

Construction Contract:

Risk management

EPCC Contract Management

beyond law...we innovate solutions

belden

Can We Ignore Risk ?

- Construction is a risky business
- Why wait till the risk occurs?
- Knowing the objectives of risk management

Risk Recognition

Dr. Julian Critchlow

“It has been said that the only major construction project to finish on time and to budget was a church, where presumably, divine intervention played a role.”

Objectives of Risk Management

- Can all the potential Risk be identified?
- Can the different identified risk be measured in order to assess the likelihood of its occurrence?
- Can the likely to occur or possibly could occur (foreseeable) be assessed as to its likely impact on finances & time?
- Can all the very serious, just serious and moderate Risk thus be identified?
- Can the Risk and its impact be financed?

Objectives of Risk Management

- Can the Risk and its impact be transferred to a 3rd party such as insurers? Is it financially viable?
- Who is best to be made responsible for the Risk?
- Can the Risk be avoided?

Objectives of Risk Management

- Can the Risk be avoided by contract terms?
- Can the Risk be avoided pre-occurrence?
- Can the Risk be avoided by the party responsible or together with all parties?

Objectives of Risk Management

- Can the Risk be controlled & managed when it occurs?
- Can it be controlled/managed by processes set up in the contract?
- Can it be controlled/managed pre-occurrence?

Objectives of Risk Management

- Can the Risk be controlled/managed once occurred?
- Can the impact of the Risk be mitigated?
- Can the impact be mitigated by processes set up in the contract?

Objectives of Risk Management

- Can the impact be mitigated by processes set up pre-occurrence?
- Can the impact be mitigated by processes used once occurred?
- Are there methods to establish the cause and effect and cause to effect of the Risk?
- Are there encouraged dispute resolution forums that allows rapid resolution?

RISK ANALYSIS & EVALUATION

- Risk: any impact on time, money, productivity, production, controls or quality
- Risk: Generic and Project Specific
- Risk Probability & Impact Assessments

- Risk Management
 - Risk Avoidance
 - Risk Allocation
 - Risk Mitigation
 - Risk Control / Management

Risk Management Activities

- **Risk Allocations**
 - Risk transfer: allocating risk to contractor or insurance
 - Risk assumption: accepting and controlling the risk
- **Risk Mitigation**
 - Risk Reduction Plans: through contractual provisions
 - Risk Deterrence: through contractual provisions on compensation/termination

Risk Management Activities

- **Risk Control Management**
 - Risk Monitoring, Early Warning, Brain-Storming, Mitigation Implementation & Financial Impact Controls
- **Risk resolution**
 - Effective Dispute Resolution Systems

Identifying the Risk

- Where to begin ?
- Allocated Risk
 - For Developer:
 - From Financier, Authorities, Market Forces, Government, Consultants & Design
 - For Contractor:
 - From Tender Documents, Financing & Market Forces
- Standard form conditions of contract - Its tried & tested
- Eg. PAM, IEM, ICE, JKR, CIDB, FIDIC, JCT, ICE, IMechE, IEE, IChemE, AIA, Bespoke Form [Putrajaya, KLCC, KLSSB, KLIA, Petronas]

Identifying the Risk

A Combination of

- Physical Sciences
- Design & Engineering Sciences
- Finance & Economics
- Statistics
- Human Behaviour

Identifying the Risk

- Research literature on risks faced in projects
- Tap senior personnel's experience
- Company's Past Experience
- Company's Operational & Management Ability
- Company's Social Culture
- See Examples on risk allocations to contractor, owner & to be shared

(See Addendum 1)

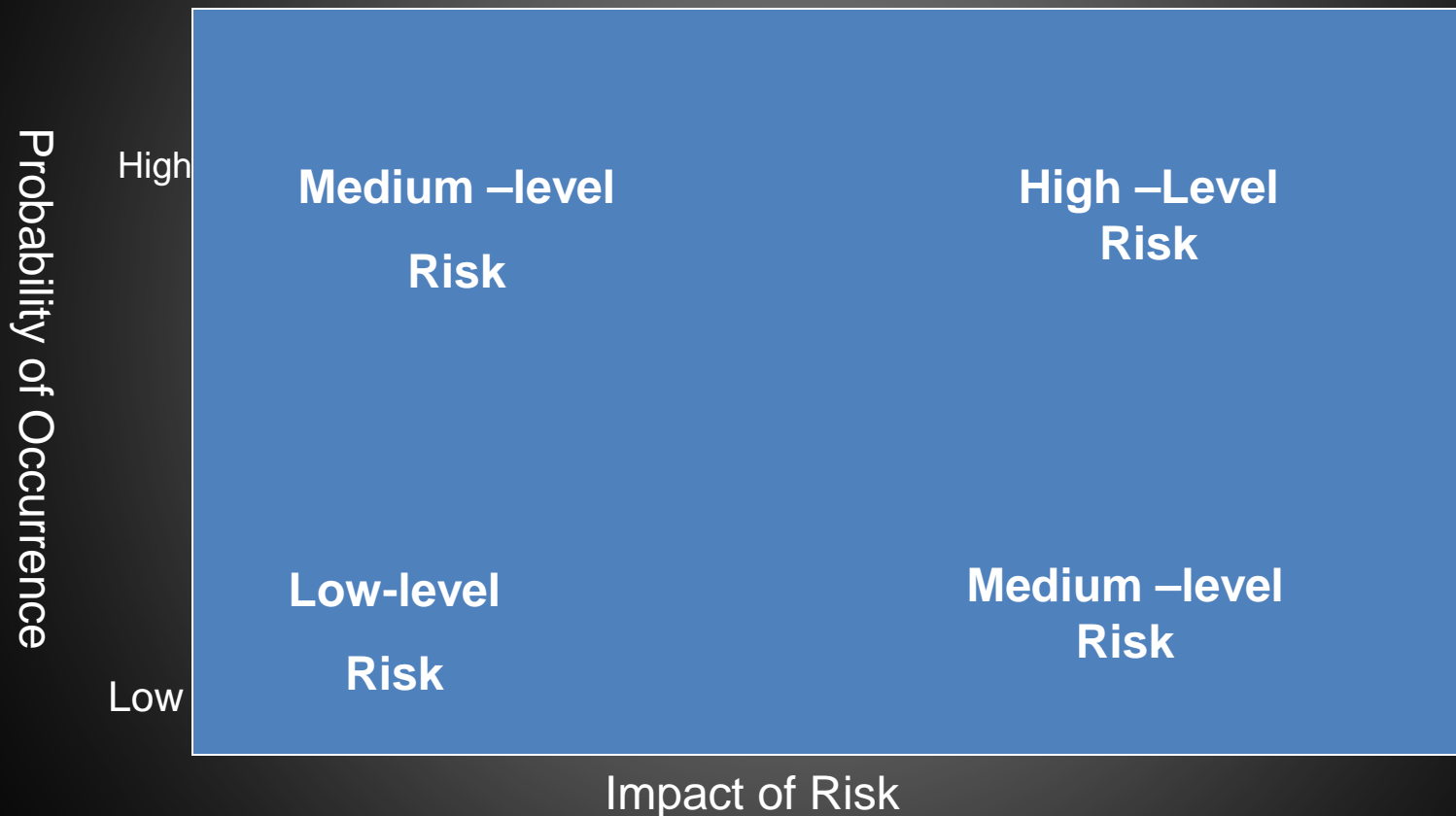
SIZE OF RISK – IMPACT GUIDE

| <u>Severity</u> | <u>Possible Consequences</u> | <u>Examples</u> |
|--|--|-----------------|
| Insignificant | No impact | |
| Minor Negative outcomes from loss or lost opportunities unlikely permanent or significant effect on reputation or performance | <ul style="list-style-type: none"> •Less Than 0.5% of total turnover financial impact • No regulatory consequence •Minor adverse publicity •Minor reversible injury | |
| Moderate Negative outcomes from risks or lost opportunities with significant impact on the co but can be managed without major impact in the medium term | <ul style="list-style-type: none"> •Financial loss up t 2 % of total turnover in any year •Limited regulatory response •Local adverse publicity •Major reversible injury | |

SIZE OF RISK – IMPACT GUIDE

| <u>Severity</u> | <u>Possible Consequences</u> | <u>Examples</u> |
|--|---|-----------------|
| <p>Serious</p> <p>Negative outcomes from risks or lost opportunities with significant effect requiring major effort to manage and resolve in the medium term but do not threaten existence of institution in the medium term.</p> | <ul style="list-style-type: none"> •Financial loss over 2 % of total turnover in 1 year Major savings programme required to break even in the medium term •Significant regulatory consequence •Negatives national press •Irreversible injury or death | |
| <p>Very Serious</p> <p>Negative outcomes from risks or lost opportunity if not resolved in medium term will threaten the existence of the institution</p> | <ul style="list-style-type: none"> •Financial loss or loss of potential financial surplus over 2 % of turnover for consecutive years •Substantial regulatory consequences •Sustained negative national press •Major sanctions •Closure of major part of business •Irreversible multiple injury or death | |

Risk Impact / Probability Chart



Risk Allocation

- Recognize the risks before it is too late
- For TNB as Owner - when the ink on the invitation to tender has dried
- For TNB as Contractor – when the ink on the bid document has dried

Contract Risk Allocations Traditionally

- Decide the overriding objective -time, cost or both?
- Identify the potential risks
- Decide who bears what
- Ensure the contract conditions correctly reflect who bears the risk

Risk Allocation

Proper Considerations

- Contractor > risk, tender price will escalate
- If tender price stays the same:
 - Contractor's ability/integrity in doubt
 - contractor may go bust
 - delays, claims & problems at the site
 - project & the owner pay the price eventually

Risk Allocation

A Fair Ethos

- Retain risk where you can
- Share the risk where it is fair / outside both parties' control
- Transfer the risk to 3rd parties if possible (insurance & NSc)

Risk Allocation

Which Risks to Retain

- Identify weakness & strength on each risk
- If strength > weakness
- If capable of controlling/shouldering risk
- “Least cost” risk bearer
- Objectives attract certain risks
- Motivation towards managing the risks

Risk Allocation

The Foreseeability Model

Risks To Contractor:

- Knowns
- Known-Unknowns which are Reasonably Foreseeable

Risks to Owner

- Known-Unknowns which are Remotely Foreseeable
- Some Unknown-Unknowns

Risk Allocation

Not a Perfect Science

- Language ambiguities
- Contra proferentum
- Conduct
 - Waiver
 - Estoppel principles
 - Good faith/reasonableness?

Risk Management During Project

- Develop Risk-Conscious Culture
- Identify the risk event when it happens
- Engage preventive & corrective action plans
- Use system that gauges effect of the risk
- Attempt amicable resolution

Risk Allocations

Sir Michael Latham

“no construction project is free of risk. Risk can be managed, minimized, shared, transferred or accepted. It cannot be ignored.”

Risk Management

Setting Up the System

- Do it now
- Survey – Saves up to 5% of your cost exposure
- Risk management culture must permeate from contract planning to contract estimating to contract management to contract close out
- See Surveys (Addendum 2)

Setting Up the System

- Form a task force
- Get data on frequency & severity of risks - site conditions, comparative studies of previous projects
- Prioritize risks based on your weaknesses

Setting Up the System

- Train project personnel on contract administration & familiarization
- Maintain same personnel from negotiation to construction
- Use a checklist (see Addendum 3)

Risk Management Steps

- Review contract against checklist before tender
- Soil investigation-disclose or have serious tenderers carry out their own
- Carry out constructability reviews to ensure design is cost-efficient

Risk Management Steps

- Utilize real-time dispute resolution procedures
- Establish realistic contract performance period

Risk Management Steps

- Budget for contingencies
- Use partnering concept
- Pre-plan for permits & approvals
- Soil & site conditions risk is best undertaken by owner
- Delegate decision making to owner's representative

Risk Management Steps

- Allow formula-based adjustments of value for variations
- Ensure procedures for claims are strictly adhered to - do not waive!
- Seek advice on new risk-sharing practices

Contractor's Risk Analysis

- Create a checklist on the various Risk that have been allocated and those that cannot be negotiated out or transferred to reliable 3rd parties (ie. equipment suppliers etc)
- Consider the causes/weaknesses that lead to each Risk
- Consider the likely effect of the Risk (time & money etc)

Contractor's Risk Analysis

- Determine the preventive methods intended to be employed and the likely outcome
- Determine the corrective strategies if the Risk occurs
- Determine the Risk Handling strategies during the Project
- Determine the Mitigation Approaches that could be employed

Contractor's Risk Analysis

- Use Risk Analysis Software to determine the probability of the occurrence of the risk and its financial & time impacts on the Project
 - *Primavera Monte Carlo, Pertmaster Project Risk/Risk Expert, Intaver Risky Project, Palisade @ Risk for Project, Projistic etc*
- Premised on the Impact Probability Analysis, determine the pricing contingencies to be adopted in a lump sum price
- See Checklist in Addendum 4

Contractor's Risk Analysis



What is Partnering?

- A commitment to maintain cost-efficiency
- Allows win-win situation by sharing cost savings
- A collaborative approach
- Mutual objectives are agreed, constant teamwork & good faith procedures are encouraged

What is Partnering?

- Senior management & site management committed to “Partnering Charter”
- Partnering Charter becomes part of contract
- Open communications & trouble-shooting are worked upon by both parties
- Tries to maintain the same site team throughout the project
- See Example of Partnering Charter (Addendum 5)



EPC CONTRACTING STRUCTURE

BALANCE OF RISKS

Owners / Sponsors

Contractors

[-----Construction Management-----]

[-----Management Contract-----]

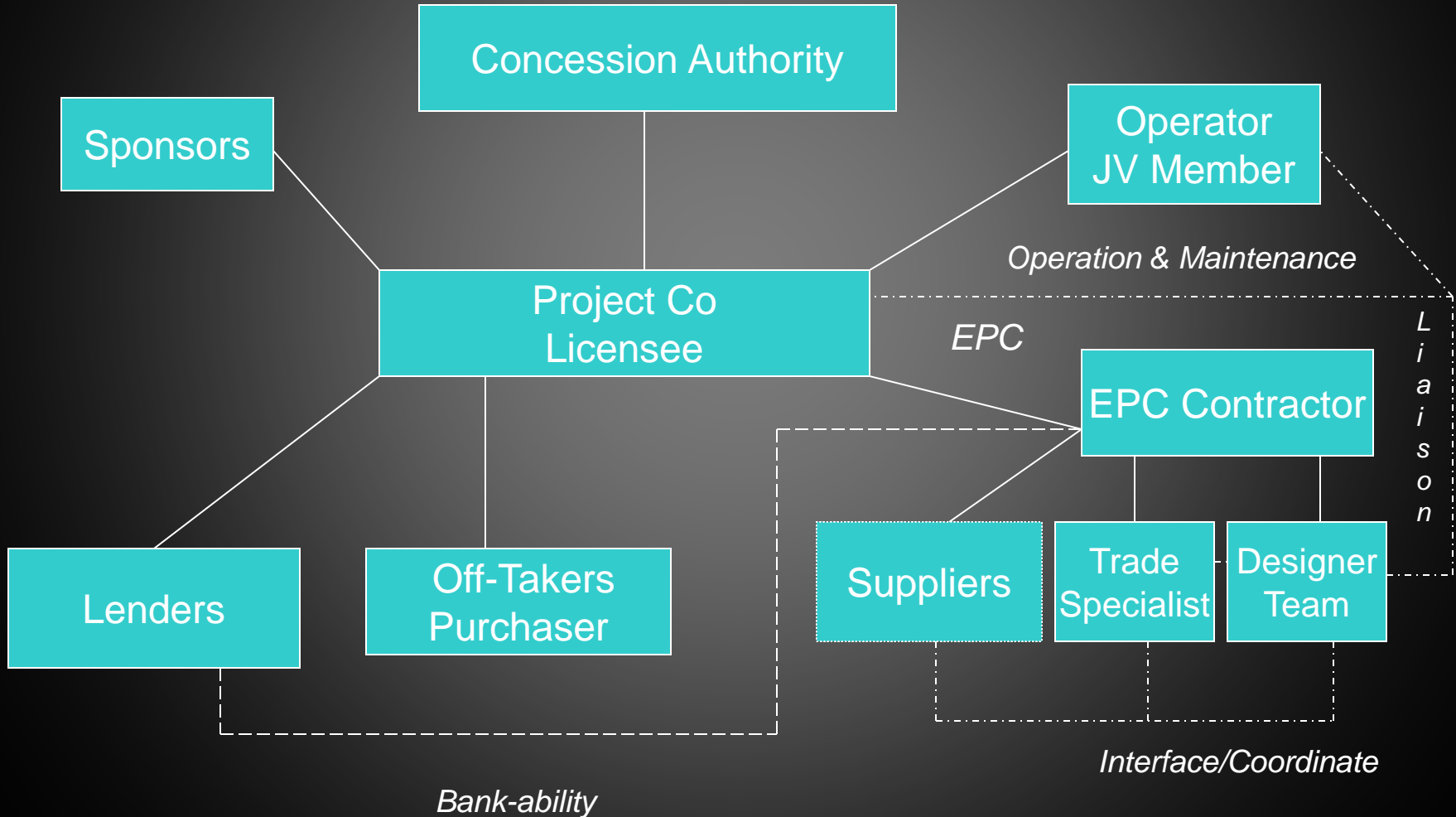
[-----Design, Bid, Build-----]

[-----Prime Contracting-----]

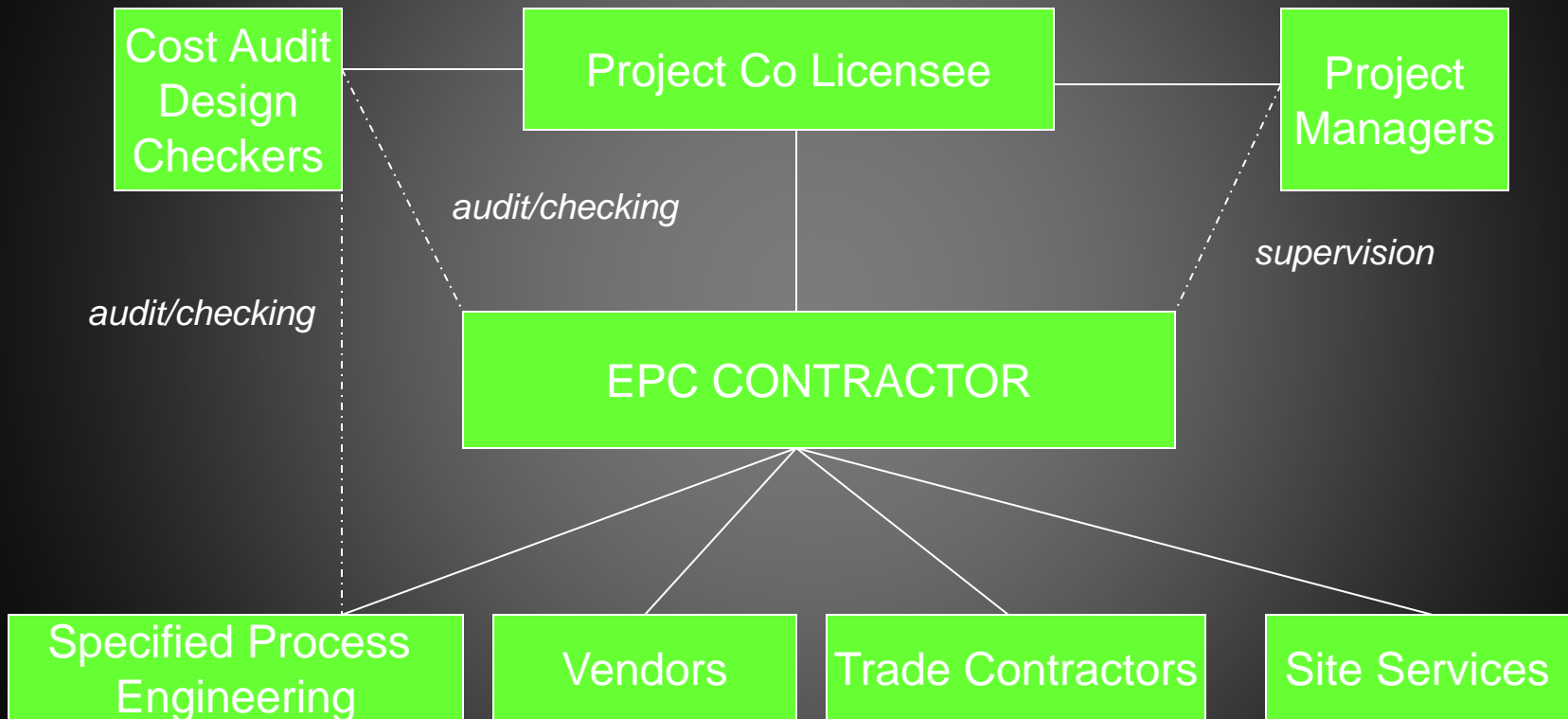
[-----Design & Build-----]

[-----EPC-----]

EPC Stakeholders

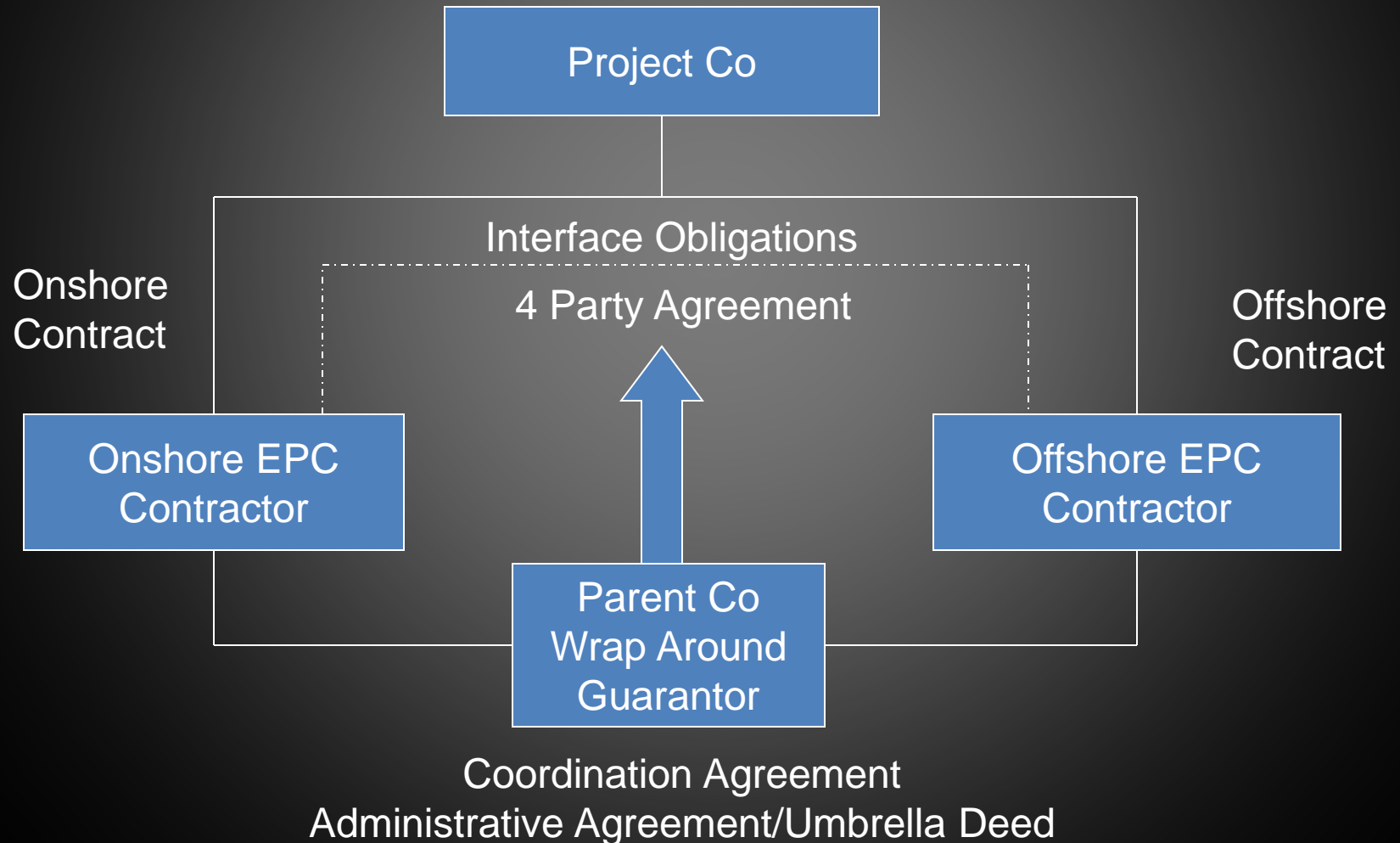


EPC Arrangements



Split EPC

Offshore Avoids Host Country Restrictions



Split EPC

Wrap Around Guarantee

- No Horizontal Defence
- Total Performance/Fit for Purpose
- Obligation to Interface & Integrate
- LAD borne for both split contractors regardless of which one is to be blamed
- Performance Bond from Parent Co for both split contractors

Split EPC

Wrap Around Guarantee

- Liability duration as long as possible and at least till expiry of defects liability period
- Termination of one split contractor auto terminates the other
- Indemnity on taxes due to split
- Parent Co dispute resolution same as split contractor (joint liability and concurrent mediation, adjudication or arbitration provisions)

Project Co

Project Implementation Risk

- **Project Team – the Personnel**
 - retention of the appropriate personnel from the Feasibility Team/Tender Team
 - awareness of time constraints, funds and resource requirements
 - competent, productive & efficient personnel : middle management
 - experience > qualification, training & education
 - exposure to global standards & new innovative management methods
 - use work teams : positive synergy through coordinated efforts

- **Project Team – the Personnel**
 - allow freedom & autonomy, utilise different skills & talents, allow completion of whole & identifiable & important / critical task, have the right personalities & size of team, provide adequate resources and leadership, have the appropriate performance evaluation and create team goals & efficacy

Project Implementation Risk

- motivation : financial, security of tenure, reputation
- simplify lines of communication
- encourage Contractor to appoint the technical consultants utilized in the Feasibility Team/ novate their appointment due to local know-how and prior involvement and knowledge

- Design Consultants & Team
- QA/QC on Design
- Fast Track Design
- Design Defects
- Design Failures
- Patent & Latent Defects or Failures

Design Risk Avoidance/Mitigation

- Conceptual Design & Design Review Phases
- Design Coordination with Specialist & Sub-Contractors
- Design Consultation with Project Co
- Design Checks

Design Risk

Avoidance/Mitigation

- Design Failure Warning Requirement to Sub-Contractors
- Design Liability Insurance
 - Extent of Cover
 - Unlimited Time Based Liability
 - Choice of Law where Long Stop Limitation Applies

Design Risk Avoidance/Mitigation

- Technology :
 - Conceptual & Front-end Design Simulations/Visualization/Animations
 - Reference Plant Design & Modular Construction
 - Techno-Economic Studies
 - International Frontier Studies & Experience
 - Process Engineering & Detailed Engineering Software & Tools

Design Risk

Avoidance/Mitigation

- Distribute the Risk
 - Specialist Designers for Particular Equipment or Engineering Process,
 - Equipment Manufacturers
 - Value Engineering
 - Interface/Integrate Assistance
 - Indemnity
 - Guarantee/Warranty – Transfer to Project Co
- Project Co Nominated or Supplied Equipment – Limit on Liability, Undertakings & Indemnity

Value Engineering From Specialist Work Methods

- Value Engineering
 - Avoiding Environmental Impacts
 - Integration between Systems
 - Pipeline Upheaval Buckling
 - Deepwater Riser Interference
 - Fluid & Smoke Patterns
 - Handling of Certain Material etc

Value Engineering From Specialist Life-Span/Production Output

- Value Engineering
 - Transmission
 - Surge Calculations
 - Corrosion Analysis
 - Hydraulic Modeling
 - Prevention of Crude Solidification
 - Prevention of Hydrate Formation & Hydrogen Induced Cracking
 - Optimum pipeline alignment
 - Seaweed Mattresses: Stabilization of Subsea Spans etc

Project Planning and Development

1. Internal Factors

- Infrastructure
- Utilities
- Project Scope
- Site Preparation
- Labour Relations
- Project Leadership
- Organizational Goal
- Management Approach
- Technical Manpower Supply
- Resource and Capital Availability
- Project Planning

2. External Factors

- Public & Safety Needs
- Market Needs
- National Goals
- Industry stability
- State of Technology
- Industrial competitors
- Government regulations
- Suppliers
- Labour Contractors
- Skilled Workers
- Logistics

Preventing Procurement Risk

Pre-Commencement :-

- Is the Company Procurement ISO Standards in place & modified to suit the situation & Host Country policies?
- Have the Procurement Department processes and procedures been developed and ready for:-
 - Bid Preparation & Issue
 - Bid Evaluation & Issue
 - Purchasing & Contract Negotiations
 - Receiving, Quality Control & Inspections (Factory & Site)

- Expediting
- Tracking
- Document Control
- Shipping
- Rejection & Re-supply
- Cost Management

Pre-Commencement:-

- Are the Procurement Team personnel hired, briefed, and in place?
- Is there a cost effective & economic plan for the procurement, logistics, utilisation of field based warehouse facilities and lay-down areas, in place?

Preventing Procurement Risk

- Have the procurement plans identified the key equipment, materials and service provider or supplier contract required?
- Have the lead times for orders & purchases and delivery been coordinated with the CPM program?
- Have all the technical equipment suppliers been confirmed as to the delivery time frames required?

Pre-Commencement:-

- Have the key equipment vendor's value engineering & designs been confirmed and agreed or is it sufficiently developed that it is likely to be finalized and ready for delivery by the required dates?
- Are the local vendors able to deliver the quality and quantity of materials & equipment required?

Preventing Procurement Risk

- Is there a need to source other potential vendors & suppliers?
- Are there alternative suppliers who can be used in event of delay or lack of supply?
- Are all vendors & suppliers informed of the material rejection & re-supply procedures & processes?

Preventing Procurement Risk

On-Project:-

- Ensure compliance with pre-commencement plans but flexibility to alter & modify to suit situation
- Monitor & Improve on-going services of vendors on cost, quality & delivery
- Coordinate & optimize the tender, evaluation, negotiation & awarding processes

Preventing Procurement Risk

- Close liaison with all vendors & technical equipment suppliers on performance & payments
- Monitor procurement and logistics process for time and cost optimization
- Optimize the QA/QC equipment and material inspection processes
- Expedite all required and outstanding purchase service orders

Preventing Procurement Risk

On-Project :-

- Make available all procurement tracking information with construction & fabrication departments for coordination
- Flexible & quick lines of communication
- Liaison with alternate vendors or service suppliers as a contingency strategy
- Monitor and optimize inventory carrying cost

Preventing Procurement Risk

- Monitor and zero optimize material and component obsolesces
- Beware of consumables, wastage & on-shelf expiry
- Constant reporting from middle management to top management
- Internal Procurement Group Audits

Construction Risks

Plan the Work > Work the Plan

Pre-Commencement

- Have all the necessary licenses /permits been procured?
-onus on Project Co or Contractor?
- Are there any site access issues or encumbrances or obstruction?
- Are all the infrastructure and utilities arranged for the site?
- Are all Authority requirements for fabrication & erection in place?

Construction Risks

Plan the Work > Work the Plan

- Is the detailed CPM program/schedule and manpower schedules finalized and ready?
- Are all or the CP design construction or erection drawings (isometrics etc) available?

Construction Risks

Plan the Work > Work the Plan

Pre-Commencement – Construction

- Are the lay-down yards & fabricators yards sufficient and ready?
- Are all the CP sub-contractors awarded and ready for commencement and to perform based on the CPM program?
- Have the labour sub-contractors sourced the required manpower & skilled manpower based on the planned manpower schedule?
- Are all the required supervisory & QA/QC management staff appointed or arranged for secondment at the required periods?

Construction Risks

- Fast Track Planning – Is it Possible?
- Are drawings developed and prepared and issued ahead of schedule of each area or item of work?
- Are the drawings coordinated?
- Are coordination meetings being held periodically and whenever required?

Construction Risks

- Is there an adequate CM Team?
- Are there adequate & constant supervision & QA/QC inspection?
- When defective work is detected, is there an immediate action requiring the performance of corrective works?

Construction Risks

- Is there a general availability & adequacy of manpower for the differing works within the localized area or the host country?
- Are adequate skilled workers available within the localized area or the host country such as specialist fabricators, welders, erectors, machinist, engineers etc?

Construction Risks

- What steps have been taken to source and obtain foreign skilled or unskilled manpower and have their work permit issues with the Host Country Government been handled and resolved
- What specialized training is offered to workers for special areas of work and how are these workers learning curves been gauged?

Construction Risks

- What is done to maintain the trained & experienced Workers?
- Safety Induction Courses, Tool Box Meetings, Active Safety Officers, Incentive & Disincentive Schemes, Whistle-Blower to Middle Management Encouragement
- Scheduling & Re-scheduling all Aspect of Works
- Coordinated Scheduling of various Works
- Time, Access & Integration Coordination between sub-contractors

Construction Risks

- Time Coordination between suppliers, fabricators & sub-contractors
- Availability & Access within and between the lay-down, fabrication and installation areas
- Mitigation & Problem Solving Meetings
- Shop drawing monitoring

- Use of Management Software
- Use of Integrated Solutions Software
- Use of Management Services
- Pre-Commencement Management Training for Pertinent Personnel
- On-Job Training of Personnel
- On-Job Audit & Improvement Solutions

- Logistic
 - Landlocked Host Country
 - Port Charges & Clearance
 - Transportation Availability for Specialized Equipment
 - Infrastructure for Transportation
 - Cost of Overcoming Logistical Problems

- Project Site Planning & Execution
- Procurement Tracking
- Fabrication Monitoring and Tracking
- Construction and resource scheduling

- Payment in agreed Currency
 - Currency Exchange Fluctuations,
 - Currency Devaluations
 - Currency Inconvertibility
- Mile Stone/Scheduled Payments & Cash-Flow
- Advance Payments, Security & Recovery

On-Job Financial & Economic Risk

- Front Loading & Rationalization of Mile Stones/Scheduled Payments
- Recognition, Valuation & Payment for Variations
- Offshore Payment Security and Accounts
- Payments for Cost Overruns
- Withholding Tax

Testing & Commissioning Risk

- Timing To Mirror Timing of Other Supply Related Systems & Off-take Agreements
- Permanent Utilities
- Supply & Storage of Raw Produce for Testing
- Testing (singular, joint & with authorities)
 - Commissioning Test : Mechanical Completion,
 - Functional Test, Emission Test, Performance Test : Substantial Completion
 - Project Co Supplied Equipment Testing

Testing & Commissioning Risk

- EPCC Obligations
 - Permanent Supply of Raw Produce for Total Commissioning
 - Final & Total Commissioning EPC Project
 - Integrated Commissioning
- Warranties

Testing & Commissioning Risk

Permanent Utilities

- Seek Design & Construction Approvals Early
- Facilities to be Constructed Much Earlier
 - especially electrical sub-stations
- Requirements of Utility Authority/Co
 - Understood Clearly
 - Fulfilled Early
- Financial Contributions Settled Early
- Constant Liaison Using Appropriate Personnel
- Access & Facilitate Connections & Energisation

Testing Risk

Supply & Storage of Raw Produce

- Project Co Should Retain Risk
- Require Ample Lead Time Notification from Contractor
- Require Contractor to Specify Period & Quantity of Supply
- If from other Existing Facilities, make early arrangements
- If from Other New Integrated Facility:-
 - Coordinated Scheduling
 - Back to Back Indemnities for Delay
- Arrangements : Supply Vessels/Pipeline

Testing Risk

Supply & Storage of Raw Produce

- If Not Possible, Convert to Post Completion Obligation as Contingency
 - Contingency Price Agreed for De-mob & Re-mob
- If Inadequate Supply, Deemed Tested or Contingency for Re-Testing Post Completion
- If Testing Fails, Re-Supply Time & Cost at Contractor's Risk
- Environmental Testing & Liaison with Authorities
- Tolerance Levels & Local or International Standards for Testing (including updated & changed standards)
- Stand-by rates

Operating Related Risks

- **Contractor's Risks**
 - delivery, testing & commissioning
 - meeting performance criteria
 - as-built drawings
 - operations & maintenance manuals
 - testing & commissioning certifications
 - engineering & equipment warranties
 - defects liability
 - latent defects

Operating Related Risks

- **Project Co's risks**
 - final payments
 - release of retention sums
 - rectify defects using others
 - integration & operating delays
 - defects or lack of productivity in Project Co supplied equipment
 - defects or lack of productivity in Project Co nominated equipment?

Output Performance Risk Mitigation

- Output Performance Guarantee
- LAD for failure on Output & Efficiency
- Defects Liability Period
- Retention Sums or Bond