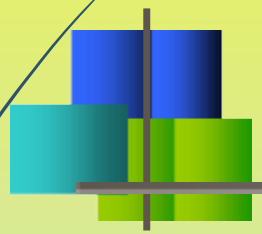
COTM 6204

Construction Risk and Change Management



CHAPTER ONE

Risk Management in Construction

Dr Meseret Getnet

2019/20

Introduction to Risk Management







Introduction to Risk Management

Is it really important to consider risk ?



Introduction to Risk Management

,

Progress always involves risk;

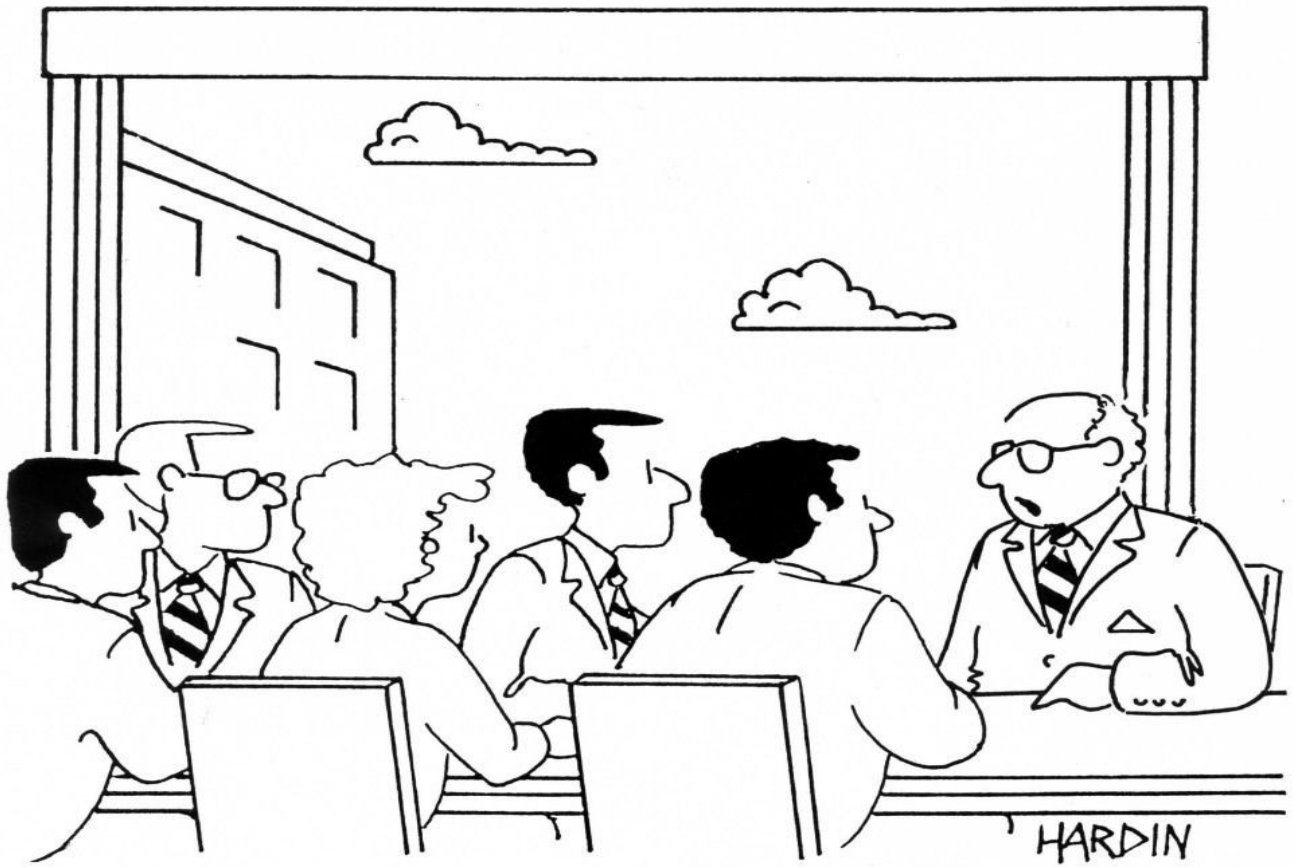




Don't be afraid to take a big step. You can't cross a chasm in two small jumps.

...David Lloyd George

Introduction to Risk Management



"We've considered every potential risk except the risks of avoiding all risks."

Introduction to Risk Management

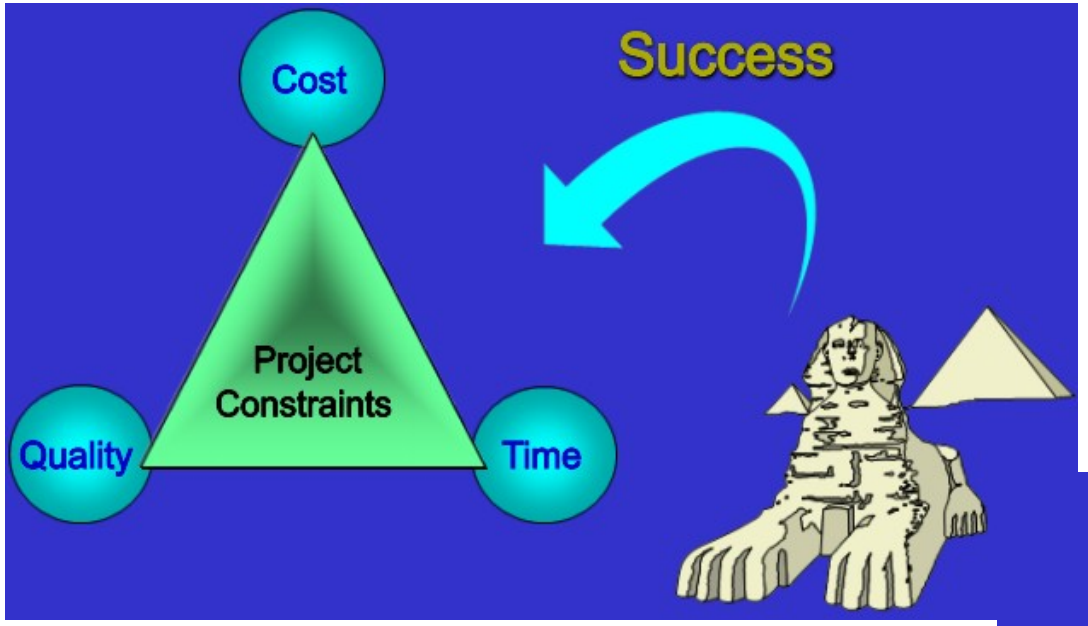
- Common words in risk management process

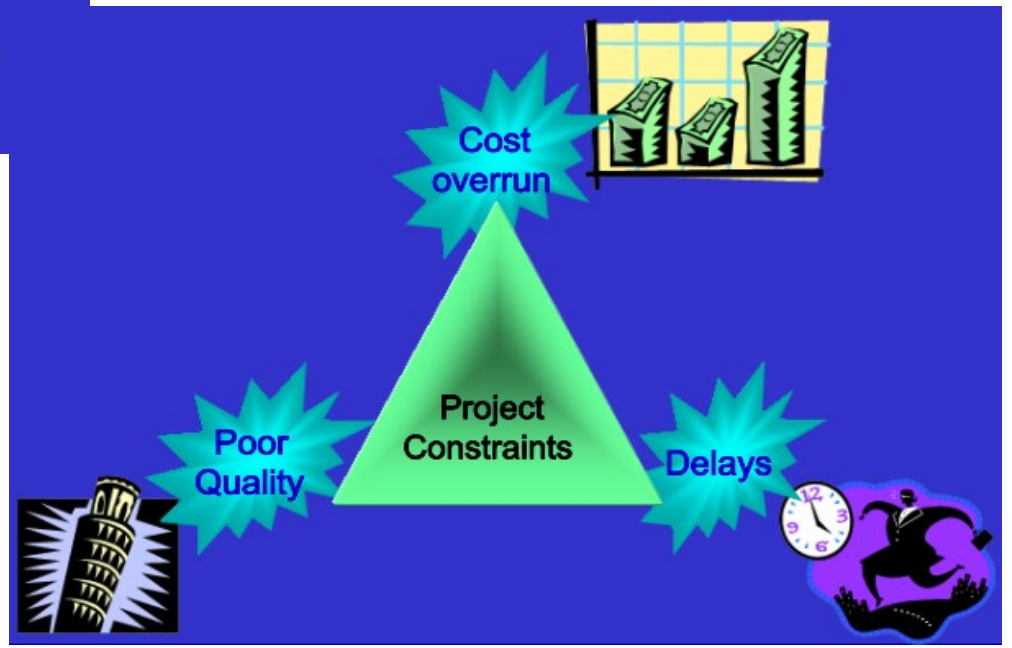


Introduction to Risk Management



Introduction to Risk Management





Introduction to Risk Management

- A major step in project planning
- A complex process since the variables are **dynamic and dependent** on variety of conditions such as:
  - project size,
  - project complexity,
  - location,
  - season of the year, …etc.
- A **Time and/or Cost contingency should be added** to cover unforeseen occurrence

Introduction to Risk Management

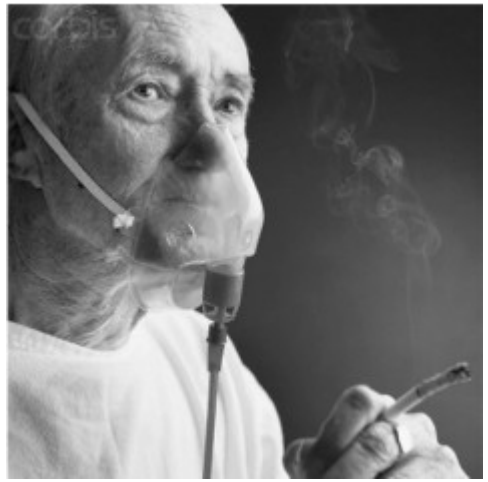
Why Risk Analysis?

- Minimize management by crisis
- Minimize surprises and problems
- Increase probability of project success or control
- Better handling of true costs and schedules by properly estimating contingencies

Introduction to Risk Management

Terms and Definitions

- **Hazard**
  - Each time we smoke, we might get cancer.
  - Smoking is a **Hazard**.
  - Smoking is **Hazardous**.
  - The **likelihood** we get cancer is **RISK**.



  - Each time you go up the stairs we **might fall**.
  - The stairs are a “**Hazard**”.
  - The **probability or likelihood** we would fall is the **RISK**.

Introduction to Risk Management

Terms and Definitions

- **Risk**
  - Risk has to do with **PROBABILITY * IMPACT**
  - We need to differentiate between **Cause, Event & Impact**.
  - A box of chocolate with **15 pieces**. All sugar-free except **ONE**.
  - ***Cause***: Having a ***non sugar-free*** chocolate in the box
  - ***Event***: Selecting that particular piece
  - ***Impact***: Gaining Weight!



Introduction to Risk Management

Terms and Definitions

- **Risk -** Risk may be defined as:
  - Any event which is **likely to affect** (adversely) the ability of project to achieve the defined objectives
  - **Undesirable extra cost or delay** due to factors having uncertain future outcome
  - **Risk** can be characterized in terms of its **Severity** where:

Severity = Likelihood of Occurrence x Magnitude of the Impact

Introduction to Risk Management

Terms and Definitions

- **Risk – *Known vs. unknown***
  - **Known Risks** are those that have been **identified and analyzed**
  - **Unknown Risks** can not be managed, may be addressed by **ertainty**



Introduction to Risk Management

Terms and Definitions

➔ Project Risk

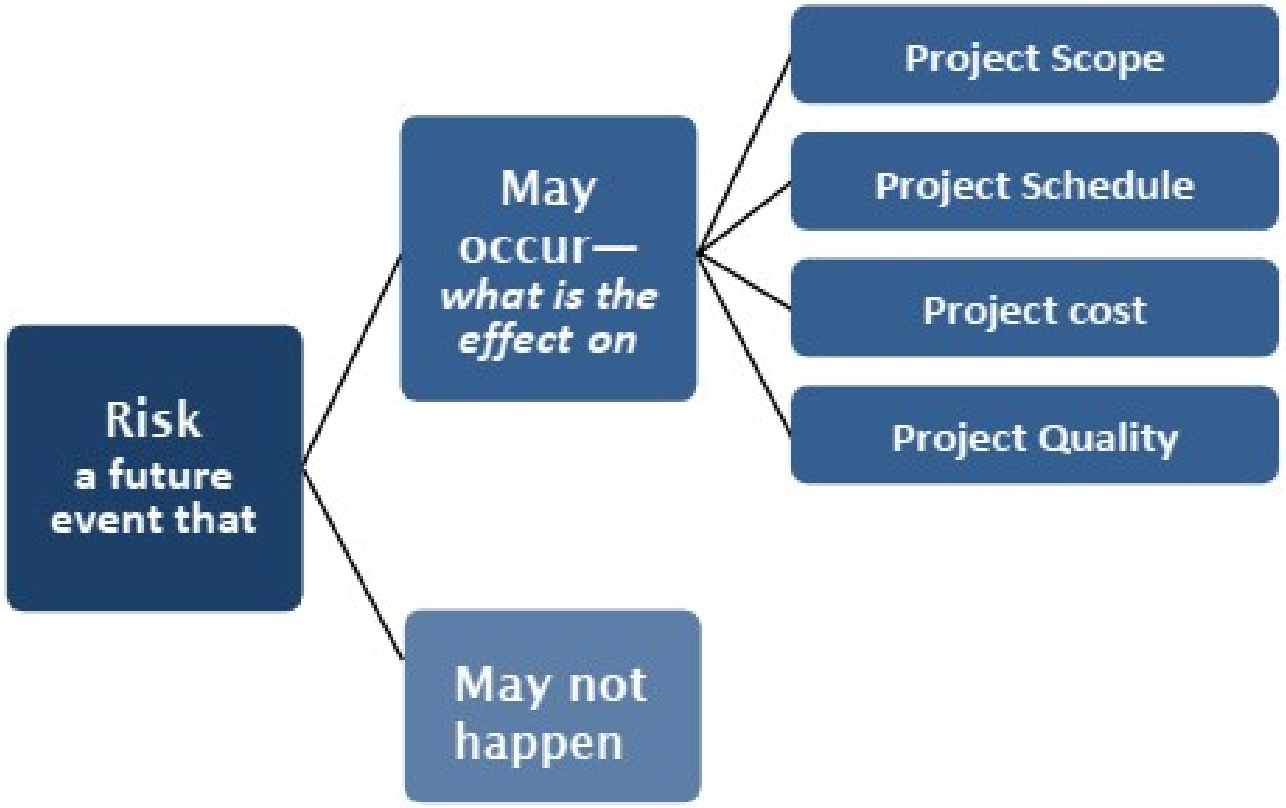
Cause	Event	Impact
Need to have a permit	Permit is delayed	Schedule slippage
Buying in $	FOREX rate change	Budget slippage
Cable on floor	Someone trips & falls	Schedule slippage
No lessons learned	Facing a new problem	Reinventing the wheel
Technology is new	System becomes unstable	Customer dissatisfaction

Project Risks

- A project risk is a future event that may or may not happened, but if it does occur it will have an effect (positive or negative) on project scope, cost, schedule or quality.
- It may have one or more causes, if it occurs it may have one or ore impacts.
- All project activities carry some element of risk, which are uncertainties about them that could affect the project for better or worse.

Project Risks

- **What a project manager needs to know is what is the likelihood a risk will occur and if it does what will it impact as this affects the project plan.**



Project Risks – Ways to Look at Risk

- Qualitative
  - High, Medium, Low
  - Red, Yellow, Green
- Quantitative
  - Based on calculated value

Example 2: *Latte* 	Example 2: *Latte* 
Qualitative data: • robust aroma • frothy appearance • strong taste • burgundy cup	**Quantitative data:** • 12 ounces of latte • serving temperature 150° F. • serving cup 7 inches in height • cost $4.95

$$R = (\text{probability of the accident occurring}) \times (\text{expected loss in case of the accident})$$

Project Risks vs Business Risk

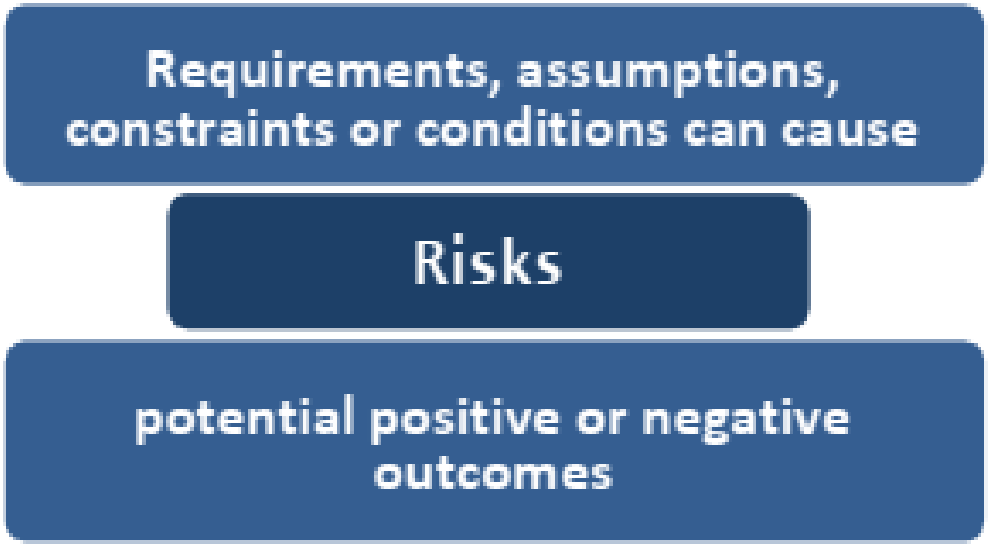
- **Business risk** implies uncertainty in **profits or danger of loss and the events** that could pose a risk due to some unforeseen events in future, which causes **business to fail**.
  - **Business risks are more general and relate to the organization**
- **Project risk** is an uncertain event or condition that, if it occurs, has a **positive or negative effect on a project's objectives.** (PMI)
  - **Project risks relate specifically to the project**

Project Risks vs Business Risk - Example

- **Project scope** - to build the stadium to the agreed specification within an agreed timescale and budget.
- **Project Risk** - that the building costs may be higher than expected because of an **increase in materials or labor costs.**
- **Business Risk** - even if the stadium is constructed on time and within budget that it will not make money for the business.
  - This could be because of lower than **expected ticket sales or higher than expected maintenance costs.**

Project Risks

- **Risks are caused by a requirement, assumption, constraint, or condition that creates the possibility of negative or positive outcomes.**



Project Risks - Continuing the example above:

- **Risk Cause - change in health and safety legislation during the build phase.**
- **Risk Outcome - increased costs to modify the parts of the stadium in accordance with the new legislation before it can be used.**

… the example …

- **Project Impact on cost, schedule and performance needs to assessed:**
  - **Shortage of skilled personnel due to demand by other building projects**
  - **Unexpected cost of inspection & license**
  - **The build of the affected parts of the stadium can be brought forward to finish project on time.**

Project Risks…

- **Risks include both threats and opportunities that project managers must assess.**
  - **Opportunities have uncertainty associated with them, but they should be grasped, and action taken to ensure that they are realized.**
  - **Threats have potentially negative impacts that the project management team should strive to mitigate.**

Individual Risks vs Overall Project Risks

- **Individual risk** is defined as “an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives.”
- **Overall project risk** is defined as “the effect of uncertainty on the project as a whole”, representing the exposure of stakeholders to variations in project outcome, both positive and negative.

Introduction to Risk Management

Terms and Definitions

- **Risk Averter**



Not likely to take a risk that is considered a high risk

Introduction to Risk Management

Terms and Definitions

➔ **Risk Taker**



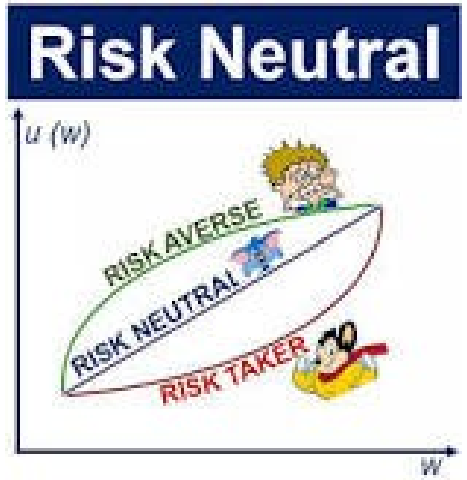
Prefers an **uncertain** outcome and may be willing to pay a penalty to take a high risk

Introduction to Risk Management

Terms and Definitions

➔ **Risk Neutral**





Tolerance to risk is proportional to the amount of money at stake

(Financial markets, IRR, Interest)

Introduction to Risk Management

Terms and Definitions

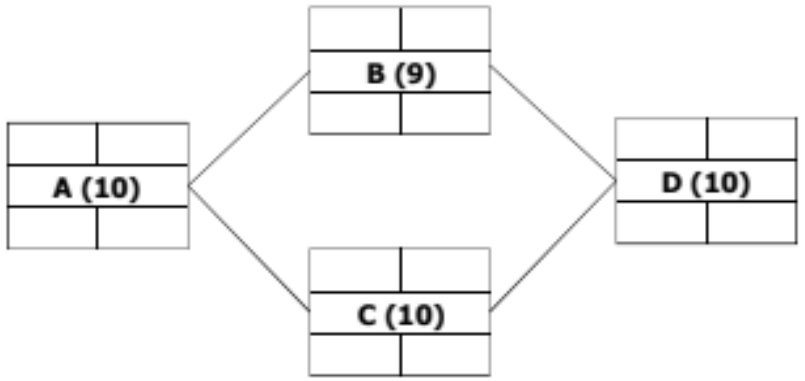
➔ Risk Vs. Uncertainty

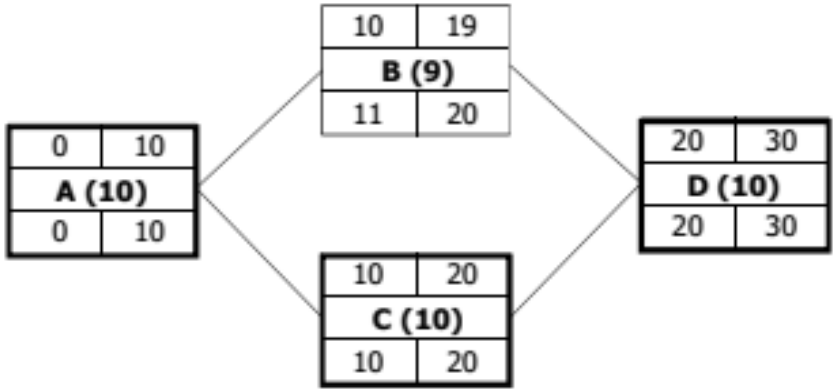
Basis for Comparison	Risk	Uncertainty
Meaning	The probability of winning or losing something worthy is known as **risk**.	Uncertainty implies a situation where the future events are **not known**.
Ascertainment	It can be **measured**	It **cannot be measured**.
Outcome	Chances of outcomes are **known**.	The outcome is **unknown**.

Introduction to Risk Management

The Impact of Uncertainty

- Consider the following small project





Total Project Duration = 30

- Basic Assumption of CPM : Deterministic Estimating
- What is the **impact if you are uncertain** about the durations?

Introduction to Risk Management

The Impact of Uncertainty

➔ Consider small uncertainty in durations; durations = + or – one day from given or any other change

Activity	Optimistic	Most Likely	Pessimistic
A	9	10	11
B	8	9	10
C	9	10	11
D	9	10	11

Introduction to Risk Management

The Impact of Uncertainty

Risk Management Example

Activity	o	m	p	Used Duration
A	7	10	12	7
B	8	9	13	11
C	8	10	12	12
D	7	10	13	10

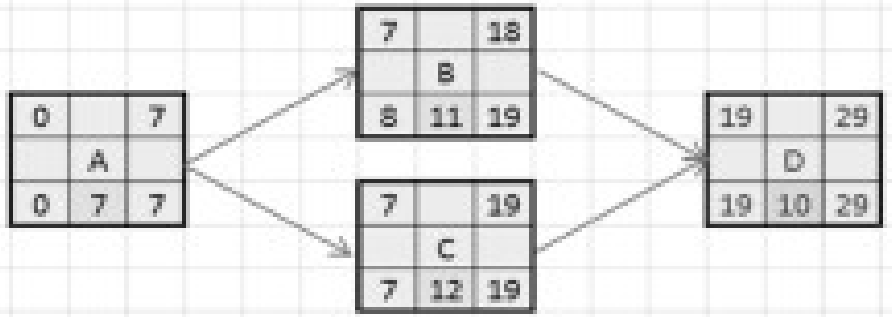
Try

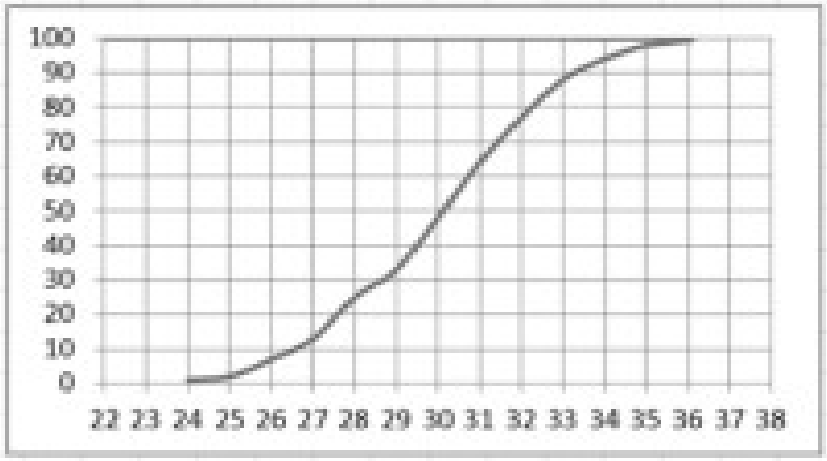
Project Duration = 29

100 trials

Trial No	Duration
1	31
2	33
3	32
4	36
5	32
6	33
7	30
8	31
9	31

24	36
Duration	Frequency	CDF
24	1	1
25	1	2
26	5	7
27	6	13
28	12	25
29	8	33
30	15	48
31	16	64
32	13	77





What is Project Risk Management?

- **The PMBOK® Guide and its Construction Extension defines as:**
  - **the processes concerned with for conducting risk management planning, identification, analysis, responses, monitoring and control a project.**
- **Project risk management is essential for successful project management and should be applied throughout a project's life cycle.**

What is Project Risk Management?

- A systematic and disciplined approach to address project risks.
- A tool to develop a proactive strategic plans and track its progress to increase the likelihood of success of a program/project.
- A tool to promote interfaces with other areas of the project (cost, schedule, scope, quality, permitting, design disciplines, etc.) to increase opportunities for success.

What is Project Risk Management?

- Experienced project manager
  - Risk management?
    - ✓ I’ve always done that!
    - ✓ What do they want me to do differently?



- Systematic;
- Disciplined;
- Proactive;
- Inclusive;
- Strategic plans

What is Project Risk Management?

- **Project risk management – Root objectives**

- **To increase the likelihood and impact of positive events or opportunities**
- **To decreasing the likelihood and impact of negative events or threats to the project.**

Why is important to have a formal Risk

- Formal and holistic approach to **identify and prioritize risks.**
- Establish confidence levels or **budgets and schedule.**
- Develop **real mitigation strategies.**
- **Support major decisions**



Project Manager = Decision Maker

The **project manager** is a decision maker.

And it is expected to make the **best decision** with **limited information** and in a changing environment where many **uncertainties are in place.**

Risk management assists in dealing with **uncertainties and lack of complete information** to support the decision making process.

What is Success?

If, good decision making leads to successful project;

How do we define “Success” in the engineering/ construction context?

.....Success?

The physical product serves as a greater purpose =

Functionality

- **The stakeholders' expectations were met;**
  - **Agreed Scope is in use.**
  - **Meets Quality expectations.**
  - **The perception of the project benefits are greater that alternatives.**
  - **Good use of moneys.**
  - **Good use of time.**

Project Risk Management

Supports…

- **Successful project**
  - **Budget**
  - **Schedule**
  - **Quality**
  - **Functionality**
  - **Reputation**

… identify the potential problems

Risk Management Supports…

- Utilizing risk-based decision-making
- Generating a proactive risk management culture
- Distributing the risks efficiently among the project participants

[Risk Allocation]

Good Risk Management Practice

1. Involve Stakeholders

Involve the stakeholders every step of the way, beginning with the initial risk assessment.

2. Tone from the Top

Creating a strong risk culture.

Risk culture is defined as the values, beliefs, and attitudes about risks by a common group of people.

Good Risk Management Practice

3. Open Communication

Communicating risks throughout your organization

4. Clear Risk Management Policies

5. Continuous Monitoring

Clear monitoring processes must be established to ensure that any and all risk mitigation efforts are working and effective.

Critical Success Factors for Risk Management



Risk Management in Construction

- **No construction project is risk free.**
- **Construction is increasingly complex and fraught with risks**
  - **Safety**
  - **Monetary**
  - **Quality**
  - **Time**
  - **Security**
  - **Equipment**
  - **Relationship**

Risk management in the construction

- Historically construction has been risky for several reasons, including:
  - Poor record of completion to cost and time.
  - High levels of disputes and litigation.
  - Intense competition for work.
  - Low margins and profit risk.
  - Poor safety and occupational health record.
  - Pressure to produce a high return on funds invested. Pressure to save time and money.
  - Pressure on health and safety provision.

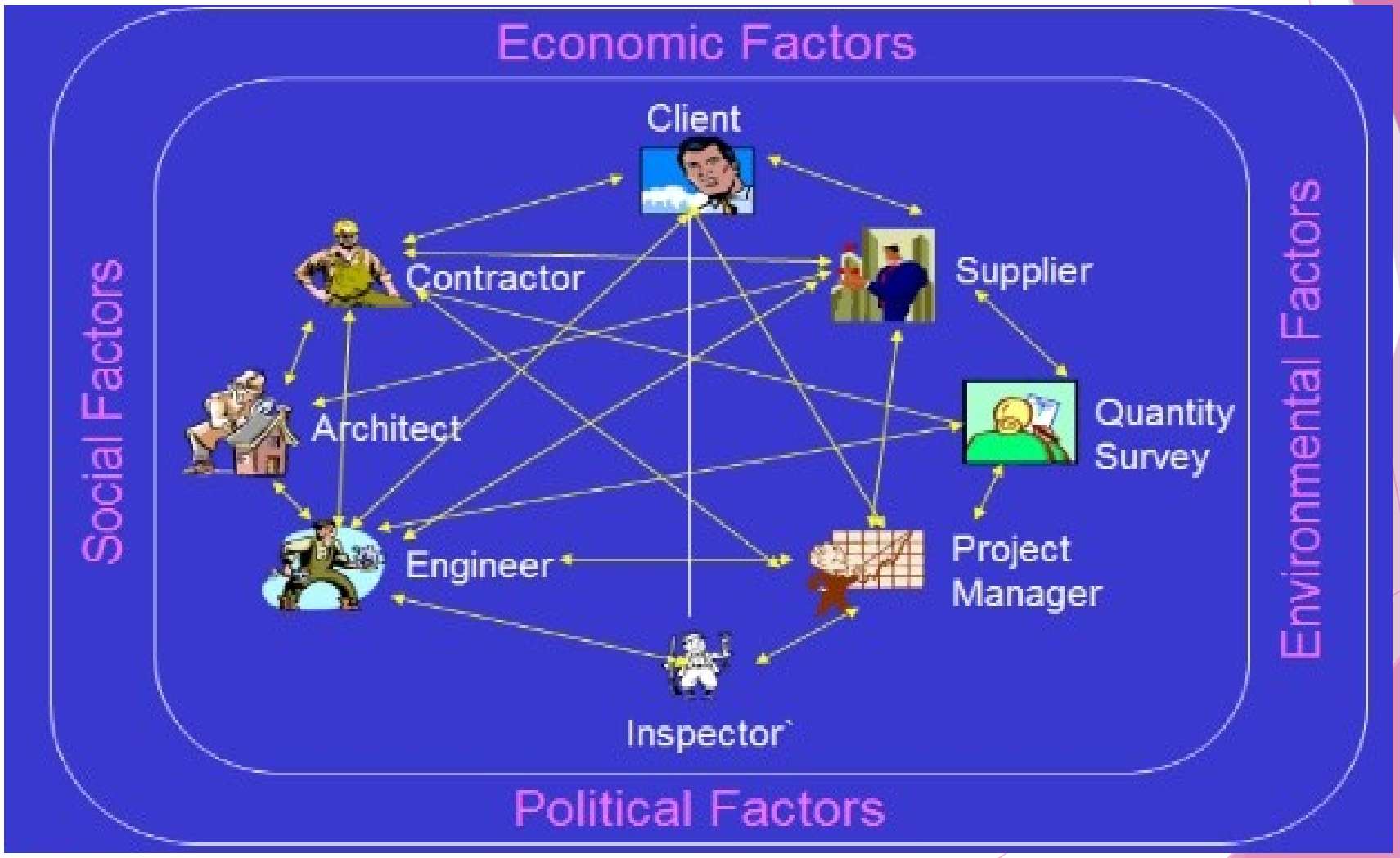
Risk Management in Construction

- **Risk can be managed, minimized, shared, transferred, or accepted and it cannot be ignored.**
- **What happens if it is ignored?**
  - **Increased costs.**
  - **Loss or reduction in profit.**
  - **Damage to brand / reputation; and at worst.**
  - **Disposal of the business or insolvency.**

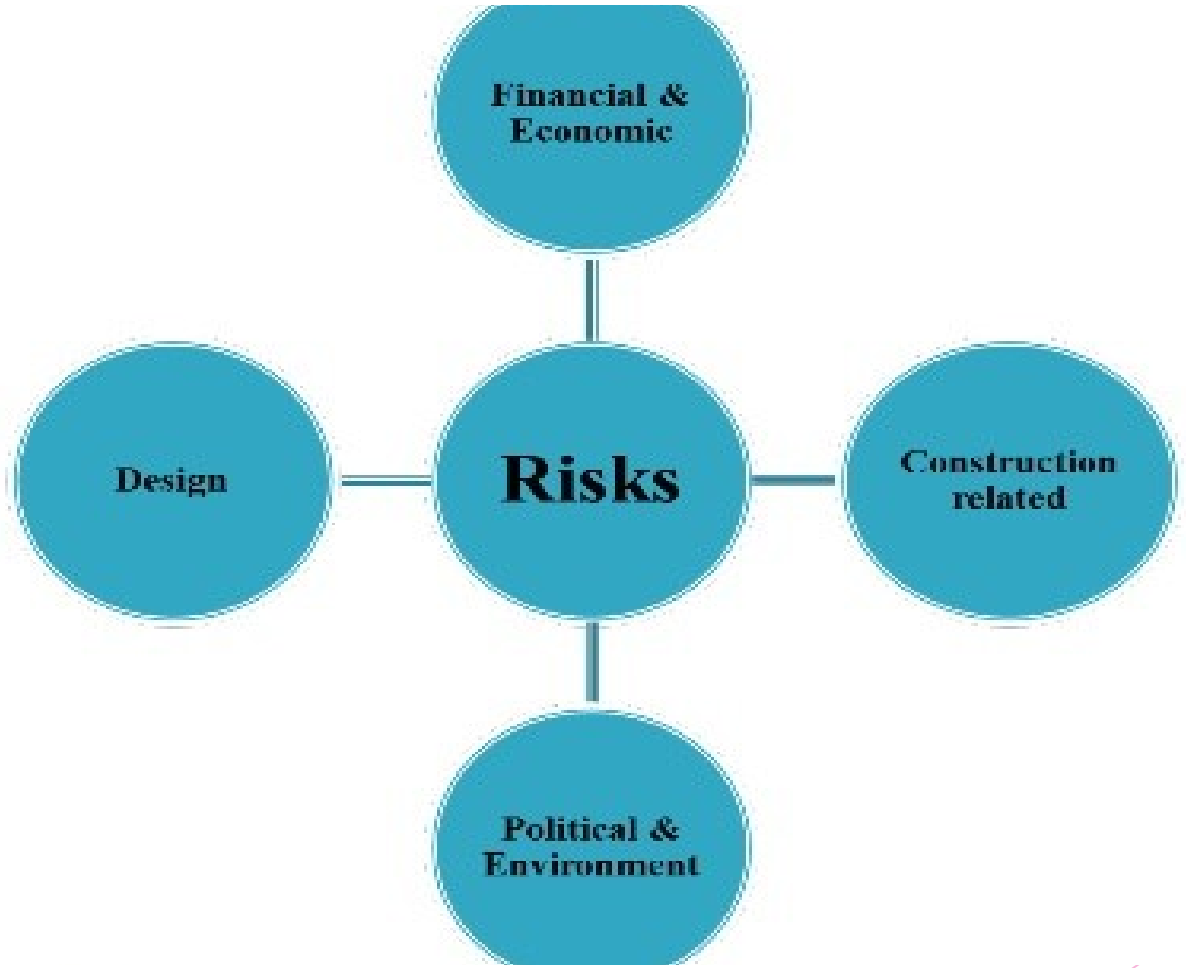
Risk Management in Construction

- **Risk management in construction is designed to**
  - **plan, monitor and control those measures needed to prevent exposure to risk.**
- **To do this it is necessary to**
  - **identify the hazard,**
  - **assess the extent of the risk,**
  - **provide measures to control the risk and**
  - **manage any residual risks.**

Risk Management in Construction - Factors



Category of Risks in Construction



Risks in Domestic Construction Projects

Every domestic construction project, regardless of its size and complexity, continually faces a variety of uncertain situations due to factors common to the construction industry, such as:

- **Long duration and aggressive schedules;**
- **Changing environment and the dynamic nature of the workplace;**
- **Complex technical processes;**
- **Open locations highly exposed to environmental agents;**
- **Unskilled workforce;**

Risks in Domestic Construction Projects

- Material shortages;
- Different organizations actively involved in the construction project with different goals, interests, and expectations;
- Many works being of public interest;
- Change in material prices; and
- Regulatory requirements.

Risks in Domestic Construction Projects

- Construction organizations should address;
  - risk management **proactively** as a team and
  - consistent throughout the construction project life cycle.
- **Risk management** offers a **proactive** approach.
- **Management of issues** is a **reactive** approach.

..... Question???

What are the significant considerations that should be taken when performing risk management in Design-Build and Design-Bid-Build construction project arrangements?

Risks in International Construction Projects

- When undertaking major project work in an international environment, careful understanding of the complex domestic risk environment is crucial.
- PESTLE analysis is a marketing tool that facilitates the tracking of the new project environment and by which these factors are examined to determine specific risks associated with the project location.
- PESTLE analysis - Political, Economic, Social,

Additional Sources of Risks in International Projects

- **Custom procedures, import duties, and import and export restrictions;**
- **Cultural and religious practices effects on working patterns, cultural differences, and language barriers;**
- **Time zone and legal working days differences between site and central office;**

Additional Sources of Risks in International Projects

- **Local labor union practices;**
- **Local weather patterns;**
- **Local regulations;**
- **Safety and security concerns (e.g., terrorism);**
- **Constraints on employment of expatriate staff and/or work visa procedures;**

Additional Sources of Risks in International Projects

- **Regulated professional services granted to locals, government pressures to use local suppliers, and investment requirements involving the use of local employees; and**
- **Currency convertibility (exchange rate fluctuations) and/or restrictions on repatriation of funds.**

Project Manager's Role for Project Risk Management

- Encouraging senior management support for Project Risk Management activities.
- Determining the acceptable levels of risk for the project in consultation with stakeholders.
- Developing and approving the risk management plan.
- Promoting the Project Risk Management process for the project.

Project Manager’s Role for Project Risk Management

- Facilitating open and honest communication about risk within the project team and with management and other stakeholders.
- Participating in all aspects of the Project Risk Management process.
- Approving risk responses and associated actions prior to implementation.
- Applying project contingency funds to deal with identified risks that occur during the

Project Manager’s Role for Project Risk Management

- Overseeing risk management by subcontractors and suppliers.
- Regularly reporting risk status to key stakeholders
- Escalating identified risks to senior management where appropriate
- Monitoring the efficiency and effectiveness of the Project Risk Management process.
- Auditing risk responses for their effectiveness

CHAPTER ONE END!

