

PM-9 Presentation

Project risk – an uncertain event or condition that, if it occurs, has a positive or a negative effect on at least on project objective, such as time, cost, or quality. A risk may have one or more causes and, if it occurs, one of more impacts. (PMBOK)

- Can result in loss or profit
 - Risks present threat and opportunity
- Taking greater risks can result in a larger profit
 - If you can manage risk, you can make more profit
 - If you can't, you have more loss

Risk vs. uncertainty

- Risk (aleatory variability) is a probable event in a project event which is known and can be measured (e.g. weather)
- Uncertainty (epistemic uncertainties) is due to limited data and knowledge about an event or its probability of occurrence (e.g. subsurface conditions)

Project risk management

- Risk management planning
- Risk identification
- Qualitative risk analysis
- Quantitative risk analysis
 - The 4 above are the most common methods
- Risk response planning
- Risk monitoring and control
- Methodology
- Roles and responsibilities
- Budgeting
- Timing
- Risk categories
- Definitions of risk probability and impact
- Probability and impact matrix
- Revised stakeholder's tolerances
- Reporting formats
- Tracking

Tools and techniques

- Documentation review
- Information gathering; brainstorming, Delphi technique, interviewing, root cause analysis
- Checklist analysis
- Assumption analysis
- Diagramming techniques
- SWOT analysis
- Expert judgement

Methods for creation and gathering ideas from a group used for problem solving and decision making

- Brainstorming
- Delphi method
- Fishbone diagram
- SWOT analysis

Brainstorming

- Quantity matters
- Encourage wild idea (out of the box)
- No criticism
- Combine and improve ideas through association

Methods of brainstorming

- Nominal group technique
- Group passing technique
- Team idea mapping method
- Directed brainstorming

Delphi Technique

- Method to collect ideas from a panel of experts
- Unlike brainstorming, it does not depend on a large number of participants, rather the experience and expertise of the participants matter
- Experts on the panel should remain anonymous to each other
- Repeating process until the answers converge

Fishbone diagram

- Material
- Manpower (Mind)
- Machine
- Environment
- Methods
- Measurement
 - All of which lead to the Defect (or quality risk)

SWOT analysis

- Internal factors
 - Strengths
 - Weaknesses
- External factors
 - Opportunities
 - Threats

Qualitative risk analysis

- Tools and techniques
 - Risk probability and impact assessment

- Probability and impact matrix
 - Risk data quality assessment
 - Risk categorization
 - Risk urgency assessment
 - Expert judgement
- Data gathering and representation techniques
 - Interviewing
 - Probability distributions
- Qualitative risk analysis and modeling techniques
 - Sensitivity analysis
 - Expected monetary value analysis
 - Modeling and simulation
- Expert judgement

Project risk

- Risk avoidance
- Risk mitigation
- Risk transfer
- Risk acceptance

Risk avoidance

- Direct approach to eliminate risk sources such as the risk of lack of knowledge
 - Get information, effective communication, simulation, gain knowledge acquisition
- Indirect approach, mostly to avoid risk impact
 - Change project scope to eliminate the risk, use proven technology, safety factors

Risk mitigation

- Reduce the size of the risk exposure to the threshold of risk acceptability

Risk transfer

- Use financial tools, such as insurance, warranties, etc.
- Contracting and subcontracting, risk becomes contractor's responsibility

Risk acceptance

- Active acceptance
 - Contingency plan
 - reserve resources
- Passive acceptance
 - Risk management procedure in processes
 - Risk management training

PM-10 Presentation

Project roles

- Owner/client
- Designer
- Contractors/subcontractors
- Suppliers
- Construction management (CM) – maybe

Project delivery

- In-house
- Out-sourcing

Stone age

- Mostly in-house, I guess

Mesopotamia to medieval ages

- Outsourcing
- Design and building by one entity (master builders)
- No standard textbook
 - Based on rules of thumb
- Knowledge transfer through apprenticeships and from father to son
- Technology transfer through migration or war

Renaissance (after medieval)

- Separation of design (architectural) and construction
- Architects were often an artist, with little knowledge of building technology
- Provide detail drawings for craftsmen
- Classic architecture (Filippo Brunelleschi)

Modern construction

- Each method carries a different level of risk for the owner
- Level of control retained by the owner correlates with the level of risk
- None of these delivery methods is right for every project
- Depends on project requirements, goals, and potential challenges
- Construction management agent could be involved in each of the methods

Project delivery method (or project procurement method) – system designed to achieve the satisfactory completion of a construction project from conception to occupancy. A project delivery method may employ any one or more contracting formats to achieve the delivery

Out-sourcing (types of project delivery methods)

- Design-bid-build (DBB or traditional method)
- Design-build
- Construction management at risk (CM at risk)
- Integrated project delivery

Construction management (CM) – professional management practice applied to construction projects from project inception to completion for the purpose of controlling time, cost, scope and quality

- Not a delivery method
- Could be involved in each of the methods
- In-house staff or third party
- Should be engaged in early stages of project
- Advise on or manage the process over the life of the project, or during specific phases
- ‘CM at risk’ is the delivery method, not this one!

Owner’s considerations

- Cost
- Schedule
- Design
- Expertise
- Risks

Compensation methods

- Lump sum / fixed price
- Guaranteed maximum price (GMP)
- Reimbursable
 - **Unit price** – based on actual quantities at set unit prices
 - **Cost plus fixed fee** – payment is based on actual cost plus a fixed fee
 - **Cost plus incentive fee** – payment is based on actual cost plus an incentive-based fee
 - **Cost plus award fee** – payment is based on actual cost plus performance-based fee
 - **Time spent** – payment based on actual hours spent at set billing rates
 - **Time and materials** – payment based on actual costs with fixed markup on costs

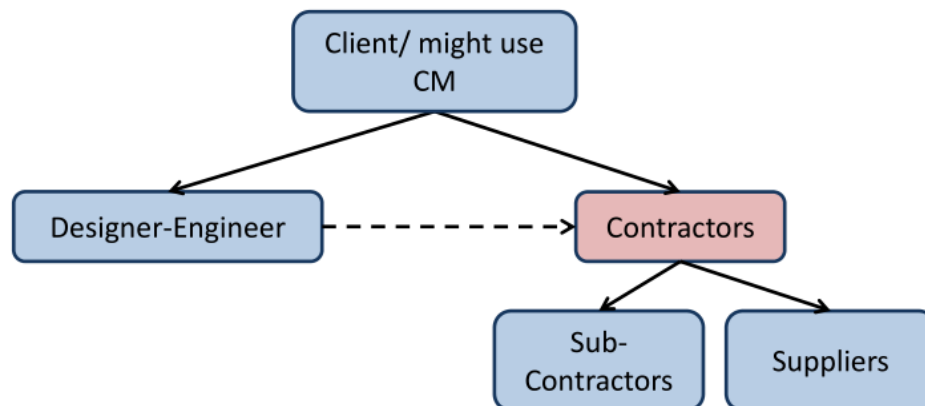
Project Delivery Method	Design-Bid-Build (DBB)	Construction Management at Risk (CMAR)	Design Build (DB)	Integrated Project Delivery (IPD)
Contracting Methods				
Lump Sum	Common	Common	Common	Rare
Guaranteed Maximum Price	Rare	Common	Common	Rare
Reimbursable	Rare	Rare - Common	Rare	Common

Selection Criteria	Low Bidder	Best Value	Best Qualifications
Project Delivery Method	Selection is based solely on Price	Selection is based on a weighted combination of Price and Qualifications	Selection is based solely on Qualifications
Design-Bid-Build	Most Common	Common; Price evaluation based on Construction Cost	Rare
Construction Management at Risk	Rare	Most Common; Price evaluation based on CMAR Fees and General Conditions	Common
Design/Build	Common	Most Common; Price evaluation based on fees and GCs; may or may not include Construction Cost	Common
Integrated Project Delivery	Rare	Common	Most Common

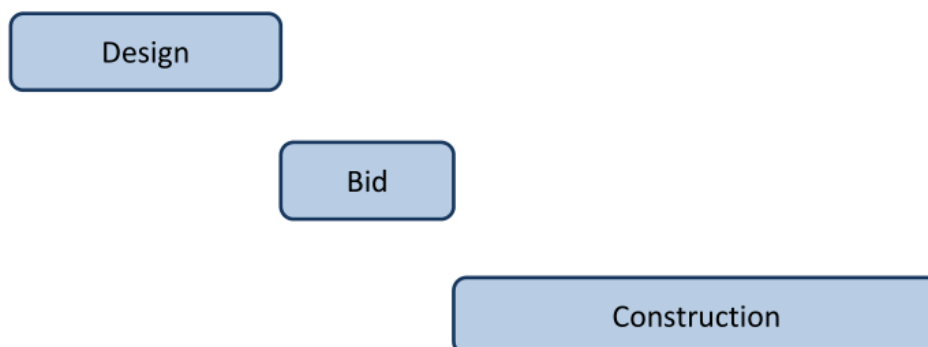
Fast-track – overlapping of design and construction

Design-Bid-Build Method (DBB or traditional method)

- Single prime uses one contractor
- Multiple prime uses several contractors



Timeline



Selection

- Usually based on lowest price first
- Most shortlist contractors based on pre-qualification

Compensation

- Fixed priced in most projects where the scope and underground conditions are known (residential and ICI, whatever that means)
- Unit price for projects that the scope might change and subsurface uncertainty exists (e.g. heavy construction such as dams, tunneling and highway)

Advantages

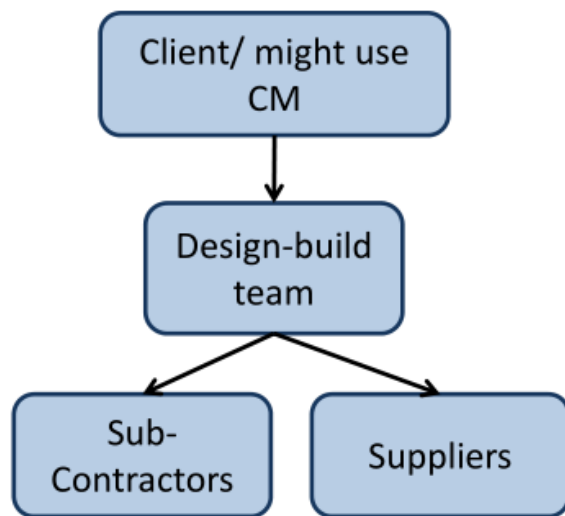
- Well-established and clear documents
- Known price before starting construction
- Comply with local, provincial or federal regulations
- Control over the projects

Disadvantages

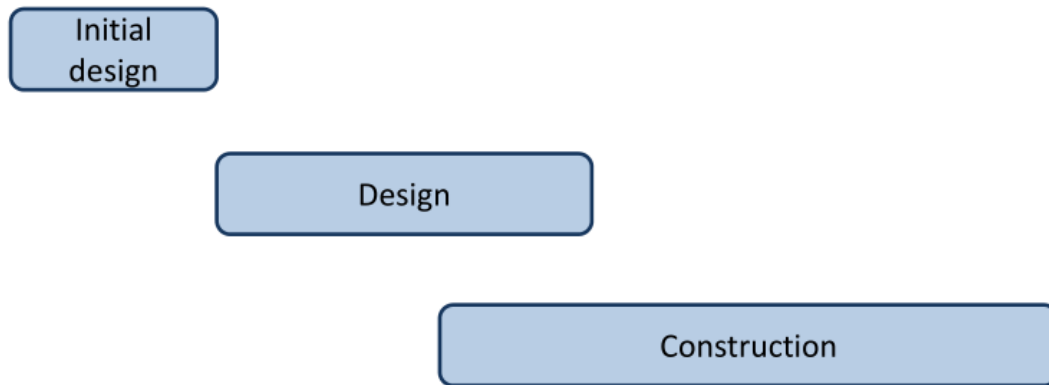
- Sequential (no overlap)
- Design are not always cost-effective
- Change order and claims from contractors to compensate their lowest price bid
- Adversarial relationships rather than cooperation or coordination among parties
- Lack of constructability analysis during design
- Least-cost approach by contractor
- Responsibility of defects

Design-Build Method

- Could be joint venture
- Could be a contractor with a designer as a sub-consultant
- Could be designer-led team with a contractor as a subcontracted entity
- Could be a single firm capable of performing both design and construction



Timeline



Selection

- Two steps
 - **Request for Qualification (RFQ)** – establish a short list
 - **Request for Proposals (RFP)** – contact shortlisted firms, requesting cost information and a technical proposal which defines the project scope along with the firms' innovations, schedule and details that define the quality of the delivered project

Compensation

- Fixed-fee contract for design and pre-construction costs and an agreed General Conditions costs and construction fee given as a percentage of total construction costs
- **Guaranteed Maximum Price (GMP)** after progress in design

Advantages

- Single point of accountability for design and construction
- Fast-track
- Better constructability
- Cost effective
- Change orders from owner side

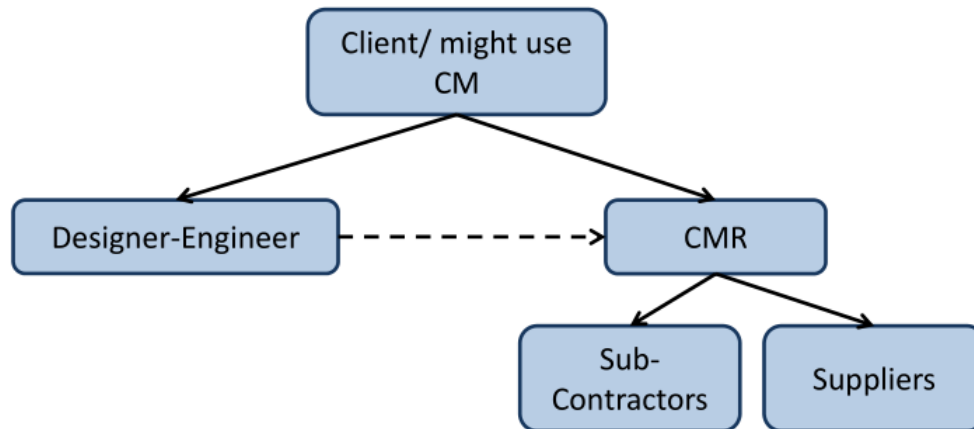
Disadvantages

- Less design control and involvement by the owner
- Owner must be highly responsive in its decision making
- May be problematic when there is a requirement for multiple agency design approvals
- Not suitable for complicated projects

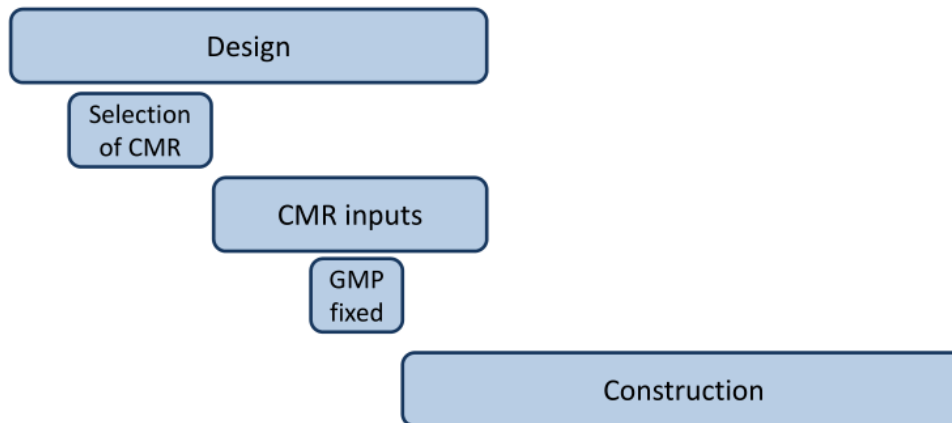
Design-build vs. Turnkey

- In some design-build instances, the contractor may also agree to be responsible for acquiring land, financing the project, and commencing projects operation
- More comprehensive arrangement is usually referred to as 'turnkey'
- Turnkey is most applied for industrial projects
- Usually not bound by traditional public sector procurement regulations
- Turnkey typically has more responsibility than design-build

Construction management at risk (CMAR)



Timeline



Selection

- One step
 - Request for proposals (RFP) for qualifications of the team, along with price proposals for pre-construction costs, general conditions costs, and construction fee as a percentage
- Two step
 - Request for Qualifications (RFQ) to establish shortlist
 - Request for Proposals (RFP) among shortlist for cost information

Compensation

- Fixed-fee contract for pre-construction and general conditions costs, along with an agreed contractor's markup fee as a percentage of construction costs
- Guaranteed Maximum Price (GMP) after design progressed enough

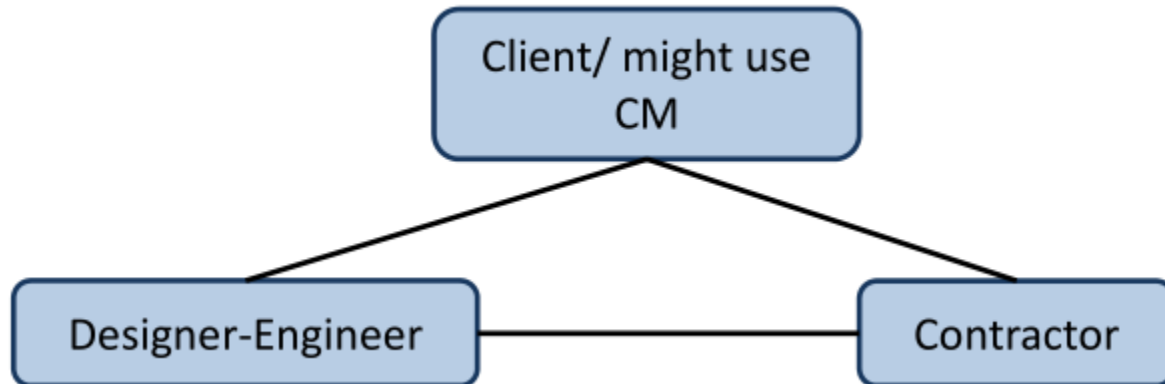
Advantages

- Inputs of contractor into design and planning
- Fast-track

Disadvantages

- Dispute and adversarial relationships after GMP is fixed
- Construction quality, the completeness of the design after GMP (guaranteed maximum price)
- Premium is placed on the proper selection of the CMR (construction manager at risk)

Integrated project delivery (IPD)



Traditional communication – all over the place, everyone talks to everyone

Integrated communication – everyone communicated to a central system

Advantages

- Input from contractors and suppliers into design
- Fast-track
- Better constructability
- Cost effective
- Entire teams interests are aligned with the project goals making the chance of success high

Disadvantages

- Lack of industry experience in such collaboration
- Lack of law and regulations
- Objective selection of the team is very difficult
- Actual agreement on the criteria and the final IPD contract can be very difficult
- Cost vs. objective

What methods are used in the 'vertical construction market'

- 60% - Design-Bid-Build (DBB)
- 25% - CM at Risk (CMAR)
- 15% - Design-Build (DB)
- <1% - Integrated Project Delivery (IPD)

What methods are used in the 'horizontal infrastructure market'

- Major method – Design-Bid-Build (DBB)
- Mostly PPP Projects – Design-Build (DB)
- Rare – CM at Risk (CMAR)

Final notes about project delivery methods

- No single solution for every project
- Considerations
 - Project type and size
 - Project uncertainties
 - Risk transfer
 - Level of owner's control and involvement
 - Time constraints
 - Owner's resources and capabilities
 - Local market knowledge
 - Legislative and regulatory requirements
- Transfer the risk to an entity who can handle it