استراتژی مدیریت ریسک در طول چرخه حیات پروژه

(بر اساس سند مهمی از CMAA)

بخش اول: مقدمه و مفاهیم اولیه مدیریت ریسک در پروژه‌های صنعت ساخت

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What we will learn?

- Introduction
- Risk Management Definitions (AACE TCM)
- The CM's Role in Risk Management
- Risk Management Plan
- Risk Management Process (AACE TCM)
- Risk Management Process (CMAA)
- Risk Meetings
- Risk Allocation
- Scale

Risk Management Process

(CMAA)

Risk management process

- Teams in the built environment face many **dynamic** threats and opportunities throughout all delivery phases.
  - Risks can **change** and **new risks** can emerge as a project or program moves into later phases.
    - ✓ *Examples include differing site conditions, market changes, new technologies, scope changes, the public's perception of the project or program, and weather.*
      - The **potential consequences** of these risk events include **changes** in cost, schedule, and quality, which all affect successful delivery.

Risk management process

- Therefore, a CM must understand that risk management is a **continuous process** to identify, analyze, respond to, and monitor threats and opportunities th**roughout all phases** on a construction project or program.
  - Risk management processes are **iterative** and must **repeat at regular intervals** throughout the entire project or program.
    - ✓ The CM should **understand** and **participate** in risk management processes throughout all phases, **even if** the team is using a **separate risk specialist**.

Risk management process

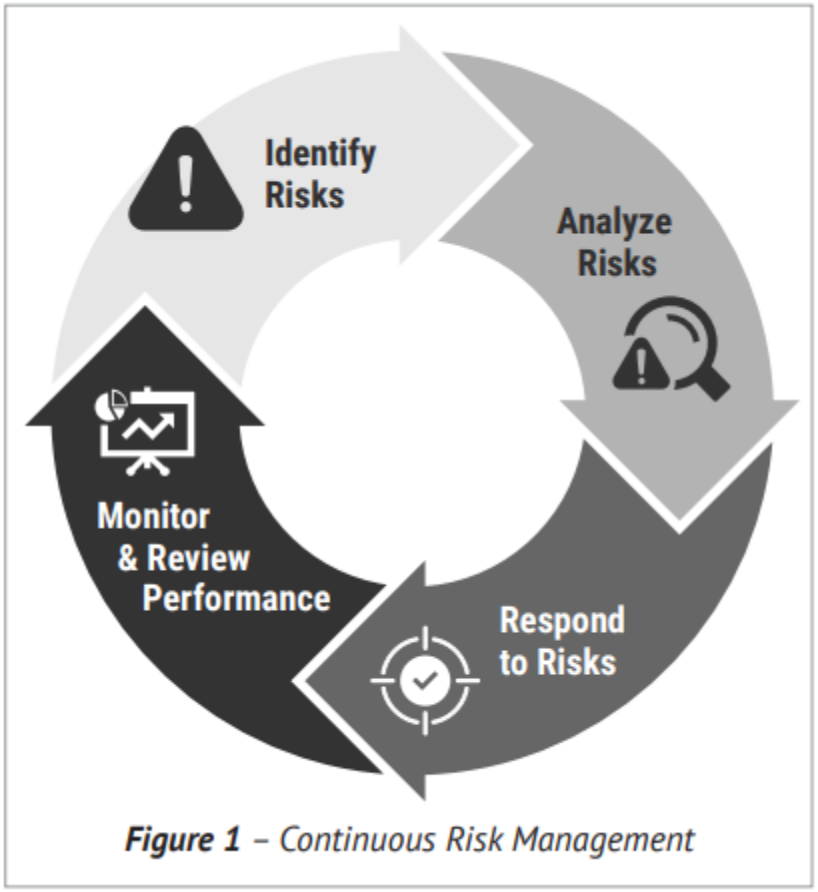

Figure 1 – *Continuous Risk Management*

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Risk management process

- **Continuous risk management** begins as early as possible (ideally during the pre-design phase) and follows the **processes defined in the team's RMP**.

- **Integrating** a continuous risk management process will:
  - Focus the team on the project's/program's requirements and constraints;
  - Improve consensus;
  - Increase the probability that the team will meet the owner's cost, schedule, and quality requirements; and
  - Reduce the number of surprises.

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Risk identification

- **Risk identification** is **when** a team evaluates a project/program to **discover** its potential threats and opportunities.
  - These risks relate to scope, cost, schedule, and quality.

Risk identification

- Risk managers,
- builders,
- consultants,
- designers,
- insurance companies,
- owners, and
- other stakeholders

may participate.

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Risk identification

- Teams should use
  - their judgment,
  - lessons learned from earlier projects/programs, and
  - outside resources like
    - ✓ audit forms,
    - ✓ databases,
    - ✓ industry publications, and
    - ✓ Surveys

    to help identify possible risks.

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Risk identification

- The **risk manager** typically **facilitates** risk **identification**, which occurs during a **risk meeting.**
- The purpose is to identify **potential risks** as early as possible, **ideally** beginning in the pre-design phase.
- **Additional meetings** should occur throughout the **full project/program lifecycle**, but the **frequency** of these **meetings** should generally **increase** as the **work progresses.**

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Risk identification

- **During** risk identification, the **risk manager** must
  1. be objective,
  2. make realistic assumptions,
  3. collect a variety of well-informed judgments, and
  4. understand each risk's potential impact(s).

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Risk identification

- The **team** should **record** each new risk in a **risk register**.
  - A risk register is a tool to **organize** the **information**.
    - ✓ **Depending** on the **team's needs**, the risk register may be a **simple spreadsheet** or a **detailed database**.
- **After** the team **identifies** a risk,

  the **risk manager updates** the risk register with
  - ✓ the name,
  - ✓ unique identification, and
  - ✓ a description for that risk, including whether it is an opportunity or threat.
- The **owner's risk register requirements** may vary, but this course provides a **possible example** of a **risk register** throughout the remaining sections.

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Risk identification

- If the **CM** is **responsible** for **delivering** risk management services,

  the CM **facilitates** risk **identification** as defined in the RMP.

  - If a **separate risk specialist** is the **risk manager**,

    the **CM** should **still participate** to

    1. **Understand** the project's/program's potential risk and
    2. **Ensure** that the team follows the RMP's process.

- The **CM** should **welcome input** from **all** team members.

For more, see Section 2.

Risk analysis

- **After** the team **identifies** threats and opportunities,

  the **next step** in the risk management process is to **analyze** each risk to provide

  1. The owner,
  2. Other team members, and
  3. Other stakeholders

  with an **assessment** of each threat or opportunity.

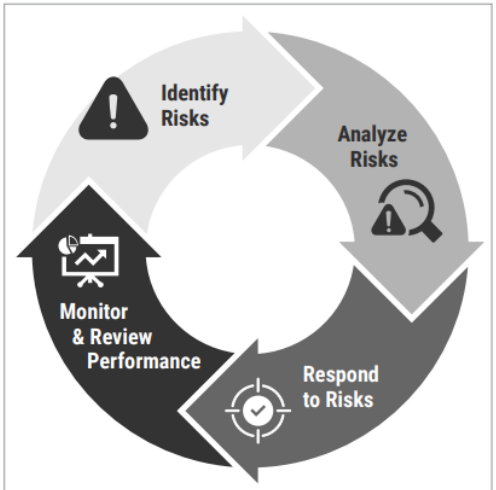

Figure 1 – Continuous Risk Management

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Risk analysis

- **Risk analysis** attempts to
  1. Categorize,
  2. Measure, and
  3. Prioritize

  risks by their potential severity and the chances they will **occur**.
- **Analysis** helps the team see **which risks** have
  1. The greatest potential impact and
  2. The highest likelihood.

  ❖ **Note** that some **parts of the industry** use the term **"risk assessment"** to refer to risk analysis (or use both terms interchangeably), but the **process is the same**.
- The **team adds** the results to the **risk register** to create a **status for each risk**

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Risk analysis

- There are **two general types** of risk analysis: qualitative and quantitative.
  - **Qualitative risk** analysis categorizes risks based on the **team's judgment** about each risk's likelihood and severity.
  - A **qualitative analysis** may include preliminary data and the **team** may **assign** numerical values to each risk.
    - ✓ Meanwhile, **quantitative risk analysis** further refines this analysis based on **measurable data** as the team moves into later phases.
    - ✓ Quantitative analysis **first requires** a qualitative analysis,

      then the team

      1. **Uses** advanced statistical formulas and
      2. **Programs** to measure the probabilities and outcomes of risk events.

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Risk analysis

- A **quantitative** risk analysis **may** be **unnecessary** for some projects and programs, i.e.,

  qualitative analysis may be **sufficient** for some teams to manage threats and opportunities.

  - *For example, on a project with a budget less than $50,000, the qualitative analysis may provide enough detail to effectively manage risk, the schedule may be too short for a quantitative analysis to deliver value, the owner may not have the budget for a quantitative analysis, etc.*
    - ✓ The **RMP** should **clarify** **if** a quantitative analysis is necessary.

Risk analysis

- However,

  the CM should generally **understand** the processes involved in **both types** of risk analysis.

  When the CM is the **risk manager**,

  the CM should **lead risk analysis.**

  For more, see Section 3.

Risk response

- **After** identifying and analyzing a risk,

  teams may **respond** to each opportunity or threat through design, engineering, and management decisions.

- **Risk responses** may involve a **wide range of actions**, including **responses** that change scope, schedules, budgets, and quality.

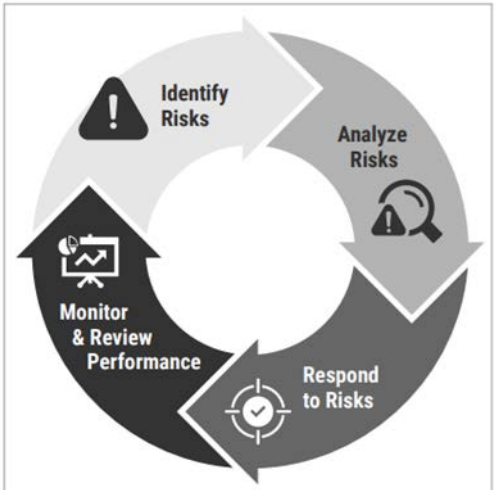

Figure 1 – Continuous Risk Management

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Risk response

- The **risk manager (the CM or risk specialist)** will **assign a risk** to the team member (or entity) that is **best able** to manage it.
  - That team member becomes the **"risk owner"** for that risk.
    - ✓ The **risk owner** will then develop
      1. A **risk response plan** with
      2. A set of **action items** and related **deadlines**

         to manage the opportunity or threat.

The team will then implement the risk response plan.

Risk response

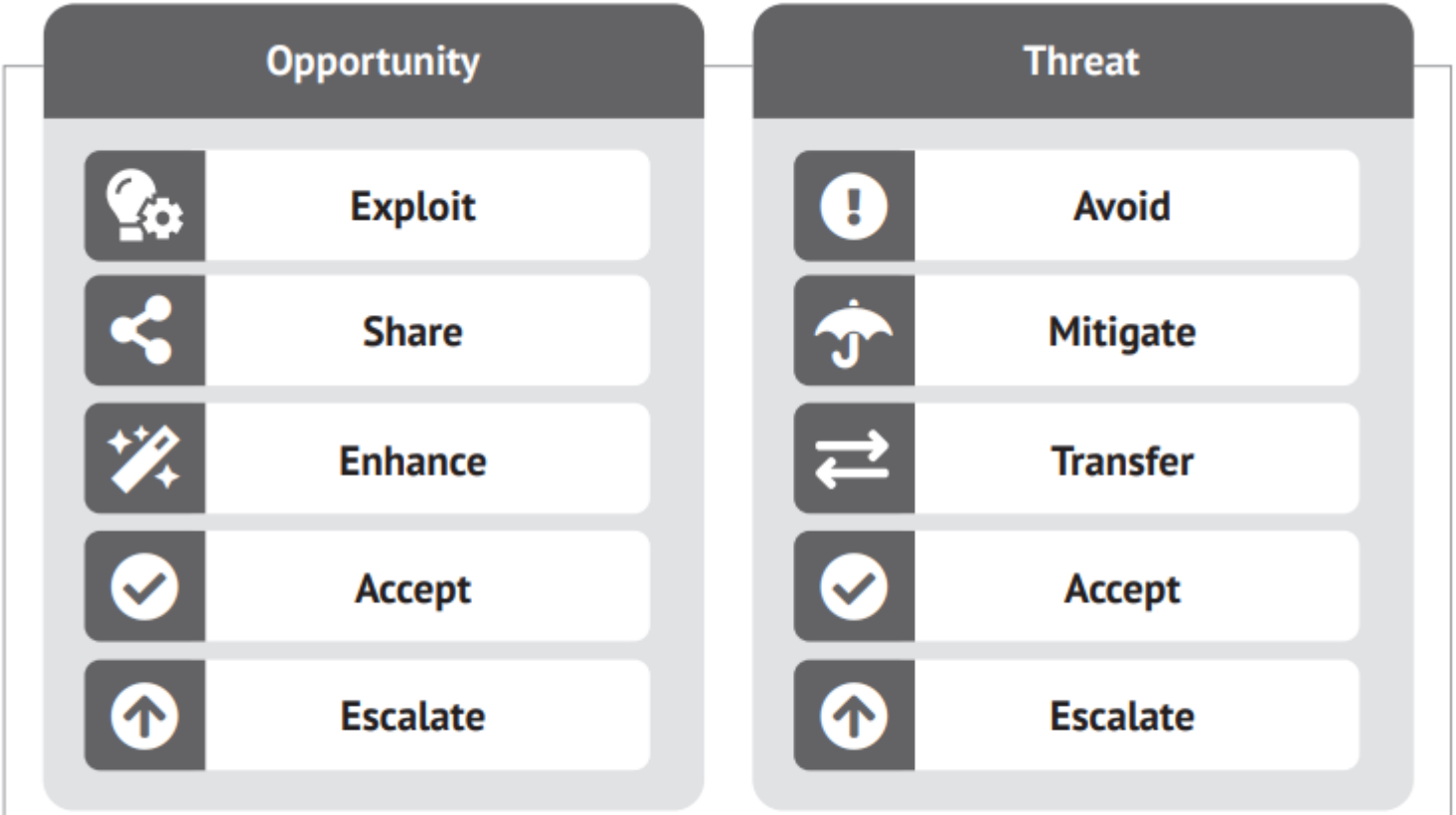

Figure 2 – Opportunity and Threat Responses

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Risk response

There are four typical categories of risk responses to an opportunity: exploit, share, enhance, and accept.

- **Exploiting responses** are actions that **ensure** that the **opportunity materializes**.
- **Sharing helps** another stakeholder **take advantage** of an opportunity to **benefit** the project/program.
- An **enhancing response increases** the opportunity's likelihood or impact.
- Finally, **accepting** means the **team will wait** and take **advantage of the opportunity** if it happens.

Risk response

Meanwhile, there are also four general categories of risk responses to threats: avoid, mitigate, transfer, and accept.

- An **avoiding risk response** removes the **threat's impact** on the project or program.
- **Mitigating** involves actions that **reduce** the threat's severity or likelihood.
- **Transferring moves** the **threat's impact** to another entity that is **better able** to manage it.
- Lastly, **accepting** means the team will **respond** to the threat **if it happens**.

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Risk response

- **Rarely**, the **team** may encounter an **opportunity** or **threat** that is beyond the project's or program's scope,

  requiring an escalate response.

- **Escalation** involves **assigning** the risk to a **stakeholder** that is in a **different part** of a team member's organization,

  such as **another department** in the owner's organization.

- That stakeholder is **then responsible** for their **own risk response**.

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Risk response

- The **risk manager updates** the risk register to **include**
  1. Who is responsible for each risk,
  2. The risk response, and
  3. Any other relevant information (such as important deadlines).
     - If the **CM** is the risk **manager**, the CM **performs this update**.
     - If the **team uses** a **risk specialist**,

       the CM should **still monitor** the risk register and **ensure** it is up to date.

For more, see Section 4.

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Risk monitoring

- Remember, risk management is a **continuous process**.
- As a project or program **progresses** and

  new information emerges,

  the team tracks and adjusts risks.
- This **risk monitoring** must continue **throughout all phases** because risks may change or new risks may surface at any time.
  - *For example, the team may resolve certain threats and opportunities that no longer have a chance to impact the project/program.*
  - **Details** about preexisting risks may also **change** or

    entirely new risks may appear.

Risk monitoring

- **Recall** that **certain risk events** may **require changes** to scope, schedules, budgets, and quality.
  - However, the **consequences** of these risk events **normally grow** in later phases.
  - As design and construction **progresses**,

    the project or program's details become clearer and uncertainty decreases,

    but the team has **less room** in the schedule, budget, etc., to **respond** to a risk event.
- **Continuous risk monitoring** helps the team
  1. **Respond** to changes in the risk environment as soon as possible,
  2. **Minimizing** the impact of threats and
  3. **Maximizing** the impact of opportunities.

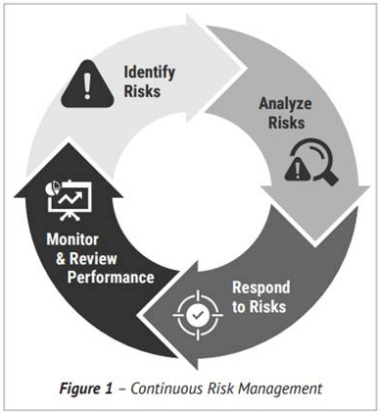

Figure 1 – Continuous Risk Management

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Risk monitoring

- The team **follows** the RMP and **meets** on a **regular basis** to review the risk register.
- **These risk sessions** occur **frequently throughout** the project/program,

  but generally become **more frequent** in later phases, such as during each progress meeting in the **construction phase**.
- The **risk manager updates** the risk register to reflect any changes, such as
  1. New risks,
  2. Any new or updated risk analysis, and
  3. Details about risk responses.

1. If the **CM** is **responsible** for risk management, the **CM leads** this process.
2. If the CM is **not the risk specialist**, the CM should still review and understand any changes.

For more, see Section 5.

Risk Meetings

Risk meetings

As the RMP explains, risk meetings (also known as risk workshops) should occur at regular intervals beginning in the pre-design phase and continuing throughout the remainder of the project/program.

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Risk meetings

- Generally, **risk meetings** are frequent but happen **more frequently** as the project or program progresses into later phases.
- **Risk meetings** may be
  1. Their own **separate** meetings or
  2. Part of the agenda for a team's **other regularly scheduled** meetings (e.g., Meetings during pre-design, design, and procurement and progress meetings during construction).

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Risk meetings

- **Each meeting** is an **opportunity** to
  1. Identify, analyze, and assign new risks to a responsible party, as well as
  2. **Monitor** risk responses on known risks and provide updates.

- Remember that risk management is a **continuous process**, so
  the **agenda** for each risk meeting **may include**
  risk identification, analysis, risk response updates, and risk monitoring.

- The **risk manager (CM or risk specialist)** should **lead** each risk meeting.
  - If the CM is **not the risk manager**, the CM should **still participate**

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Risk meetings

- Ideally, the **CM joins** the project or program during the pre-design phase and **participates in risk meetings** throughout all phases.

For more on planning risk meetings, see Section 5.

Risk Allocation

Risk allocation

- The **CM (and risk specialist, if separate)** must be **aware** of the contract provisions concerning risk.
- **All construction contracts** have provisions that **distribute risk responsibility** among parties.
- **Before entering a contract**, each party must understand **how risk is allocated** in the contract documents.

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Risk allocation

- Some of the most common risk allocation provisions include (but are not limited to):
  - Ambiguity or conflict in contract documents;
  - Changes and claims;
  - Contract time, including liquidated damages, early completion incentives, and no damages for delay clauses;
  - Differing site conditions and pre-construction site conditions;
  - Errors and omissions insurance;
  - Indemnification and negligence;
  - Insurance and waiver of subrogation;
  - Notice requirements;
  - Payment terms, retainage, pay when paid, or pay-if-paid clauses;
  - Responsibility for safety;
  - Submittals and approvals;
  - Suspension and termination; and
  - Weather and force majeure.

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Risk allocation

52.236-2 Differing Site Conditions.

As prescribed in 36.502 , insert the following clause:

DIFFERING SITE CONDITIONS (APR 1984)

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of-

(1) Subsurface or latent physical conditions at the site which differ materially from those indicated in this contract; or

(2) Unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; *provided*, that the time prescribed in paragraph (a) of this clause for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

Risk allocation

- **How** the contract documents **allocate risk** may **determine** how the **team manages** the risk.
  - Remember that **risk is dynamic**, and the **team should assign** a risk to the party that is **best able to manage** it.
    - ✓ The relationships among the team and responsibilities of each team member **can change** depending on the contract requirements,
      so the **party best able** to manage a risk or how the team responds to a risk may **vary**
      depending on the language in the contract documents.

Risk allocation

The project's or program's delivery method is critical for determining how the team will manage risk. A **delivery method** is a system that employs one or more contracting formats to successfully complete a project or program.

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Risk allocation

- **Each delivery method** allocates **risk differently**,

  but **effective risk management** is **critical** in any delivery method.

- **Even if the CM** is **not** the risk manager,

  the CM must understand that **each delivery method** presents advantages and disadvantages for **managing risk**,

  1. Consider the owner's risk tolerances, and
  2. **Help the owner select** the appropriate method for the current project/program.

Risk allocation

- **Figure 3** summarizes some major risk considerations for some of the **most common delivery methods.**
  - Note that **this list** includes several popular delivery methods but it is **not comprehensive.**
  - **Other risks** may apply to certain delivery methods.
  - An **owner may also choose** a less common method not listed here or a unique variation that combines elements from **multiple methods**.
  - The CM should **advise the owner** and **apply guidance** from the chart below, as appropriate.

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations*

Delivery Method	Construction Management at-Risk
	A form of construction management which the owner often combines with another method (e.g., design-bid-build, multiple prime contracting, etc.). The CM acts as the owner's agent during design. When design is complete, the CM bids to construct the project/program within a guaranteed maximum price. If the owner accepts the CM's bid, the CM transitions to an at-risk CMAR position and is the same entity as a builder.
Common Opportunities	Projects and programs that use a CMAR can benefit from increased cost transparency. However, the relationship between the CMAR and lead designer is critical to exploiting this opportunity. The earlier the CMAR joins the team, the more the designer and CMAR can collaborate, increasing the odds that the final design and CMAR's bid will account for the owner's budget, schedule, and quality requirements.
Common Threats	If the owner has their own construction management staff or hires a separate agency CM, this may create adversarial relationships among the team. To mitigate this threat, the owner may require the CMAR to work in an open book format (i.e., the owner reimburses expenses and pays the CMAR a fixed profit). If clearly defined, shared savings clauses in the CMAR's contract can also mitigate this threat.

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations cont.*

Delivery Method	**Design-bid-build** (also known as the traditional method)
	The owner contracts with a lead designer and a separate prime builder who manage their own subsidiary teams of designers and trade partners. Work progresses in a linear sequence, requiring the completion of one phase before proceeding to the next phase. Note: laws in some jurisdictions require certain public sector owners to only use this method.
Common Opportunities	This method's linear process presents an early opportunity for the team to verify and manage scope as the design progresses. The owner can exploit, share, and enhance this opportunity by hiring a CM early in the pre-design phase. The CM can help the owner develop clear design requirements, appropriate construction documents, and realistic estimates. The CM can also manage risk and scope (such as determining which threats to transfer to the builder), minimizing the negative impact and maximizing the positive impact of any change(s).

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations cont.*

Common Threats	**Design-bid-build** (also known as the traditional method)
	A builder does not begin construction until the design is complete. If the owner has a tight deadline for substantial completion, any delays during construction could threaten the project/program. The owner can accept this threat or attempt to mitigate it with incentives in the builder's contract for early completion.
	If the design is unrealistic for the budget, the construction documentation may be inaccurate. As a result, the owner may experience delays, cost overruns, and quality issues. As before, the owner can mitigate this threat by hiring a competent CM early in the pre-design phase.
	Builders in weaker markets may knowingly submit deficient bids to win the work and use low cost materials, increasing the likelihood of quality issues. Clear construction documents, thorough bid evaluations, and effective quality management processes in all phases can mitigate this threat.

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations cont.*

Delivery Method	Design-build
	The owner contracts with a single entity (a firm or team of firms) for design and construction. The design-builder manages their own subsidiary teams of designers, builders, and trade partners.
Common Opportunities	In this method, the designer and builder are the same entity, so internal disputes among the design-build team members do not affect the owner. The owner can accept that this single point of responsibility for design and construction reduces the owner's claims risk. Projects/programs with routine, well-defined requirements are usually good candidates for this method because they have less uncertainty. Examples may include office buildings, schools, roads, and industrial facilities. The owner can exploit this opportunity by providing clear, well-defined, and realistic requirements. The owner can enhance this opportunity by hiring a CM early in pre-design or having a CM on staff to help fully develop the requirements and manage risk throughout design and construction. This method is sometimes fastest because the design-builder may be able to start construction before all design elements are complete (i.e., fast-track construction). The owner and CM can accept this opportunity, or attempt to exploit/enhance it by providing clear requirements.

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations cont.*

Common Threats	Design-build
	If the owner does not have clear requirements, the owner may lose control over the design process. If the requirements are vague, the design-builder may design and construct the project/program in the way that best manages the design-builder's risk, not the owner's risk. The owner can mitigate this threat by determining their requirements before securing the design-builder. A variation of this method called "progressive" design-build can also mitigate the threat that the owner will lose control of design. Progressive design-build contracts allow the owner/CM and the design-builder to develop the design together in a step-by-step manner. However, progressive design-build has some limitations. During the design phase in progressive design-build, costs can escalate before the design-builder submits a guaranteed maximum price, especially if the project/program has complex requirements and significant risk. The owner typically accepts this threat.

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations cont.*

Delivery Method	Integrated project delivery
	A form of agreement in which all parties (the owner, designer, builder, etc.) collaborate and share the responsibility and risk for delivery. The entire team also usually works under a single contract or partnership agreement.
Common Opportunities	This method focuses on team collaboration. The owner and CM can enhance this opportunity to foster a collaborative team culture by selecting this method for projects/programs that provide a greater benefit to society. For example, integrated project delivery's widest use is in healthcare projects/ programs because they serve a public need and are more likely to elicit altruistic feelings from stakeholders.

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations cont.*

Common Threats	Integrated project delivery
	Integrated project delivery is relatively new to the industry, so the biggest threat is that there is limited legal precedent. Similarly, disputes amongst the team can quickly create an adversarial relationship. To attempt to mitigate these threats, the owner and CM can intentionally select team members based on their abilities or history of working together. Contract negotiations can be lengthy because the entire team usually works under the same contract. The owner and CM can accept this risk by planning extra time in the schedule for negotiations or attempt to mitigate it by proactively hiring a mediator to facilitate negotiations. Despite this method's philosophy of shared risk, the ultimate threat is still to the owner if the project/program fails. The owner might be able to use insurance to transfer this threat, but this may vary. The owner could also mitigate this threat by structuring the contract so that all participants share rewards for successful delivery. For example, team members may be less likely to put their own interests first if there are additional financial incentives for on-time, on-budget delivery.

Risk allocation

Figure 3 *– Common Delivery Methods and Risk Considerations cont.*

Delivery Method	Multiple-prime contracting
	The owner contracts directly with separate designers, builders, and trade partners from various disciplines, such as structural, mechanical, electrical, etc. The owner (or their CM) administers the contracts and manages the overall schedule, budget, and quality. Note: laws in some jurisdictions require certain public sector owners to only use this method.
Common Opportunities	This method is sometimes fastest because the team may be able to start construction before all design elements are complete (i.e., fast-track construction). For example, the earliest construction activities on the critical path might begin before the designs for some non-critical construction activities are complete. The owner and CM can exploit, share, and enhance this opportunity by carefully sequencing design and construction activities. The owner and CM may also develop requirements that allow the project/ program to be designed and built in sequential phases.
Common Threats	The owner has a higher threat of claims because the owner has greater control over the schedule, budget, and quality than in most other methods. Clear requirements, thorough bid evaluations, and effective quality management processes can mitigate this threat. The owner may also mitigate this threat if the owner's staff performs some of the work.

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Risk allocation

- Consider how the owner's risk may change in the following examples:
  - In design-bid-build, the **prime builder** usually manages the construction schedule.
    - The **owner** does **not dictate** the builder's means and methods to **avoid** the **risk** of managing the schedule **but also accepts** the risk in this method that it may **take longer** to reach **final closeout** than some other methods.

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Risk allocation

- Consider how the owner's risk may change in the following examples:
  - Meanwhile, multiple prime contracting

    frequently offers an opportunity to deliver the **completed structure(s) sooner** by **starting construction before** design is complete (i.e., fast-track construction).

    - ✓ The **owner (or agency CM)** can **exploit** this **opportunity** by coordinating the **overall construction schedule**, but the **owner** also **accepts** the **claims risk** of **managing** the **schedule**.

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Risk allocation

- Consider how the owner's risk may change in the following examples:
  - Similarly, **no two projects** have the **exact same risks**, so the **same delivery method may not** always be **appropriate for an owner**.
    - ✓ **Each project** or **program** is unique (i.e., budgets, schedules, quality requirements, etc., may vary),

      so the **CM may need** to **carefully advise** an owner to consider **multiple options**.
    - ✓ Risk is dynamic, which means **risk can change** from project to project.

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Risk allocation

- Consider how the owner's risk may change in these examples:
  - An **owner who is unfamiliar** with the design and construction process may have **relatively simple requirements** on a small project.
    - ✓ In this example, **design-build** may best manage the **owner's risk** because **most disputes** will remain **internal design-build team issues** that do not affect the owner.

Risk allocation

- Consider how the owner's risk may change in these examples:
  - However, on a **separate project** for the same owner, the **owner may not have clear requirements.**
    - ✓ If the owner is **not able to finalize** their requirements **before design begins**,

      design-build on this project **may expose** the owner to delays, cost overruns, and quality issues.
  - The **CM may advise** the owner to choose a **different delivery method**, such as design-bid-build.

Risk allocation

- Many **factors** may **influence** the **owner's choice** of delivery method, including (but not limited to) the:
  - Budget, schedule, quality, functional, and performance requirements;
  - Local design and construction marketplace;
  - Owner's available construction management staff;
  - Owner's level of expertise in the design and construction process;
  - Owner's risk tolerance; and
  - Owner's other resources to support the project/program.

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Scale

- The **scale** of a team's **risk management processes**
  1. Must meet the owner's requirements and
  2. Should reflect the scope, size, complexity, and risks of the current project or program.

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Scale

- **Each** project or program is unique, so
  - the **thresholds** for categorizing risk,
  - level of analysis,
  - parties responsible for managing risks,
  - contingency amounts, and
  - frequency of meetings

  may all **change**.
- For example, **recall** that an **RMP's length** and **complexity** should be appropriate for the project/program.

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Scale

- The risk management process's **scale must meet** the owner's requirements, if applicable.
- Remember that an **owner's risk tolerance** will vary, so some owners may have **preconceived requirements** regarding risk.
- An owner may have their own definitions for **"minor"** or **"major"** risks and respond to them in unique ways.
- **Other owners** may manage risk **uniformly across** their entire construction **portfolio**, e.g., always **require the team** to perform a quantitative analysis or to hold weekly risk meetings.

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Scale

- **When** the **owner does not have** a predetermined scale,

  the **CM** and **risk specialist** should first consider the team's overall budget to **determine** the risk management **process's scale**.

- All projects and programs may **encounter risks** that could impact delivery.
  - However, the **range of potential risk** events **usually grows** when a project or **program is larger** because there is **more complexity**.

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Scale

- **Teams** with **larger budgets** may **manage risks differently**

  than **teams with smaller budgets**

  because the **range of risk events** on a large project/program may be many times **greater**.

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Scale

- For example, consider the following scenarios:
  - The same threat with a **cost estimate of $1 million** may be a **“minor” risk** on a **multibillion-dollar program**.
  - The program team may only perform a **qualitative analysis** on the threat and assign it to a **junior team member**.
  - The **agenda** for the team’s regular **semi-weekly** or **monthly** risk meetings would **include any updates** about the threat.

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Scale

- For example, consider the following scenarios:
  - However, the **same multibillion-dollar** program may also encounter a **"critical" opportunity** that is **worth hundreds** of millions of dollars.
  - This risk would **not apply** to a **small** project.
  - The **team may decide** to
    1. **perform** qualitative and quantitative analyses,
    2. **transfer** the opportunity to a senior stakeholder (such as a mayor, governor, or other elected official who might be better able to manage a political risk), and
    3. **schedule** daily or weekly risk meetings.

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Scale

- Note that **considering cost** is the **minimum factor** when **scaling a risk management** process.
- Projects and programs with **stricter requirements** in other areas may also need a **larger scale** risk management process.
  - These **areas may include** (but are not limited to) the schedule, quality, safety, sustainability, and public impact.
    - ✓ For example, a project with a **sustainability certification requirement may scale** the risk management process based on **each risk's impact** on achieving certification.

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Scale

- The **risk manager** must
  1. Consider the **owner's full scope** and
  2. **Tailor** the risk management process appropriately.
     - If the **CM is the risk manager**, the CM is responsible for **scaling** the process.
     - If the **CM is not the risk manager**, the CM should **advise** the owner about an appropriate scale and **monitor** the process.

استراتژی مدیریت ریسک در طول چرخه حیات پروژه

(بر اساس سند مهمی از CMAA)

بخش دوم: شناسایی ریسک (Risk Identification) در پروژه‌های صنعت ساخت

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What we will learn?

- Introduction
- Risk Assessment (AACE TCM)
- Risk Identification (AACE TCM)
- Unique Risks
- Internal and External Risk
- Risk Breakdown Structure
- Risk Register

Introduction

Introduction

- **Risk identification** is when a **team** **evaluates** a project/program to

  discover the potential threats and opportunities related to

  scope, cost, schedule, and quality.

- The **risk manager (the CM or a risk specialist)** **facilitates** risk identification during **each risk meeting** (also sometimes called a **risk workshop**),

  ideally starting in the pre-design phase and continuing throughout all project/program phases.

  - If the CM is **not** the **designated risk manager**,

    the CM should **still participate** to

    1. **Understand** the applicable risks and
    2. **Ensure** the team follows a suitable risk identification process.

Introduction

- During **risk identification**,

  teams should **welcome diverse** input from all team members to identify the plausible opportunities and threats on the project/program.

  Teams must:

  - Be objective;
  - Collect a variety of judgements;
  - Make realistic assumptions;
  - Refer to appropriate outside resources;
  - Understand each risk's potential impact(s); and
  - Use their well-informed judgment.

Introduction

- The **CM** must **recognize** that **all team members** have **their own knowledge** and **experience** which can help **identify applicable risks.**
  - The CM
    1. **Promotes** a **culture** of diversity, equity, inclusion, and belonging among the team and
    2. **Welcomes contributions** from all team members during risk identification.

Risk Assessment

(AACE TCM)

Process map for risk management

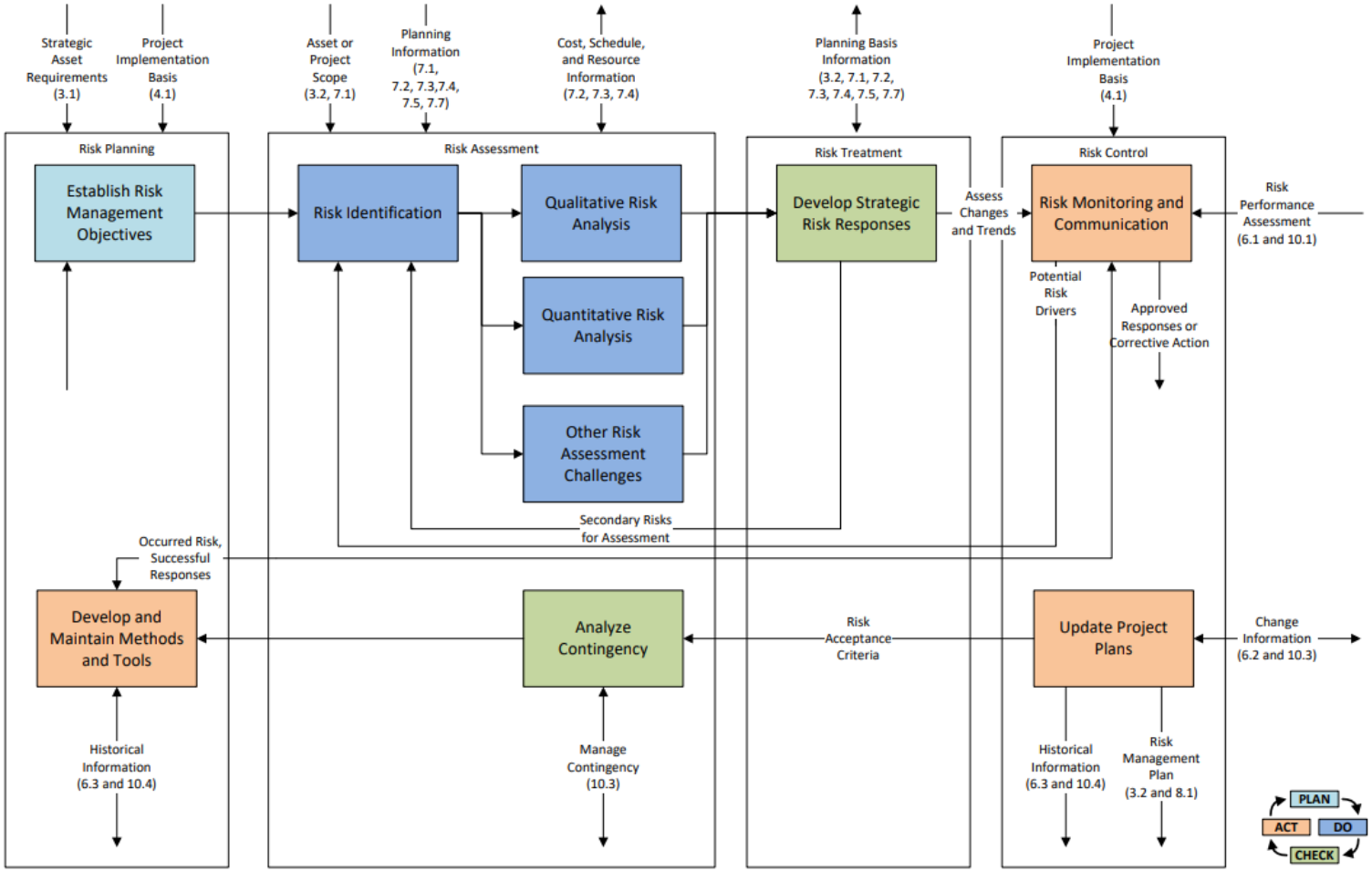

Figure 7.6-1 Process Map for Risk Management

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Risk assessment

- Once the **risk management process**

  has been **planned** and

  informal agreement or formal approval obtained from **all stakeholders**,

  the **team can start** working through the **next step** of risk assessment.

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Risk assessment

- Risk assessment is typically comprised of three distinct tasks:

1. **Risk identification.**
2. Qualitative risk analysis.
3. Quantitative risk analysis.

Risk Identification

(AACE TCM)

Risk identification

- **All members** of the team should work together to **identify** asset or project risk drivers for analysis.
  - **Risk drivers** are **events** or **circumstances** that may influence or drive uncertainty in asset or project performance.
    - ✓ In this sense, **risk drivers** can also be considered the **'cause'** of risk.
    - ✓ They may be **inherent characteristics** or **conditions** of the asset or project, perhaps external influences, events, or environmental conditions ranging from **climatic** to **economic**.

Risk identification

- Checklists or a knowledge base of common risk drivers may be developed and used to **facilitate** this risk identification step.
  - **Checklists** and similar tools such as a **risk breakdown structure (RBS)** are generally based on

    project historical data and can serve as invaluable prompts during risk identification **brainstorming**.

    Risk drivers can be general or systemic in nature.

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Risk identification

- Empirical research of past project experience is generally required to **understand** these drivers.
  - For example, **research** of historical industry data has shown that one of the most significant project risk drivers is having a **poor level** of project scope definition and planning.
  - However, **other risk drivers** may be **unique** to the asset or project;

    therefore, **input** from the entire project team should be **obtained** using **creative processes** such as brainstorming workshops or other facilitated risk assessment meetings

    in order to reveal the **full spectrum** of risk perception i.e. systemic, project-specific, or varying combinations of both.

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Risk identification

- Initially, the output of this step is a **list** of potential risks.
- Essentially it is the **first draft risk register**.
- The **list** should employ a **three part** risk **metalanguage** to describe each risk event.

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Risk identification

- These structured descriptions will separate
  1. cause,
  2. risk and
  3. effect.
     - An example of a **typical risk description** using **metalanguage** follows:
       1. “Due to ,
       2. there is a threat / opportunity that may occur,
       3. which may lead to .

Risk identification

- **Ensuring** each risk is **explicitly** described in this way helps **minimize confusion** and can **aid** the identification process.
  - For example, **brainstorming** may reveal that there are **multiple causes** behind one risk and vice versa.
    - ✓ In addition, having **delineated cause** and **effect**, this will aid risk **response planning** and the assignment of the most **competent** or **qualified** risk owner.

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Risk identification

- It is during the **initial risk identification forums** that the team may invest **their peak level of effort** for this step,

  however, it is important to note that this is an **ongoing process.**

  - **Every team member** should be **empowered** to bring for review a **new risk driver**, at any stage in the project or asset life-cycle.
    - ✓ **Periodic risk control meetings** can facilitate ongoing risk identification.
  - In addition, it is important to remember that risk identification efforts **must focus** on risks that matter

    i.e. those that **can influence** project objectives,

    irrespective of their

    1. Probability of occurrence or
    2. Severity of impact.

Risk identification

- To **clarify once more**,

  risks that matter are **essentially areas** of uncertainty that can be **quantified** and,

  if they **were to occur**,

  could have a **positive or negative** impact on business goals or project objectives.

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Risk identification

- **One last** important aspect of risk identification that must be given appropriate consideration, when identifying risk drivers and populating a risk register,

  the **risk practitioner** must be careful that the **following elements** are **not mistaken to be risks**:

  - Issues or problems,
  - Causes,
  - Effects.

Risk identification

- For example, an **issue** is generally a **risk** that has **already occurred**.
  - A **proactive** risk management process should have permitted the **creation** of an **appropriate risk response** ahead of time and
    a **good risk register** should acquire a **number of occurred risks** as the project evolves but,
    if for some reason this **does not happen**, it is more appropriate to **record** and **manage** such problems in an **issue log**.
- Failure to do so will unnecessarily burden the process, curtailing the potential benefits that could have otherwise been enjoyed as a consequence of a more proactive approach.

Risk identification

Issue definitions
'A relevant event that has happened, was not planned and requires management action. It could be a problem, query, concern, change request or risk that has occurred' (*Management of Risk: Guidance for Practitioners*, OGC, 2002).
'It can be any concern, query, request for change, suggestion or off-specification raised during the project. [They] can be about anything to do with the project' (*Prince2: Glossary of terms*, AXELOS, 2009; © AXELOS Limited 2011).

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Risk identification

- To **further illustrate** what a risk is not, let us consider **poorly defined scope**.
  - *This is not a risk per se but a cause.*
    - ✓ Such a cause will **drive** numerous risks and effects that, ideally, should be individually isolated, explicitly defined and quantified.

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Risk identification

- In the **case of systemic risks**, such as **poorly defined scope**,

  it is **worth noting** that because the resulting risks are unlikely to be individually identifiable,

  it is **likely** that the risk(s) may only be defined in **general terms**, and

  the **subsequent effect** only quantifiable at the bottom line.

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Risk identification

- Finally, late delivery and schedule overrun is **not**, for example, a **risk** but an **effect**.
  - The **effect** is often **what team's have** in mind when they **enter a workshop** so the risk practitioner can **perhaps seize** on this and use it to their **benefit**.
    - ✓ When brainstorming,

      it is often useful to build off an effect that is widely appreciated and work backwards by seeking to elicit every potential risk driving the effect in question (e.g. risk of delayed procurement),

      subsequently asking the team to identify all potential causes of the identified risk (e.g. poorly defined scope).

Unique Risks

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Unique risks

- **All team members** must understand that each project and program is **unique**, so the applicable risks to the owner, other team members, public, etc., **may vary**.
  - For example, a **program's critical components** may rely on a **new construction material** that no team member has used before.
  - In another example, the **team** may be unfamiliar with the surrounding community.

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Unique risks

- **Teams** should evaluate risks from **earlier projects/programs**,

  but must recognize that **risk events** could **materialize** in new or unexpected ways.

  - In other words, the way that **something happened** before on another project or program is **not necessarily how** it would happen **again**.

- Projects/programs that **use**
  - same delivery method,
  - type of construction, etc.,

    may encounter **similar risks**,

    but there are **usually** some **specific differences**.

    - *For example, a cybersecurity threat on one project could cause minor delays and cost overruns, but the same threat could cause a separate project to fail.*

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Unique risks

- **Whether or not** the CM is the **risk manager**,

  the **CM must encourage** the team to

  1. keep open minds and
  2. consider unique risks

     during risk identification.

- The **CM** and **risk manager (if a separate entity)** should **review** **lessons learned** from earlier projects and programs to **understand**

  how and when **those risks** may **apply** to the current project/ program.

Internal and External Risk

Internal and external risk

- During risk identification, the team must consider **factors** that are both inside and outside of the team.
  - An **internal risk** is an opportunity or threat that **comes** from **within the team**.
    - ✓ The team usually has at **least some control** over an **internal risk**.
  - Meanwhile, an **external risk** is an opportunity or threat that comes from **outside the team.**
    - ✓ The team usually has **less control** over an **external risk**, so the **range** of possible risk responses is usually **more limited**.

Internal and external risk

- For example:
  - A project team **may identify** an **opportunity** for the owner to **provide certain** long lead equipment and materials to **expedite** the construction **schedule**.
    - ✓ This opportunity is an **internal risk** because it **only involves** the **team** and is **within the team's** (i.e., the owner's) control.

Internal and external risk

- For example:
  - Meanwhile, a project team may also **identify** an **external risk** of a **global pandemic** that **stops** all work for days, weeks, or months.
    - The **threat** would come from outside the team and there would be **almost nothing** the team **could do** to avoid, mitigate, or transfer the threat to the project **schedule**.

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Internal and external risk

- **Risk identification** should include **all** possible external risks, even if an external risk is **outside of the team's control**.
  - **Identifying** external risks helps the team **understand** the project's or program's **risk profile**.
  - Furthermore, **early identification** of an external risk that is outside of the team's control could **still be critical** for successful delivery.
- **If** the team must **accept** an external risk,

  the **"accept" risk response** might plan the **steps in advance** that the team could take to manage the **risk after** the **external risk event happens**.

  For more on risk responses, see Section 4.

Risk Breakdown Structure

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Risk breakdown structure

- As a **team identifies** the risks they **may encounter**,

  the team may **reference a document** called a risk breakdown structure (RBS).

  - An **RBS** is an optional tool for some teams, **while other** owners may **require it.**

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Risk breakdown structure

- An **RBS** is a risk identification aid that shows a **general hierarchy** of risk categories **starting** with
  1. Most general categories of risk and
  2. Each category's associated sub-categories.
- An **RBS** sets a baseline to help team members think about and identify **applicable risks.**
- An **RBS** may also be a useful tool to **communicate risks** to a general audience, such as the **public** or **end users**.
  - ❖ However, an RBS usually **does not define** specific risks.
    - ✓ An RBS is **only a tool** to help teams **identify risk**.

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Risk breakdown structure

- The **example** in **Figure 4** shows a common way for an RBS to categorize risks, but it is **not comprehensive**.
  - Teams may **have** different risk categories or **display** the RBS in a **different format.**

Risk breakdown structure

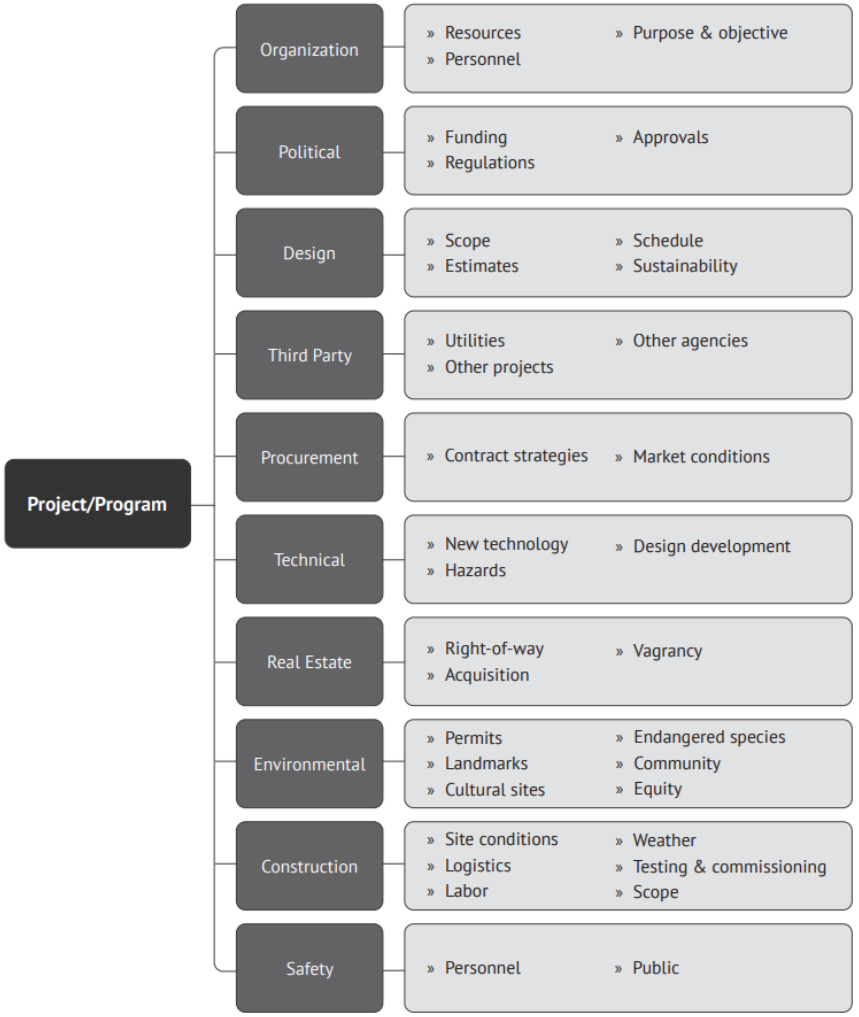

***Figure 4** – Example RBS*

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Risk breakdown structure

- An **owner's RBS requirements** will **vary**.
- **Some owners**
  1. May have their **own RBS**,
  2. Require the **team to provide** an RBS, or
  3. Have **no** RBS **requirement**.
- If an **owner** requires an **RBS**,

  the **contract documents** should define the **RBS requirements**.

  - If the contract documents **require an RBS** but **do not define** what the team should include in the RBS,

    the **CM or risk specialist** should **find** or **create** an RBS with the **owner's and team's input**.

The CM/ risk specialist should also update the RMP to include the selected RBS.

Risk breakdown structure

- **Teams** that have an RBS should **use the RBS** as a **guideline** to **identify** risks, **not a comprehensive list** of all possible risk categories.
  - An RBS is a **starting point** to help the team **think about risk**, but risk is **dynamic** so **no RBS** will **show every possible** category of risk.
    - ✓ If a project/program **uses an RBS**, **team** members may **still identify** valid risks that **do not correspond** to a category on the RBS.

Risk breakdown structure

- A **CM must remember** to be objective, collect a variety of judgments, and make realistic assumptions.
- **When** the team identifies **new risks**,

  the **CM** and **risk manager** (if using a separate risk specialist) should always **consider** them even **if they do not match** the RBS.

  - The **risk manager (CM or risk specialist)** may **update the RBS** as the project/program progresses

    but **should refer** to the **RMP** and **owner's requirements**.

    - ✓ If the CM is **not the risk manager**, the CM should **still monitor** this process.

Risk Register

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Risk register

- **Recall** that a **risk register** is a tool the team should use to record and organize each **new risk**.
- A **risk register** may be a **simple spreadsheet** on **smaller** projects or a detailed **database** on **larger** projects/programs.
  - **Unlike an RBS**, a risk register includes **specific information** about each risk the team **may encounter** (or **has encountered**).

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Risk register

- A **risk register** is the **team's** risk management body of knowledge.
- The **risk register logs** all the opportunities and threats that the team **identifies** for the project/program.
- Teams may refer to **risk registers** from **earlier** projects and programs to see
  1. **What previous teams** identified and
  2. **How** they may **apply** to the current project/program.
     - For this reason, the **risk manager (CM or risk specialist)** should
       1. Retain and
       2. Properly store

       the risk register for **future use** after the project/program is complete.

Risk register

- **Only** the **CM** or the **risk specialist** should **modify** the risk register and **any changes** should include a date and summary.
  - The **CM/risk specialist** must also **archive** all previous versions.
    - ✓ To accomplish this, a **best practice** is to
      1. Use a main file and
      2. Save a separate backup file

      each time the CM/risk specialist **updates** the risk register.

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Risk register

- **After** the **team identifies** a risk, a risk register **must include**:
  - **Risk description:**
    - ✓ A **statement** that **explains** the risk in a "Cause, Risk, Impact" format that helps the **team understand** the risk;
  - **Risk ID:**
    - ✓ A **reference number** that is
      1. **unique** to each risk,
      2. **permanent**, and
      3. usually follows a **sequential numbering** system,
      4. but **some** teams may choose to add other **numbers or letters** to the ID,

         such as **letters** that show **when the risk event** is most likely to **occur**;

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Risk register

- **After** the **team identifies** a risk, a risk register **must include**:
  - **Risk name:**
    - A brief, easy-to-understand name that
      1. **Compliments** the **risk description** and
      2. **Helps** team members **quickly understand** the risk; and
  - **Threat or opportunity:**
    - A **field** that shows if the risk is
      1. A threat which has the potential for
         i. loss,
         ii. damage, or
         iii. any other undesirable event,
      2. An opportunity which has the potential to
         i. reduce costs,
         ii. save time, or
         iii. improve quality

Risk register

- **If** the team uses an **RBS**,

  a **field** showing **each risk's RBS category** would also be **appropriate** at this point.

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Risk register

- **Figure 5** presents a partial risk register based on a **hypothetical** project.
  - The **sample** demonstrates the types of information a team may include at the **risk identification stage**.
- Note, the **risk register** in **Figure 5** **references** the RBS from **Figure 4**, **but** an RBS would **not necessarily apply** to all projects/programs.
- An **RBS** would also **not necessarily represent** **all the possible categories** of risk **because** risk is **dynamic**.
  - On an actual project or program, a risk register would include more risks than in this example.
- **Figure 5** should **also contain** additional fields/columns which this course will introduce in later sections.

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Risk register

Project Name **Project Risk Register**			Rev: 0 (Initial risk meeting) Date: December 15, 2023	
Risk ID	**RBS**	**Risk Name**	**Risk Description**	**Threat/ Opportunity**
ID-1	Procurement/Market Conditions	Pre-purchase curtain wall	Long lead of the curtain wall system could delay the curtain wall's arrival, which could delay the critical path and the completion date	Threat
ID-2	Construction/Scope	Construction scope change	The owner is unfamiliar with construction, which could lead to scope changes during the construction phase that could create delays, cost overruns, and quality issues	Threat
ID-3	Design/Schedule	Deficient drawings	Due to the tight design schedule, the drawings could be deficient, resulting in more change orders/RFIs/claims	Threat

Figure 5 *– Partial Risk Register with Risk Identification*

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Risk register

Project Name **Project Risk Register**			Rev: 0 (Initial risk meeting) Date: December 15, 2023	
Risk ID	**RBS**	**Risk Name**	**Risk Description**	**Threat/ Opportunity**
ID-4	Political/Approvals	Senior stakeholder support	The state's governor and several legislators are highly-engaged and want to show the project is a success, so these officials could help expedite the approval process and allow design and construction to begin sooner	Opportunity
ID-5	Real Estate/ Acquisition	Purchase available adjoining lot	An empty lot next to the jobsite is for sale below the market rate and purchasing it would improve site access and staging, which could also shorten the construction schedule	Opportunity
ID-6	Construction	Certificate of occupancy	An administrative delay could delay the certificate of occupancy's signoff at the end of the project, which would delay substantial completion and move-in	Threat

Figure 5 *– Partial Risk Register with Risk Identification*

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