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Driving Success in Projects EPC Contracting

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Abstract

Purpose: To explain how EPC project owners can align front-end development, contracting strategy, procurement discipline, execution monitoring, cost optimization, and claims prevention into a single governance framework.

Methodology: Analysis of the EPC lifecycle and the use of the Kashagan project as a case study to illustrate the impact of technical complexity, immature risk planning, and execution failures.

Findings: EPC success is determined early in the process specifically through mature FEED, fit-for-purpose risk allocation, robust bidder pre-qualification, adequate tendering time, and disciplined clarification processes.

Unique Contribution to Theory, Practice and Policy: Project owners should strengthen EPC outcomes by ensuring mature scope definition, selecting contract models based on risk, implementing continuous contractor performance evaluations, and utilizing stronger contract terms to safeguard against claims.

Keywords: Projects, Contracting

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INTRODUCTION

EPC contracting is one of the most widely used delivery approaches for capital-intensive projects in the oil and gas, energy, petrochemical, infrastructure, and industrial sectors. Under a standard EPC arrangement, the contractor typically assumes responsibility for engineering, procurement, and construction, while the owner defines the business need, performance objectives, and administration framework. However, the success of this model is frequently undermined by "Owner-Contractor Risk Asymmetry"—the systemic phenomenon where owners attempt to transfer undefined or immature risks to the contractor. When this asymmetry is ignored, it leads to inflated bid pricing, adversarial relationships, and aggressive claims behavior, often culminating in megaproject failure.

To mitigate this asymmetry, owner-side preparation must align with recognized EPC/turnkey principles and structured front-end planning, ensuring a disciplined transition from project definition to executional reality.

EPC success requires a chain of disciplined decisions: selecting the right contract strategy, procuring the right contractor, managing execution risks early, and optimizing costs without compromising scope quality. Each of these decisions depends on the maturity of the project scope and the owner's ability to quantify uncertainty before transferring risk to the market.

This paper serves as a technical narrative suitable for executive review, project governance discussions, or conference publication. It is organized around the core EPC lifecycle: project development, strategy selection, procurement, execution, monitoring, cost control, and claims management.

Project Development Phases and the EPC Interface

A successful EPC project begins before the EPC contract is signed. The project development lifecycle normally progresses from proposal and FEED into detailed design, procurement, construction and operation. The EPC phase is positioned at the point where the owner seeks to convert a sufficiently defined project concept into an executable contract. If the project enters EPC with unresolved scope, poor constructability assumptions or incomplete technical requirements, the contract may appear commercially transferred but remain operationally exposed. This aligns with front-end planning guidance, which treats early scope definition, execution planning and risk identification as key drivers of downstream project success (CII, n.d.).

Table 1: EPC Success Begins with Project Development Discipline and Clear Phase Gates

Phase	Primary Purpose	Relevance to EPC Success
Project Proposal / FEED	Defines business objectives, scope boundaries, process requirements, site constraints, major equipment philosophy and preliminary cost/schedule basis.	Establishes the technical and commercial basis for tendering and risk allocation.
Detailed Design	Transforms FEED into approved-for-construction design and detailed engineering deliverables.	Determines the contractor's ability to procure, fabricate and construct without ambiguity.
Procurement	Sources long-lead equipment, bulk materials and specialized services.	Affects schedule criticality, cost certainty and interface risk.
Construction	Executes site works, fabrication, installation, testing, commissioning support and handover.	Converts the contract scope into physical completion while managing safety, quality and productivity.
Commissioning	Receives the facility and verifies that performance and reliability objectives are met.	Tests whether EPC deliverables achieved the owner's business case and lifecycle objectives.

Strategy Selection for EPC Contracting

Contract strategy selection should be treated as a risk-based decision rather than a default procurement preference. There are eight owner-side factors that influence the appropriate EPC strategy: schedule criticality, project location, brownfield extent, cost, contractor availability, project management team resources, scope complexity and scope maturity. Together, these factors determine whether risk should be transferred to the contractor, shared between parties or retained by the owner. This approach is consistent with ISO 31000 risk-management principles, which require risks to be identified, analyzed, evaluated, treated, monitored and communicated through the decision process (ISO, 2018).

When scope is mature, site conditions are well understood and competent contractors are available, a fixed-price EPC approach can provide strong cost and schedule discipline. However, when scope uncertainty, brownfield interface risk or market limitations are high, excessive risk transfer may generate inflated bids, aggressive claims behavior or execution instability. The optimum strategy is therefore not necessarily the most rigid contract form; it is the model that best aligns risk ownership with the party that can manage that risk most effectively.

Table 2: Key Success Factors for EPC Strategy Selection

Selection Factor	Meaning	Implication for Contract Strategy
Schedule criticality	Urgency of completion, revenue start-up dates or regulatory deadlines.	High schedule criticality may justify packaging, long-lead procurement, early works or incentive mechanisms.
Project location	Remote, offshore, congested, politically sensitive or logistically difficult sites.	Location risk affects contractor pricing, labor access, logistics plans and contingency requirements.
Brownfield extent	Degree of interface with existing operating facilities.	Higher brownfield content usually increases unknowns, shutdown dependency, safety interfaces and claims exposure.
Cost	Capital budget, market pricing, escalation risk and owner affordability.	Cost pressure should not drive premature risk transfer when scope is immature.
Contractor availability	Number and capability of qualified EPC contractors.	Limited competition may require alternative packaging or commercial models.
PMT resources	Owner project management team depth and technical capability.	Lower owner capacity may favor clearer single-point accountability; higher capacity may support EPCm or multi-package strategies.
Scope complexity	Technical novelty, integration difficulty and specialist technology content.	Complex scope may require stronger FEED, specialist prequalification and collaborative execution.
Scope maturity	Completeness and reliability of design, quantities, specifications and interfaces.	Low maturity is the strongest warning against aggressive fixed-price contracting.

EPC Contracting Models and Risk Allocation

The paper compares several EPC contract strategies along a risk-allocation spectrum. These include lump-sum turnkey, lump-sum procured build, convertible lump-sum turnkey, EPCm and cost-reimbursable arrangements. The main difference between these models is not only price form; it is the distribution of engineering, procurement, construction and management responsibility between the contractor and the owner. Standard

EPC/turnkey forms such as the FIDIC Silver Book reinforce the importance of clear allocation of design responsibility, performance obligations, securities, claims procedures and dispute avoidance/settlement mechanisms (FIDIC, 2017/2022).

Table 3: EPC Contracting Models and Typical Risk Positions

Model	Pricing Basis	Typical Scope Emphasis	Risk Position	Best-Fit Conditions
LSTK / EPC	Fixed price	Engineering, procurement and construction	Mostly contractor	Mature FEED, clear scope, stable site conditions and strong market competition.
LSPB / PC	Fixed price	Procurement and construction emphasis	Mostly contractor	Cases where engineering basis is already substantially complete or owner controls engineering separately.
CLSTK	Hybrid pricing	Engineering to procurement/construction transition	Shared	Projects requiring early contractor involvement or conversion to lump sum after further definition.
EPCm	Hybrid pricing	Engineering/procurement plus construction management	Shared	Complex or uncertain projects where owner retains more direct control of packages and interfaces.
Cost reimbursable	Cost plus fee	Engineering or selected project services	Mostly owner	Uncertain scope, urgent work, exploratory execution or cases where pricing cannot be reliably fixed.

A fixed price contract can transfer defined risk, but it cannot eliminate undefined risk. Undefined risk usually returns to the owner through contingencies, exclusions, change orders, disputes or degraded bidder participation. Conversely, reimbursable or hybrid models can be appropriate when they allow transparent progress under uncertain conditions while protecting the owner through governance, open-book controls and milestone-based accountability.

Bidding Success Factors

Procurement is the point at which the owner tests whether the project scope, contract terms and market strategy are sufficiently mature. Four procurement success factors: mature FEED design, bidders pre-qualification, sufficient bidding period and a structured bidding question-and-answer process.

Mature FEED Design

FEED maturity is the technical foundation for EPC tendering. A mature FEED should define the required facility, scope boundaries, design basis, site data, interface responsibilities, required standards, performance guarantees and major equipment philosophy. When FEED is weak, bidders are forced to price uncertainty, and the owner faces a trade-off between inflated bids, exclusions or post-award claims. This is also consistent with AACE estimate-classification guidance, where estimate reliability is linked to the level and quality of project definition deliverables available at the time of estimate preparation (AACE International, 2020).

Bidders Pre-Qualification

Pre-qualification should address technical capability, financial strength and previous performance. Technical capability verifies whether the contractor has executed similar scope, managed comparable interfaces and delivered under similar conditions. Financial review

assesses solvency and capacity to absorb project cash-flow demands. Previous performance evaluation helps distinguish contractors with reliable delivery behaviour from those with recurring claims, delays, quality failures or subcontractor management problems.

Sufficient Bidding Period

A compressed bidding period may appear to accelerate procurement but can weaken bid quality. EPC bidders need enough time to review technical documents, develop construction methodology, obtain vendor

quotations, evaluate site constraints, price risk and prepare exceptions or alternatives. An adequate bidding period improves competitiveness because contractors can submit more confident prices rather than relying on conservative contingency.

Bidding Q&A Process

A disciplined clarification process reduces ambiguity and preserves fairness. Clarifications should be logged, answered consistently, and issued to all bidders when relevant. Owner responses should also be reviewed for commercial impact, as a technical clarification may inadvertently modify risk allocation, pricing assumptions, or schedule obligations.

Crucially, the Q&A phase serves as a final "stress test" for the project's definition. If the volume and nature of bidder queries indicate that the FEED is immature or that site conditions are too uncertain for a fixed-price commitment, the owner should pivot the contracting strategy to avoid inflated risk premiums or future claims.

Adaptive Contracting:

Target-Cost and Reimbursable Models: When the Bidding Q&A or FEED review reveals significant scope gaps, traditional Lump Sum Turnkey (LSTK) models can become counterproductive, driving contractors to "price-in" extreme contingencies or adopt adversarial claims strategies. In such scenarios, owners are increasingly adopting flexible models that align contractor incentives with project outcomes:

Target-Cost Contracts (Pain-Share/Gain-Share): In this model, a "target price" is agreed upon based on the best available data. If the final cost is lower than the target, the savings are shared between the owner and contractor (Gain-Share). If costs exceed the target, both parties share the loss (Pain-Share). This transforms the relationship from adversarial to collaborative, as both parties are financially incentivized to optimize costs and streamline execution without sacrificing quality.

Reimbursable Contracts with KPI-Linked Incentive Fees: For projects with high uncertainty or extreme urgency, cost-reimbursable arrangements (Cost-Plus) ensure that the contractor is not penalized for undefined risks, thereby preventing project stagnation. To maintain discipline, these are coupled with Performance-Based Incentives linked to Key Performance Indicators (KPIs), such as:

- **Schedule Milestones:** Bonuses for early achievement of critical path dates.
- **Safety & Quality:** Incentives for zero-LTR (Lost Time Record) or low rework rates.
- **Operational Performance:** Payments tied to the actual throughput or efficiency of the facility upon commissioning.

Execution Challenges and Risk Controls

The execution phase converts procurement decisions into project performance. The paper identifies contractor financial solvency, subcontractor competency, contract terms and conditions, and skilled labor availability as key execution challenges. These challenges are interconnected: a financially stressed contractor may delay subcontractor payments, which may affect labor availability, productivity, quality and claims behavior.

Table 4: EPC Execution Challenges and Owner-Side Controls

Challenge	Risk to EPC Execution	Owner-Side Control
Contractor financial solvency	Cash-flow stress, inability to fund mobilization, delayed supplier payments or insolvency during execution.	Financial health checks, parent-company support, performance security, payment milestone discipline and early-warning monitoring.
Subcontractor competency	Weak subcontractors, poor interface control or inability to meet quality/schedule requirements.	Approval of key subcontractors, robust qualification criteria, subcontractor performance tracking and direct interface workshops.
Contract terms and conditions	Ambiguous risk allocation, unclear payment terms, weak change management or ineffective dispute procedures.	Clear scope, responsibility matrix, strong change clauses, notice requirements and dispute escalation mechanisms.
Skilled labor availability	Shortage of qualified labor, productivity decline, rework and safety incidents.	Labor resource plans, workforce qualification requirements, mobilization tracking and productivity dashboards.

A practical execution governance framework should combine milestone reviews, risk workshops, schedule quality checks, cost trend reviews, field productivity metrics, quality surveillance and claims early-warning indicators. The owner's objective is not to micromanage the contractor, but to detect weak signals early enough to intervene contractually and commercially before the project enters a recovery mode. This monitoring logic is consistent with ISO 31000's emphasis on risk monitoring, review and communication as continuous activities rather than one-time planning exercises (ISO, 2018).

Case Study: The Kashagan Project

The Kashagan project illustrates how extreme technical conditions and execution failures can compound into major cost, schedule, environmental and economic consequences. The project involved a large offshore field in the North Caspian Sea, Kazakhstan, in ultra-shallow water requiring purpose-built artificial islands and facilities designed for harsh Caspian conditions. The project experienced major cost escalation from approximately USD 10 billion to more than USD 50 billion and launched more than eight years later than the original 2005 plan. The project's delays, technical issues and pipeline replacement challenges are widely cited as a cautionary example for megaproject front-end risk planning (Eurasian Research Institute, 2015).

The technical failure was hydrogen sulfide related pipeline leakage after the September 2013 start-up, which triggered a full production shutdown and a major replacement project. The consequences extended beyond cost and schedule. Emergency flaring of toxic gas led to a USD 735 million fine from the Kazakh government; Reuters reported that the consortium appealed a USD 737 million ecological fine in March 2014 (Reuters, 2014).

Table 5: Kashagan Case Study: Consequences and Owner-Side Lessons

Aspect	Observation from Case Study	Lesson for Project Owners
Technical context	Ultra-shallow offshore field, artificial islands and harsh environmental conditions.	Site conditions and execution environment should be treated as central drivers of contract strategy, contingency and technical assurance.
Technical failure	H ₂ S-related pipeline leaks after start-up and subsequent shutdown.	Materials selection, corrosion risk, sour-service design and quality assurance require rigorous independent review.
Cost and schedule impact	Cost growth from approximately USD 10 billion to more than USD 50 billion; more than eight years of delay versus the original plan.	Megaprojects require realistic contingencies, strong front-end risk assessment.
Environmental and economic impact	Emergency flaring fine and revision of revenue expectations.	EPC risks can affect not only project economics but also national, environmental and reputational outcomes.

The core lesson is that mature design before execution and stronger front-end risk assessment are not administrative formalities; they are protection mechanisms for capital, schedule certainty, environmental compliance and stakeholder confidence. For project owners, the Kashagan case reinforces the need for independent technical assurance, sour-service risk assessment, constructability validation, realistic contingency and strong governance over start-up readiness.

Cost Optimization Strategies

Cost optimization in EPC contracting should not be confused with cost cutting. True optimization preserves technical integrity while reducing waste, duplication, avoidable contingencies and inefficient risk allocation.

Table 6: Cost Optimization Strategies for EPC Project Owners

Strategy	Technical Perspective	Expected Benefit
90% FEED	Increase design maturity before tendering.	Reduces bidder uncertainty, change orders and contingency pricing.
Appropriate contract model	Match contract form to scope uncertainty and owner capability.	Avoids forcing fixed-price risk transfer where the risk cannot be priced reliably.
Bid alternatives	Invite technically compliant alternatives that reduce cost, schedule or execution risk.	Uses contractor innovation while preserving owner technical requirements.
Project modular packaging	Break the project into logical packages or modules where beneficial.	Improves market participation, constructability and interface control when properly governed.
LTA utilization	Use long-term agreements for repeatable materials, equipment or services.	Improves pricing leverage, delivery predictability and administrative efficiency.
Industry terms and conditions	Use balanced, market-recognized provisions where possible.	Improves bidder confidence and reduces risk premiums.
Robust risk management	Identify, quantify, assign and monitor risks throughout the project.	Prevents late discovery of risks and supports proactive mitigation.

The strongest cost optimization lever is often early scope definition. Once construction has started, opportunities for cost reduction are narrower and may introduce quality or claims risk. Therefore, owner organizations should treat FEED maturity, tender quality and contract model selection as cost optimization tools, not merely procurement prerequisites. This is reinforced by AACE guidance linking estimate confidence to project-definition maturity and by CII guidance on the value of structured front-end planning (AACE International, 2020; CII, n.d.).

Contractor Performance Evaluation as a Monitoring Tool

CBE is a monitoring tool that can be interpreted as a structured evaluation process that helps the owner identify issues early, align execution with project goals and support continuous improvement. The evaluation should not be limited to a final score at completion. It should function as a live management tool linked to milestones, deliverables, risk trends and corrective actions.

Table 7: Performance Evaluation as an EPC Monitoring Tool

Monitoring Objective	Application in EPC Execution	Example Indicators
Early identification of issues	Define key milestones and leading indicators at project start.	Late engineering deliverables, procurement slippage, low productivity, increasing nonconformances, delayed notices.
Alignment with project goals	Link contractor performance reviews to safety, quality, cost, schedule and operability objectives.	Schedule performance index, quality closure time, HSE performance, change order trends, commissioning readiness.
Continuous improvement	Capture lessons during execution rather than only after completion.	Corrective action closure, recurring issue reduction, subcontractor performance trends, lessons-learned implementation.

For maximum value, performance evaluation should be linked to contract scope categories and project phases. For example, engineering quality, procurement expediting, construction productivity and commissioning readiness should be evaluated using different criteria. A single generic scorecard can hide the real root cause of poor performance. A scope-tiered evaluation model allows the owner to identify whether the risk is contractor-wide, package-specific, subcontractor-driven or related to owner-caused interfaces.

Safeguarding the Project Owner against Claims

Claims prevention is an integrated discipline that starts with contract drafting and continues through project execution. Best practices in claims management include: well-defined scope, responsibilities and payment terms, strong documentation, timely notification for changes or claims, robust dispute resolution clauses and experienced legal and project management expertise. These safeguards are consistent with EPC contract forms that emphasize notices, claim procedures, securities and dispute avoidance/adjudication as part of the contract-administration system (FIDIC, 2017/2022).

Table 8: Owner Safeguards against EPC Claims

Safeguard	Purpose	Typical Tools
Well-defined scope and responsibilities	Reduces disagreement over inclusions, exclusions and interface ownership.	Scope of work, responsibility matrix, battery limits, deliverables list, assumptions register.
Clear payment terms	Avoids disputes over earned value, milestones, retention and cash-flow expectations.	Milestone schedule, measurement rules, payment certificates, withholding provisions.
Strong documentation process	Creates evidence for decisions, delays, changes, instructions and performance issues.	Daily reports, meeting minutes, correspondence logs, change registers, delay notices.
Timely notification	Protects contractual rights and allows early mitigation.	Notice clauses, change request procedures, claim substantiation timelines.
Robust dispute resolution clauses	Provides structured escalation before disputes become disruptive.	Negotiation, senior management escalation, expert determination, arbitration or litigation path.
Experienced legal and PMT expertise	Anticipates claim triggers and manages commercial correspondence.	Claims review board, contract administration training, legal review of critical notices.

The best claims strategy is prevention through clarity, timely administration and evidence. Owners should avoid informal instructions that bypass change control, delayed responses to contractor notices and incomplete records of interface constraints. Even when a claim cannot be avoided, strong records and timely notices enable fair resolution based on evidence rather than negotiation pressure.

Integrated Framework for EPC Success

The EPC success framework developed from this paper can be summarized as a sequence of owner-controlled decisions and controls. Each element strengthens the next. Mature FEED supports better strategy selection. Better strategy selection supports more competitive procurement. Strong procurement supports smoother execution. Monitoring tools detect performance gaps. Claims safeguards protect the owner when disagreement occurs.

- Establish a mature project definition before tendering, including scope, interfaces, site data, standards and execution constraints.
- Select a contract model based on scope maturity, project complexity, schedule criticality, market capacity and owner PMT resources.
- Pre-qualify bidders using technical capability, financial solvency and previous performance rather than price competitiveness alone.
- Provide sufficient bidding time and manage clarifications through a controlled Q&A process.
- Track execution risks through milestone-based performance evaluation and early-warning indicators.
- Optimize cost through FEED maturity, risk allocation, bid alternatives, modular packaging and long-term agreements.

- Protect the owner through clear scope, timely notices, strong documentation and robust dispute mechanisms.

CONCLUSION AND RECOMMENDATIONS

Driving success in project EPC contracting requires the project owner to manage the full contracting lifecycle, not only the tender or contract award stage. The owner's most important contribution is disciplined preparation: defining scope, understanding risk, selecting the right commercial model, qualifying capable contractors and establishing governance mechanisms that continue through execution.

The main conclusion is that EPC contract success is determined by alignment: alignment between scope maturity and contract model, between risk allocation and risk control capability, between procurement process and market conditions, and between execution monitoring and project objectives. When this alignment is weak, the owner may face inflated bids, contractor distress, execution delays, technical failures and claims. When it is strong, EPC contracting can provide clear accountability, disciplined delivery and improved capital project outcomes.

Recommendations for Project Owners

- Adopt FEED maturity as a mandatory gate before selecting fixed-price EPC contracting.
- Use a formal strategy selection matrix that evaluates schedule, location, brownfield extent, cost, market capacity, PMT resources, complexity and scope maturity.
- Develop a contract model decision guide covering LSTK, LSPB, CLSTK, EPCm and reimbursable options.
- Strengthen bidder pre-qualification by integrating technical, financial and previous-performance criteria.
- Build live contractor performance evaluation into execution governance rather than relying on end-of-project assessments.
- Create an early-warning dashboard for financial solvency, subcontractor performance, skilled labor availability, engineering progress, procurement slippage, quality trends and claims notices.
- Institutionalize claims prevention through document control, timely notices, change management discipline and experienced legal/PMT involvement.
- Use cost optimization strategies that preserve technical integrity instead of simply reducing scope or transferring unrealistic risk to contractors.
- Rather than treating CBE as a post-completion formality, the project owner should utilizes a multidimensional Balanced Scorecard (BSC) framework. This approach prevents "blind spots" by ensuring that technical success is not achieved at the expense of safety, quality, or financial sustainability.

REFERENCES

- AACE International. (2020). Recommended Practice No. 18R-97: Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries. AACE International.
- Construction Industry Institute. (n.d.). Front End Planning. Construction Industry Institute. <https://www.construction-institute.org/front-end-planning>
- Eurasian Research Institute. (2015). Current Challenges for the Kashagan Offshore Oil Field Project. <https://www.eurasian-research.org/publication/current-challenges-for-the-kashagan-offshore-oil-field-project/>
- FIDIC. (2017; reprinted 2022). Conditions of Contract for EPC/Turnkey Projects (Silver Book, 2nd ed.).
- International Federation of Consulting Engineers.
- ISO. (2018). ISO 31000:2018 Risk management — Guidelines. International Organization for Standardization. Reuters. (2014, March 18). Kashagan oil group appeals \$737 mln ecological fine. Reuters.