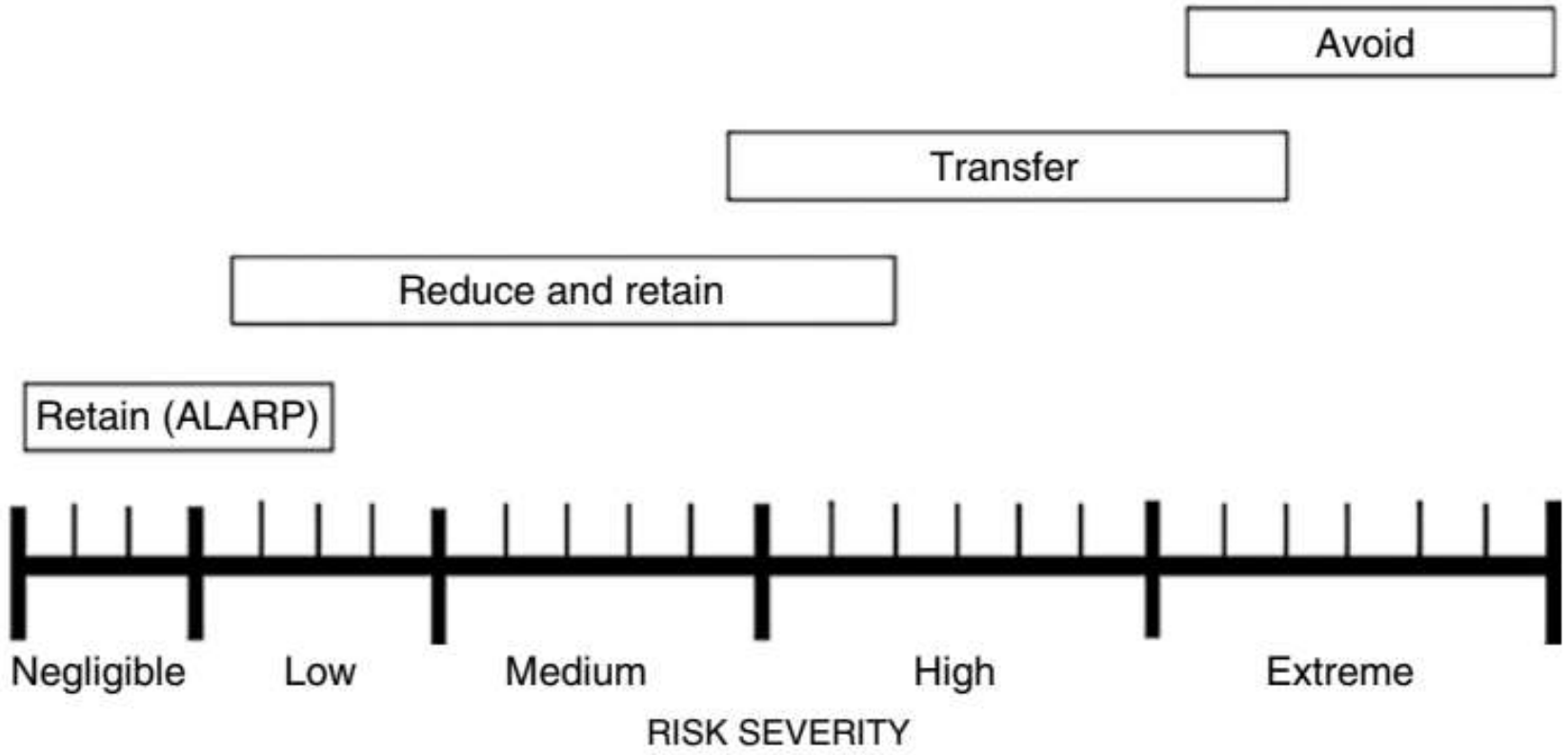
- To sum up the principles of risk treatment: **reducing the likelihood of occurrence** usually means trying to **do things better** by **enhancing** or **increasing** management interventions, controls, techniques, and tools.
- Reducing the adverse consequences of risks is often a matter of ensuring **extra resources** and **backup facilities** are available, using '**workaround**' routines, or developing **emergency procedures**.

Risk Mitigation Principles

- Reducing the duration of exposure for a risk may be achievable through **rescheduling** or increasing **scheduling flexibility**, or by **reducing** the **duration** of longer term liability commitments.
- Some risk responses and treatment options may be predetermined, or at least shaped, by the **strategic risk policies** of a project stakeholder organization.

Risk Response Options

Strategic Use of ALARP ('As Low as Reasonably Practical')



Strategic Use of ALARP ('As Low as Reasonably Practical')

The first aim is achieved through the ALARP principle, whereby the **severity point**, beyond which other risk treatments will be considered more effective, is set as low as reasonably practical. At the other end of the scale, the 'Avoid' and 'Transfer' options are intended to embrace as many 'High' and 'Extreme' severity threat risks as possible.