

STR 665

RISK MANAGEMENT

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Assistant Professor

TENTATIVE COURSE SCHEDULE

| Week | Date | Original Topic | Deliverables |
|------|--------|--------------------------------|--|
| 1 | 24-Sep | Introduction – What is Risk? | |
| 2 | 1-Oct | Qualitative Analysis Methods | |
| 3 | 8-Oct | Quantitative Analysis Methods | Project Announcement/ Paper analysis and Critique |
| 4 | 15-Oct | The Analytic Hierarchy Process | Case Study for @RISK |
| 5 | 22-Oct | Monte Carlo Simulation | Project Groups & Topic selection |
| 6 | 29-Oct | Introduction to Fuzzy Logic | |
| 7 | 5-Nov | Midterm | Project Methodology Framework |
| 8 | 12-Nov | @RISK Application | |
| 9 | 19-Nov | The Analytical Network Process | Project literature review, methodology, data collection technique/case study |
| 10 | 26-Nov | Fault Tree and Decision Tree | |
| 11 | 3-Dec | Paper analysis and Critique | |
| 12 | 10-Dec | B/C Analysis | Project Q & A |
| 13 | 17-Dec | Case Study Applications | |
| 14 | 24-Dec | Project Presentations | Project Submission/Presentation |

GRADING SCHEME

- . Final Exam 50%
- Midterm Exam 15%
- Term Project 20%
- Class work/Assignment 15%



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IEDM 618 : Risk Management in Engineering Projects

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STR 679 Infrastructure Asset Management

Dr: Hesham Osman

STR 614 Seismic Structural Analysis

Dr.: Bahaa Hanfy

Dr: Mostafa ElSayed

STR 652 Seismic Behavior of Steel Structures



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Welcome to the "Risk Management" course

Dear All,

Welcome to the "Risk Management" course. This moodle will be our basic mean of communication. Lectures, assignments and any extra readings will be posted here. Wish you all a fruitful and smooth semester.

Regards,

Dr. Mona Abouhamad

Topic 2

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SEARCH FORUMS

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CONSTRUCTION PROJECTS

- Change cannot be eliminated, but by applying the principles of risk management, engineers are able to improve the effective management of this change
- In construction projects each of the three primary targets of cost, time and quality are likely to be subject to risk and uncertainty
- It is vital to recognize the root causes of risks, and not to consider risks as events that occur almost at random.
- Risks can frequently be avoided if their root causes are identified and managed before the adverse consequence – the risk event – occurs.

RISK AND UNCERTAINTY

The word risk originated from the French word *risqué*

Risk

- Fatalities and injuries,
- Probability of reliability,
- Probability of adverse effect
- Consequences of adverse effects
- The likely effects on a project.

- risk is where the outcome of a event, or each set of possible outcomes, can be predicted on the basis of statistical probability.
- This implies that there is some knowledge about a risk as a discrete event or a combination of circumstances
- In most cases, project risks can be identified from experience gained by working on similar projects.

Are risks only bad events ?

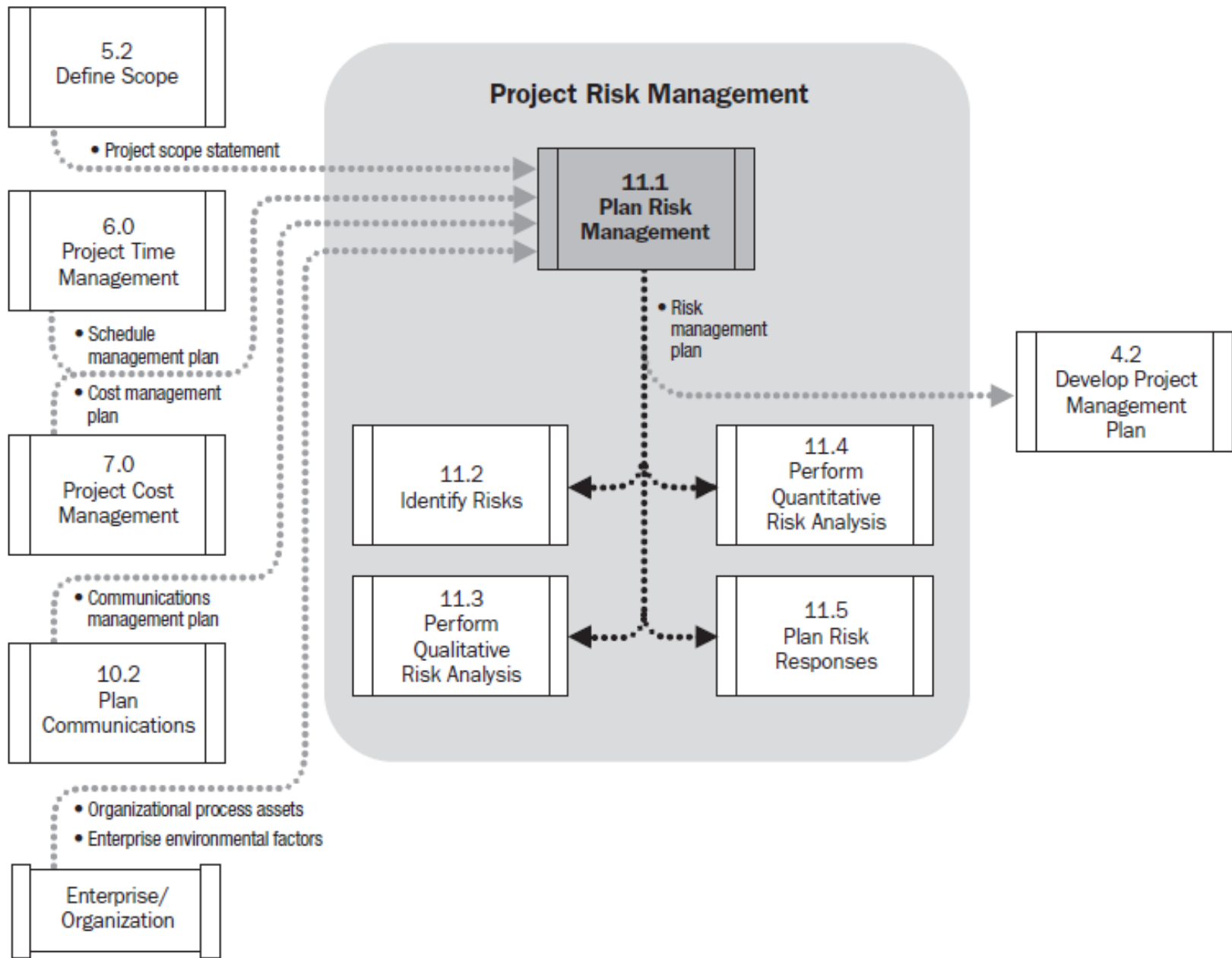
ANTICIPATED PROJECT RISKS

What can happen in a construction project ?

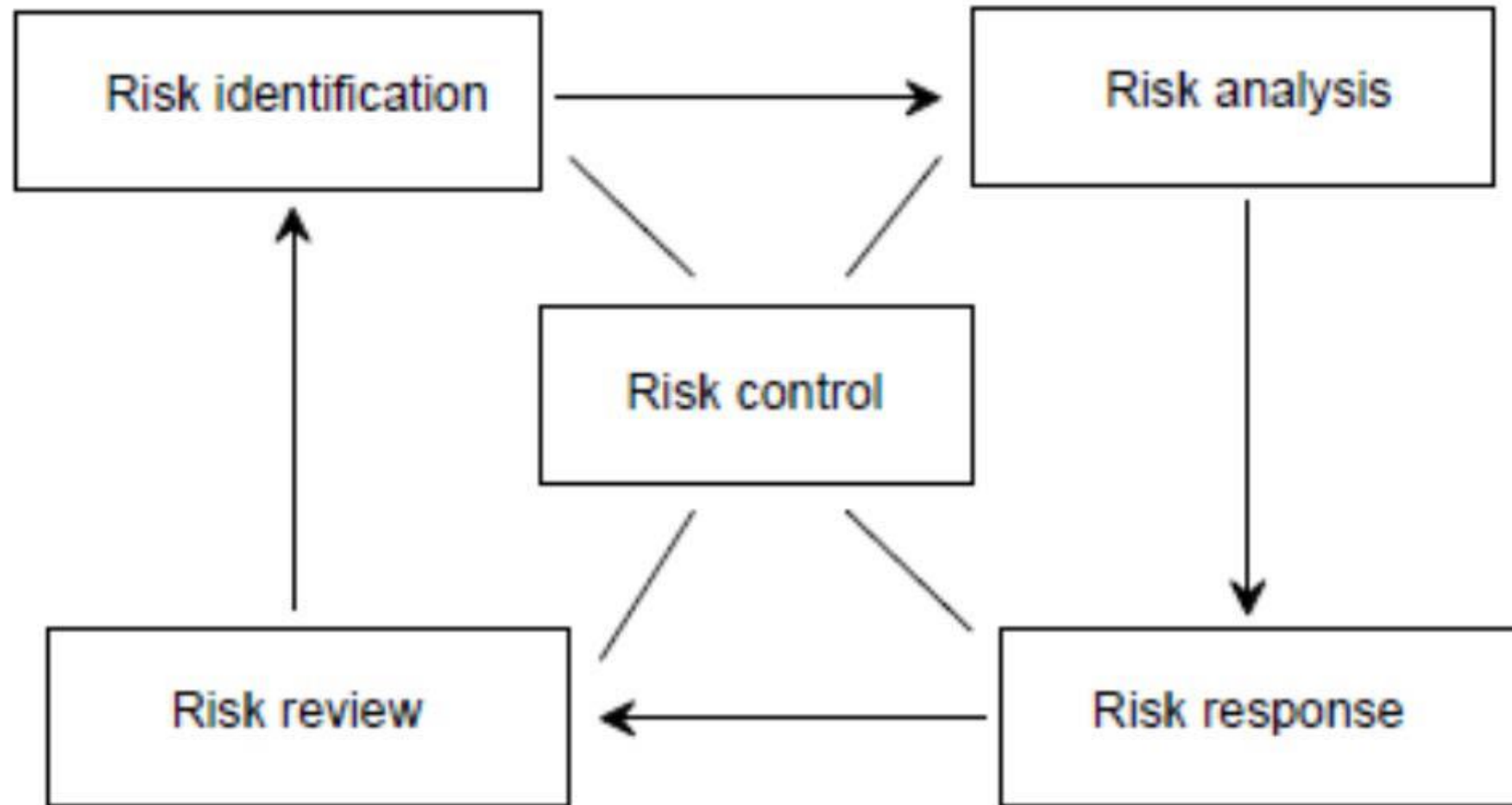
- Naturally occurring risks
- External impacts
- Supplier interruptions
- Labour Disputes
- Currency fluctuations (Excessive inflation/floatation)

HOW ABOUT PREVIOUSLY CONSTRUCTED PROJECTS ?

- Structural failure
- Operational failure
- Need for rehabilitation
- Naturally occurring events



The Risk Management Process



The risk control process (Merna and Lamb, 2004)

Identify Risks

- Risk is referred to as the probability and severity of a particular circumstance or a combination of circumstances that will negatively affect a municipality's ability to meet its objectives. Risk management, therefore, is the analysis and collective actions to be taken to reduce risk to an acceptable level.
- Risk = Probability * Consequence

RISK BREAKDOWN STRUCTURE

- A hierarchically organized depiction of the identified project risks arranged by risk category and subcategory that identifies the various areas and causes of potential risks.

Project

Analyze risk

The identified risks are assessed in terms of the predictability and probability of an event occurring and affecting a municipality's infrastructure.

| Source of Risk (Defects) | Hazards | Potential Impacts | Organisational Objectives Compromised |
|---|------------------------------------|--|---|
| Sewer-pipe longitudinal and transverse cracking | Structural failure — pipe collapse | <ul style="list-style-type: none"> ■ Sewer backup ■ Basement flooding ■ Road closure ■ Service interruptions | <ul style="list-style-type: none"> ■ Reliable customer service ■ Protect health and safety ■ Prevent property damage |
| Cast-iron water-main joint failure | Surface settling and loss of water | <ul style="list-style-type: none"> ■ Service interruption and washouts ■ Excessive operating costs | <ul style="list-style-type: none"> ■ Reliable customer service ■ Fire and health protection ■ Prevent property damage and personal injury ■ Provide efficient operation |

Organizational Objective

Severity Level

| | Catastrophic (10) | Critical (7) | Moderate (4) | Negligible (1) |
|---------------------------|--|---|---|---|
| Reliable Customer Service | Extensive sewer backups with large numbers of customers affected for extended period of time | Smaller number of customers affected by backups; some mitigation bypass pumping | No backups into basements, but bypass pumping into storm systems | Brief sewer surcharging; no backups; no overflows |
| Health and Safety | Death or serious injury among large numbers of customers or service workers | Severe injuries or health hazards among workers or customers | Minor injuries or illness among service workers only; no impact on customers | No injuries or illness among customers or service workers |
| Environmental Protection | Severe and irreversible contamination of environmentally sensitive areas | Significant but reversible environmental impacts on limited areas | Brief, easily reversible contamination of small areas; manageable cleanup costs | Impacts lasting less than 1 day; only very small areas involved |

| Likelihood | | Probability Level |
|------------|----|---|
| Frequent | 10 | Will occur more than 4 times over next 2 to 5 years |
| Likely | 8 | Will occur 2 to 4 times over next 2 to 5 years |
| Occasional | 6 | Will occur once over next 2 to 5 years |
| Seldom | 3 | May occur once over next 2 to 5 years |
| Unlikely | 1 | Unlikely to occur over next 5 years |

| Probability | | Probability Level | | | | | | | | | |
|-------------------|----------------|-------------------|----|--------|----|------------|----|----|--------|----|----------|
| | | Frequent | | Likely | | Occasional | | | Seldom | | Unlikely |
| Probability Level | | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Severity | Severity Level | | | | | | | | | | |
| Catastrophic | 10 | 100 | 77 | 60 | 47 | 36 | 28 | 22 | 17 | 13 | 10 |
| | 9 | 77 | 60 | 47 | 36 | 28 | 22 | 17 | 13 | 10 | 8 |
| | 8 | 60 | 47 | 36 | 28 | 22 | 17 | 13 | 10 | 8 | 6 |
| Critical | 7 | 47 | 36 | 28 | 22 | 17 | 13 | 10 | 8 | 6 | 5 |
| | 6 | 36 | 28 | 22 | 17 | 13 | 10 | 8 | 6 | 5 | 4 |
| | 5 | 28 | 22 | 17 | 13 | 10 | 8 | 6 | 5 | 4 | 3 |
| Moderate | 4 | 22 | 17 | 13 | 10 | 8 | 6 | 5 | 4 | 3 | 2 |
| | 3 | 17 | 13 | 10 | 8 | 6 | 5 | 4 | 3 | 2 | 2 |
| | 2 | 13 | 10 | 8 | 6 | 5 | 4 | 3 | 2 | 2 | 1 |
| Negligible | 1 | 10 | 8 | 6 | 5 | 4 | 3 | 2 | 2 | 1 | 1 |

Plan Response

- Risk Avoidance
- Risk abatement (mitigation)
- Risk Retention
- Risk transfer

Risk Avoidance

Risk avoidance means opting to avoid the risk, or not proceed with a specific task, activity or project associated a particular risk.

- The cost of this option to the organization is not receiving the intended benefit of a proposed infrastructure project.

• Risk Mitigation

- Adopting a series of proactive steps that will prevent or minimize the effect of a hazard compromising the organizational objectives,
- These mitigation steps reduce the probability and/or the severity of the hazard if it occurs.

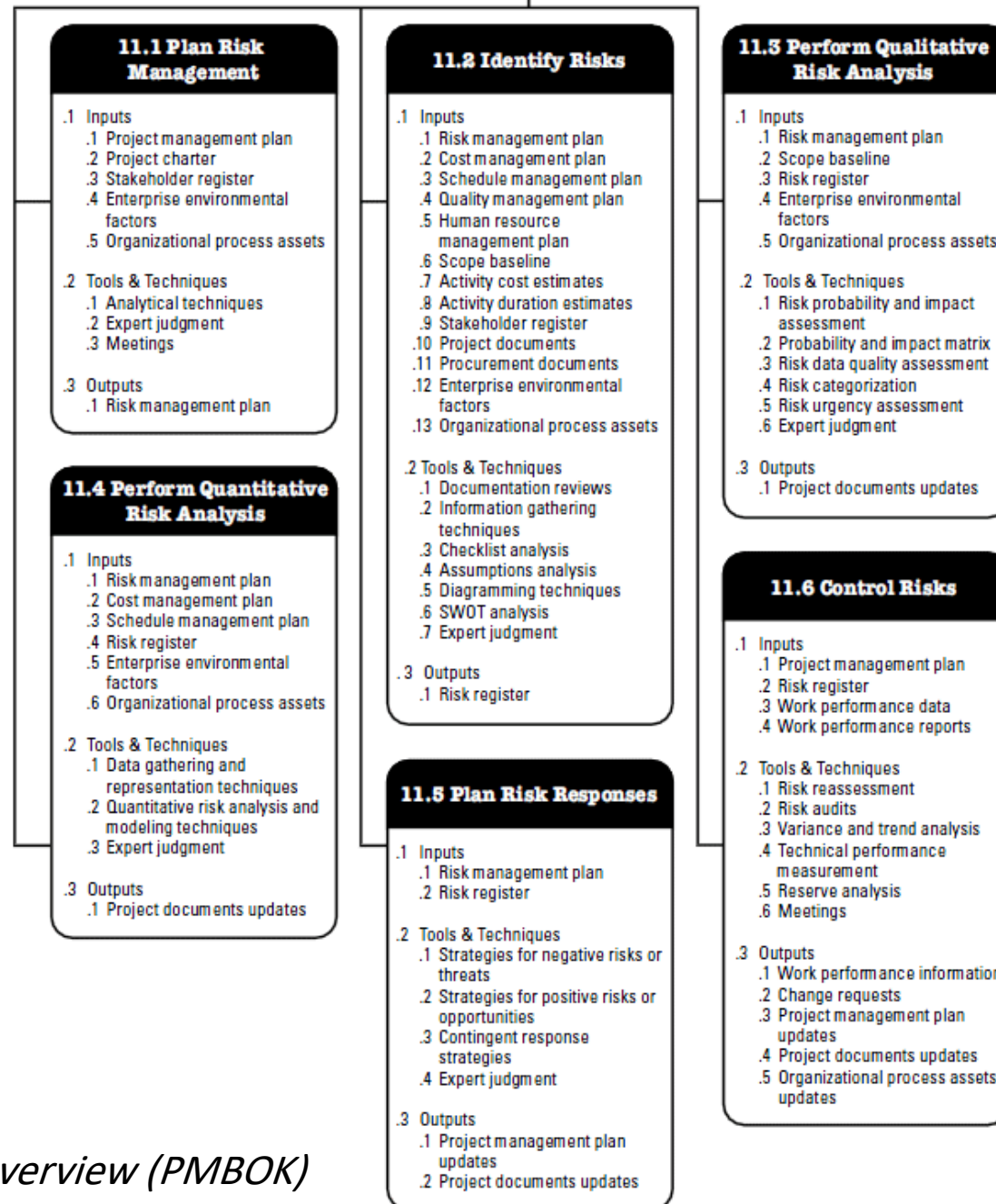
- *Risk Retention*

- • Applied when it is not possible or cost-effective to avoid, abate, or transfer the risk.
- • The risk can be safely absorbed, When the probability or severity of loss is so high that to transfer the risk would cost almost as much as the cost of the worst loss that could ever occur.

- *Risk transfer*

- Shifting the risk burden to a third party,
- It is usually done through conventional insurance as a risk transfer mechanism.

Project Risk Management Overview



References

- Lecture Notes
- Selected readings will be made available on course website

<http://www.elearn.eng.cu.edu.eg/course/view.php?id=122>

- Smith, Nigel J., Tony Merna, and Paul Jobling. *Managing risk: in construction projects*. John Wiley & Sons, 2009.
- Guide, P. M. B. O. K. "A guide to the project management body of knowledge." *Project Management Institute*. Vol. 3. 2004.