

MMSA Webinar Series

Why Projects Fail: Capital Lessons Learned and Nickel Project Case Study



***Mining and
Metallurgical
Society of America***

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Why Projects Fail: Lessons Learned and Nickel Project Case Study

Presented by: Justin Norman, Managing Director at FTI

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Overview

Large industrial and infrastructure projects are historically **vulnerable to cost overruns and schedule delays**. Many of the **risks can be managed – or even avoided** – when comprehensive and objective due diligence, with a focus on construction, is performed prior to funding and execution is effectively monitored by experienced and independent professionals to **protect investments and better ensure certainty of outcome**.

A failed project **doesn't always result in total loss**, but rather a level of **underperformance that significantly affects return on investment**.

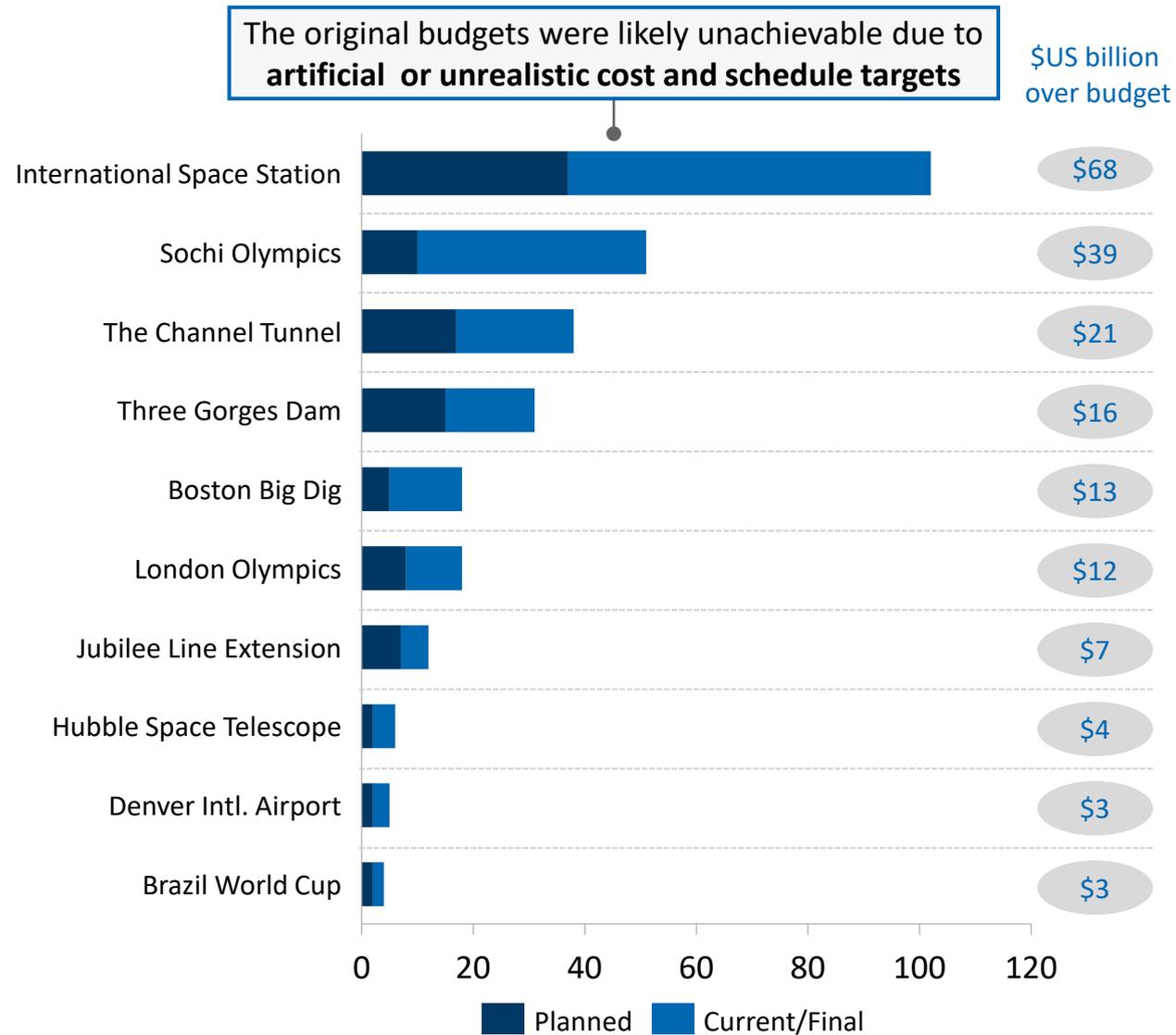
During this presentation, you will be guided through:

- Why projects fail
- Why funding budgets are exceeded
- Why things don't go as planned during execution
- General lessons learned
- Case study: Araguaia Nickel Project

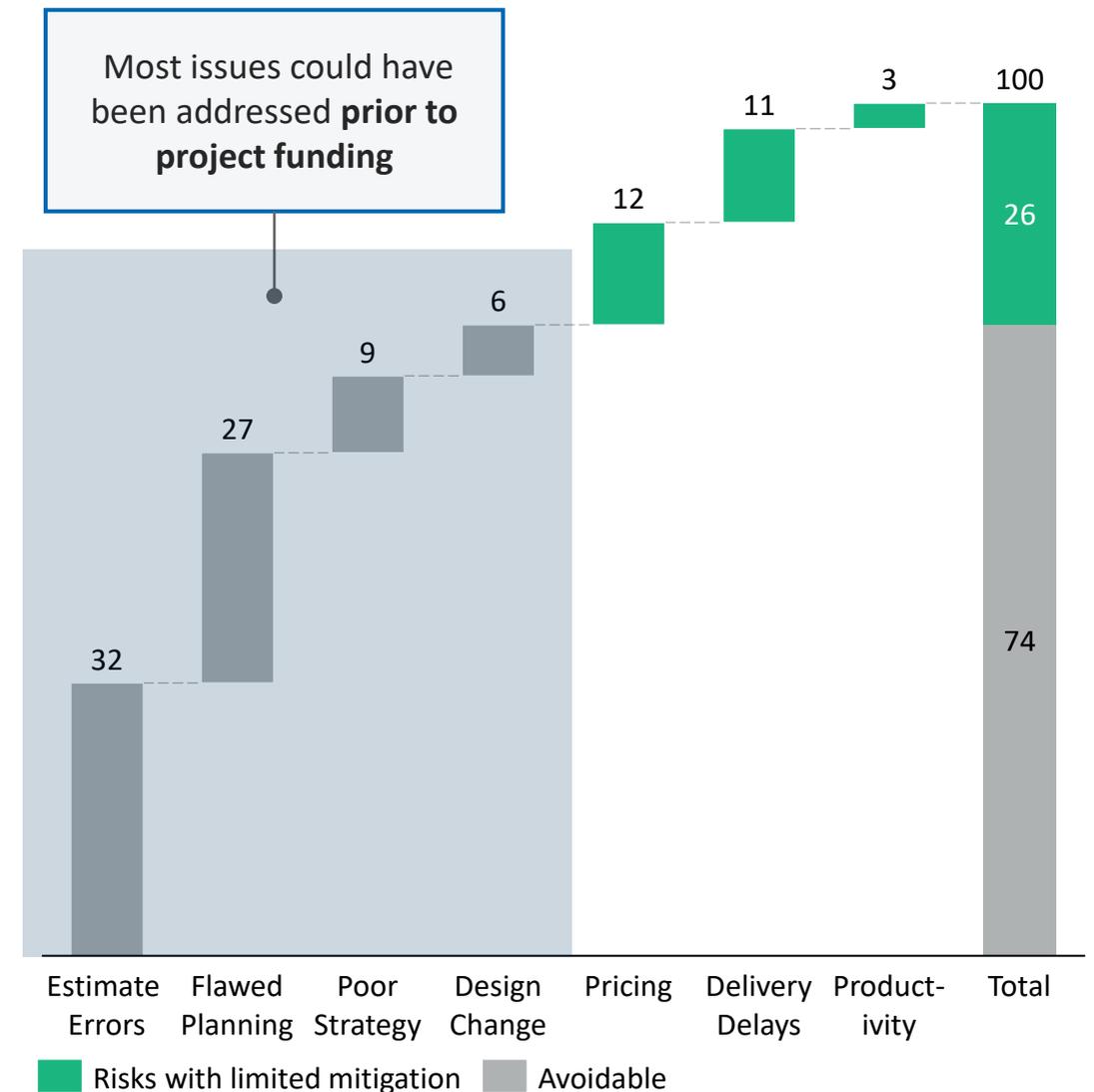


At FTI, we see a recurring issue of significant cost overruns, principally related to bad, incomplete or optimistic baselines, followed by market pricing and execution challenges

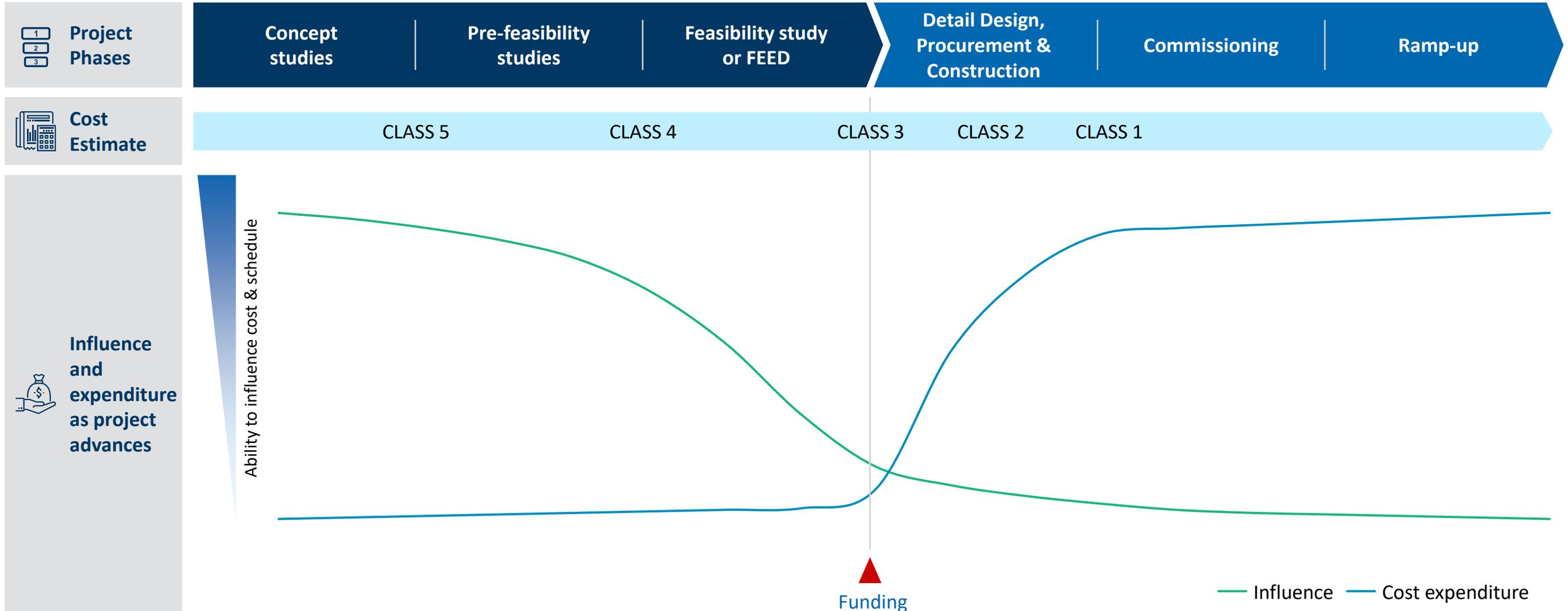
Budget overruns for major projects (B\$)



Reasons for cost overrun in major construction projects (%)



A project's ability to influence cost and schedule outcomes is determined **early in definition, prior to funding**, and quickly diminishes as the project funded and progresses through execution

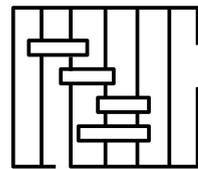




■ Why Projects Fail

Why Projects Fail: Common Root Causes

1) Funding approval dates driving **premature decisions**

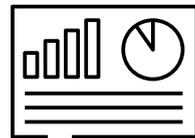


2) Schedule and cost **optimism and artificial** and schedule targets

3) **Weak execution experience** on owner, and contractor teams

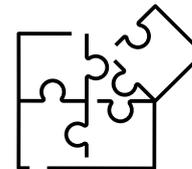


4) Late identification and quantification of **project-specific** risks



5) Lack of **construction-driven** project management

6) Poorly defined or Incomplete **scope definition**



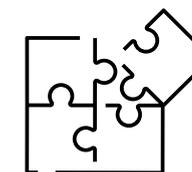
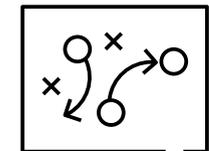
7) **Rule-of-thumb contingency** over project-specific evaluation

8) Technology/process **risks unclear or undefined**



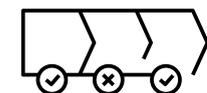
9) **Inadequate** execution processes, procedures, or systems

10) **Flawed execution plan**, commercial strategy, risk allocation



11) **Mismanagement** of permitting and land acquisition

12) **Insufficient ops engagement** during project definition





■ Why Budgets are Exceeded

Why Funding Budgets Are Exceeded: Technology and Design

- **Technology or process is insufficiently defined or proven**
- Access to proprietary technology not secured or providers not engaged during basic design
- **Nature of inputs or raw materials not fully understood/test work or piloting insufficiently complete**



**Funding Budgets
Exceeded**

TECHNOLOGY

DESIGN AND OPERATIONS

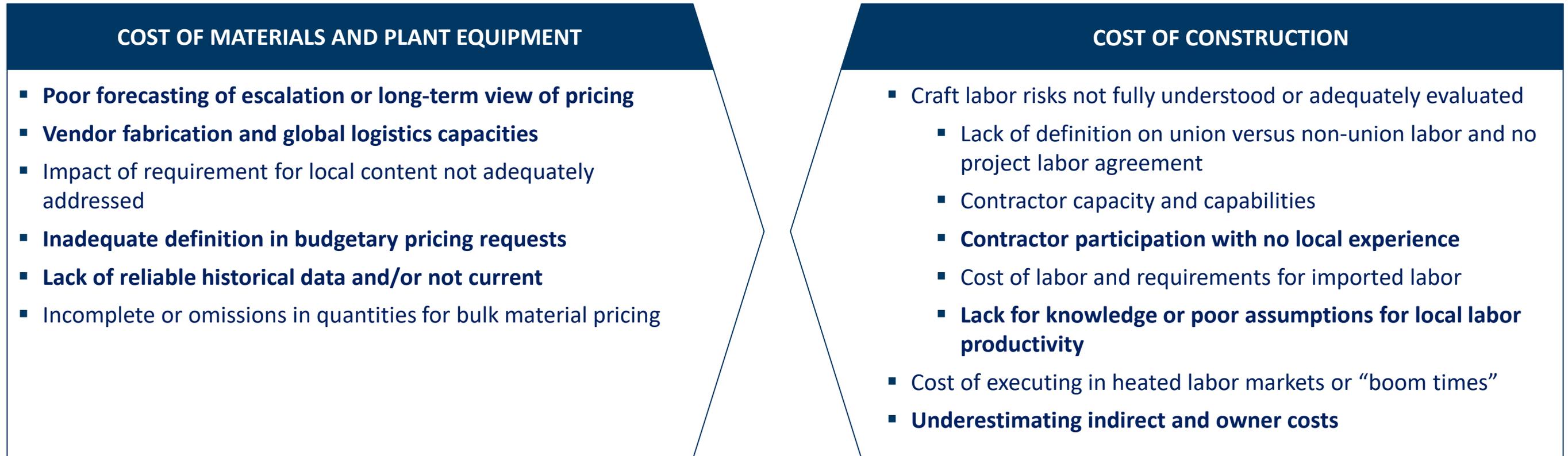
Insufficient design definition to support adequate capex

- **Low investment in geotechnical and subsurface investigation**
- **Insufficient engineering to support scope definition and quantity development at funding**
- **Lack of construction and operations participation in basic design**
- **Poor understanding of environmental permitting requirements**

Region, country or site-specific conditions inadequately evaluated

- Geology and seismology
- Topography and climate

Why Funding Budgets Are Exceeded: Cost Estimating



Understated owner costs

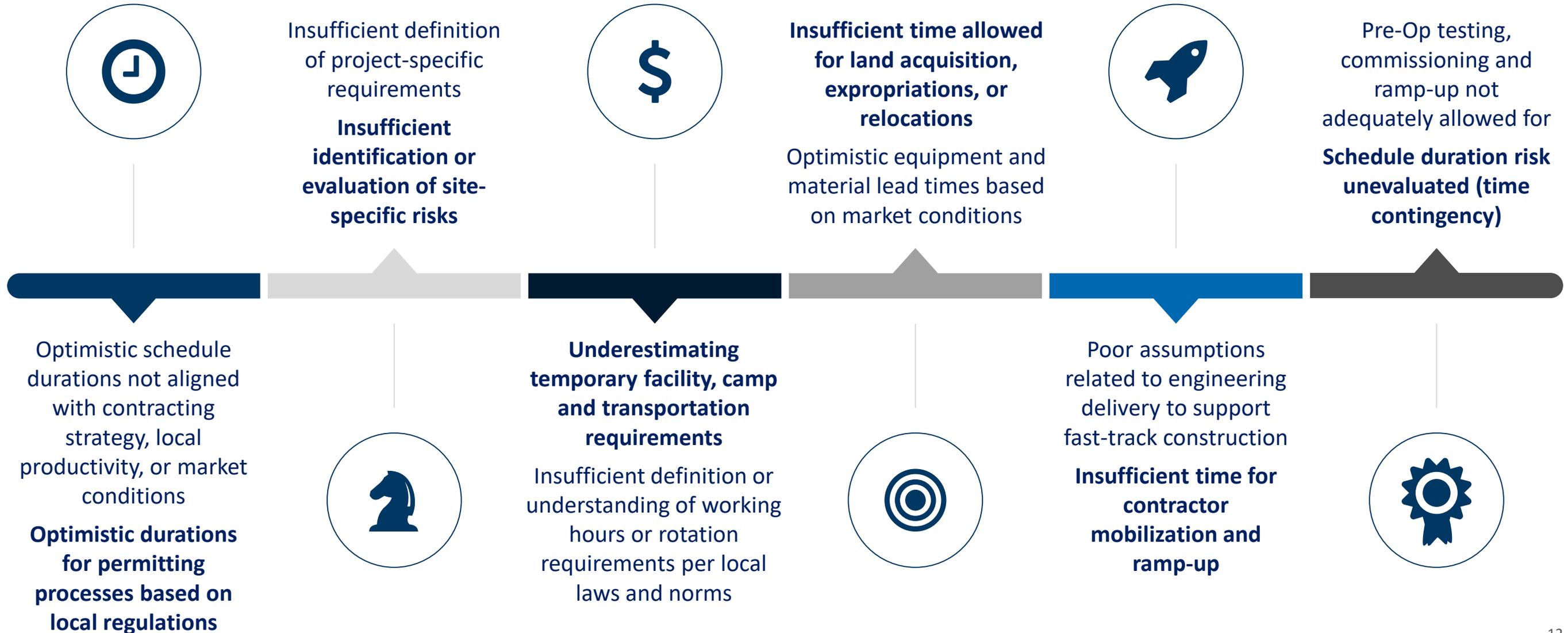
Inadequate contingency evaluation to cover risks and estimate exclusions or qualifications

Capital cost estimate developed independent of schedule



Funding Budgets Exceeded

Why Funding Budgets Are Exceeded: Execution Planning and Scheduling





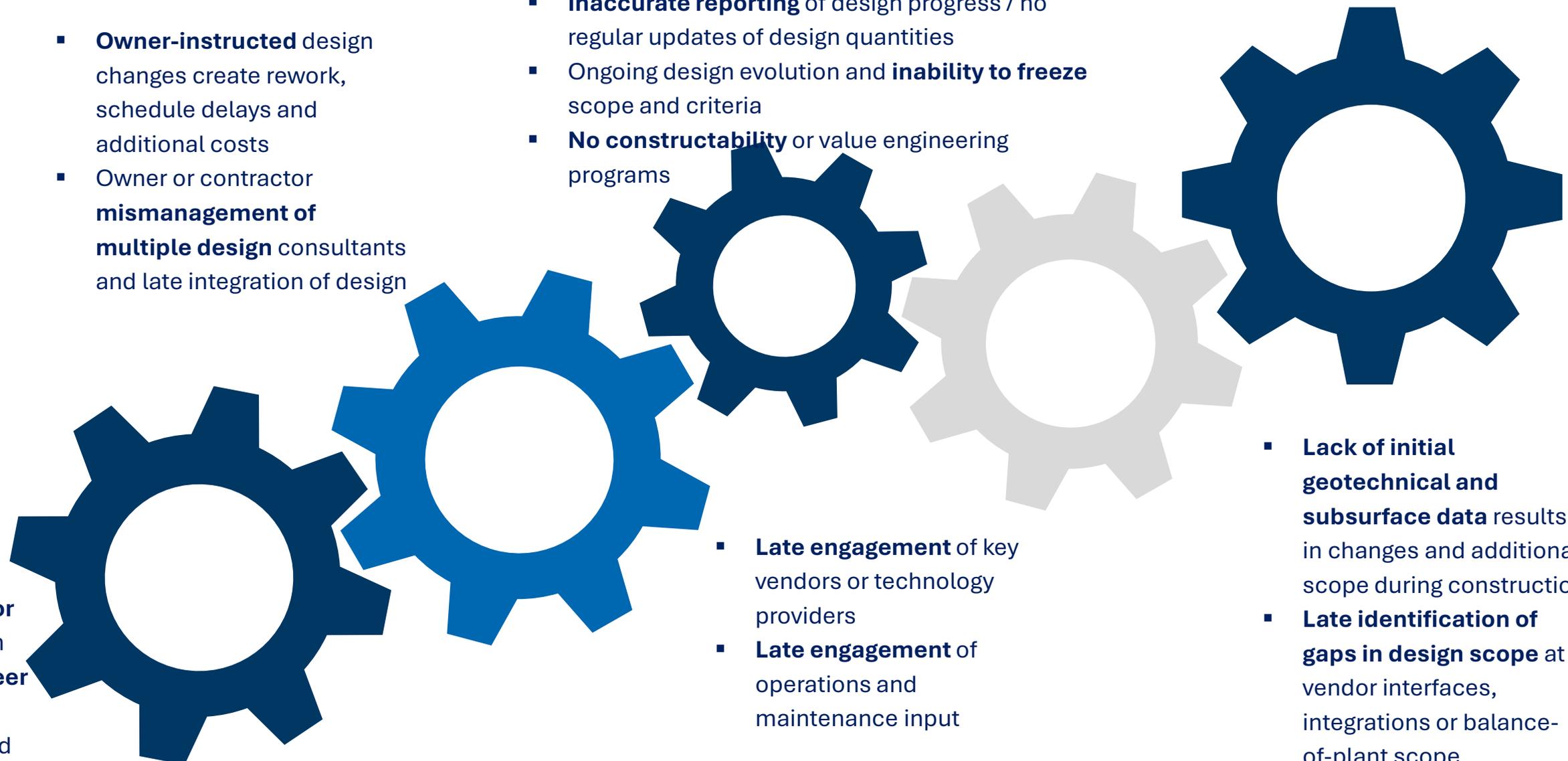
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- Why Things Don't Go as Planned

Things Don't Go As Planned during Execution: Engineering



- **Owner-instructed** design changes create rework, schedule delays and additional costs
- Owner or contractor **mismanagement of multiple design** consultants and late integration of design
- **Inaccurate reporting** of design progress / no regular updates of design quantities
- Ongoing design evolution and **inability to freeze** scope and criteria
- **No constructability** or value engineering programs



- **Over-reliance on vendor reps** to complete design
- **Lack of resident engineer at the site** during construction, testing and start-up

- **Late engagement** of key vendors or technology providers
- **Late engagement** of operations and maintenance input

- **Lack of initial geotechnical and subsurface data** results in changes and additional scope during construction
- **Late identification of gaps in design scope** at vendor interfaces, integrations or balance-of-plant scope

Things Don't Go As Planned during Execution: Procurement and Contracting



- **Late award** of long-lead procurements or critical/early works contracts
- Obligating suppliers or contractors to agree to **unrealistic schedules**

- Funding or owner **governance constraints** for awards or changes
- **Misalignment** of commercial strategy and level of project definition

- Misalignment or misconceptions related to **risk allocation**
- Vendor (or sub-supplier) **shop quality**

- **Late identification** of traffic and logistics constraints
- Lack of in-shop **quality inspections and expediting**

- Lack of oversight, inspection, and performance **monitoring at offsite fabrication or modularization facilities**

Things Don't Go As Planned in Execution: Construction



- Delays in **permitting, land acquisition, or relocations**
- Schedule based on **excessive sustained progress**
- **Unrealistic schedule** with endless recovery plans
- No tracking of schedule **performance against a baseline**
- **Poor systems/processes** for progress measurement and total scope quantities

- **Deficient or no forecasting** of cost based on performance trends and emerging risks
- **Construction rework** due deficient work quality or design errors

- **Lack of initial EPC planning** centered on supporting construction

- **Schedule misalignment** with execution plan
- Construction durations **not site or region specific**

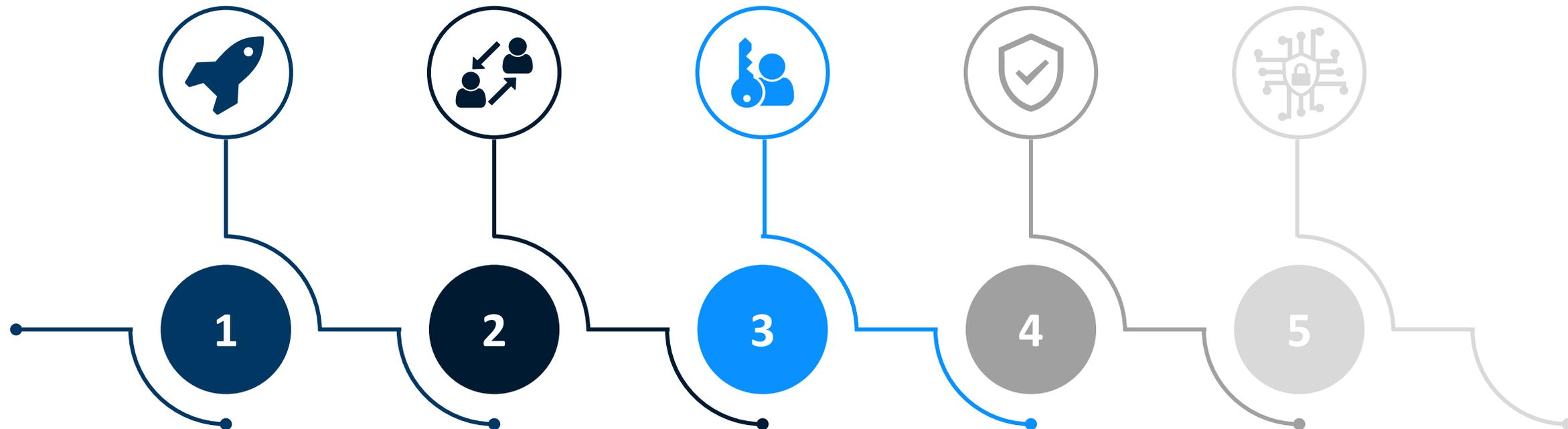
- **Poor productivity assumptions**
- **Poor labor relations** management
- **Poor safety culture and safety performance**

- **Lack of control or visibility of field indirect cost performance**
- **Lack of camp space** for remote projects
- **Insufficient cost and schedule contingency**
- **No risk management** plans actively monitored



■ Lessons Learned

Lessons Learned and Best Practices: Prior to funding



- Ensure the project team **has relevant sector and regional experience**.
- **Involve key vendors and technology providers** before funding.
- **Align commercial strategy** with the execution plan, cost, and schedule.

- Focus on **early planning, clear roles, and objectives**.
- Complete basic engineering and **finalize key design criteria**.

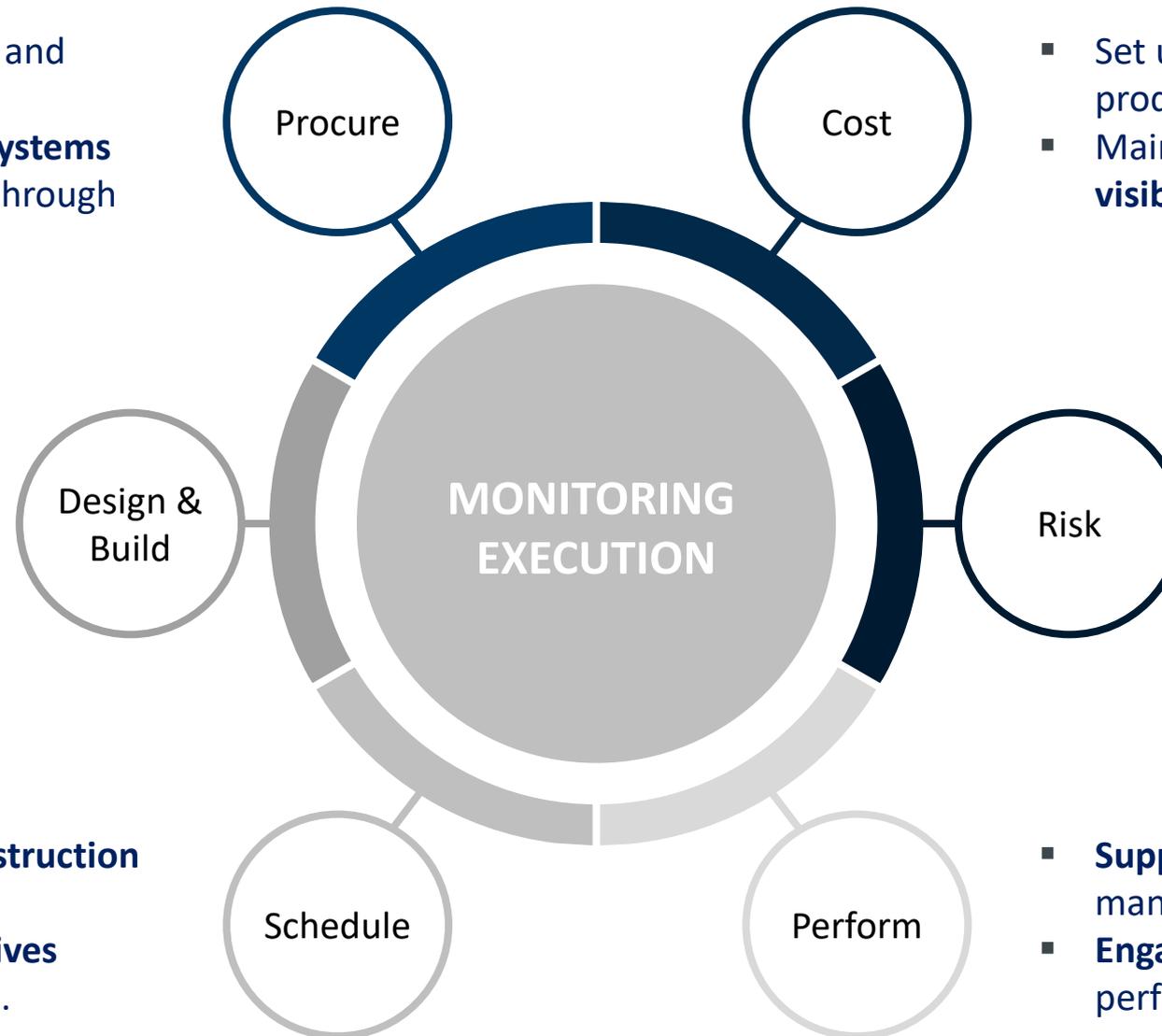
- **Plan for construction, testing, and commissioning** sequences early on.
- **Confirm technology**, before funding.

- **Identify risks** and mitigation strategies.
- **Maximize integration** of engineering, procurement, and construction.
- Establish **project-specific** cost and schedule contingencies.

- Engage **qualified independent parties** for reviews of capital cost, schedule, and execution plans.
- Ensure FEED/feasibility reports include **Basis of Estimate, Schedule, and Execution Plan**.

Lessons Learned and Best Practices: During project execution

- **Shop quality inspections and expediting** for key equipment and materials.
- **Implement material control systems and processes** from decision through commissioning.
- **Prioritize constructability** during design for a construction-driven approach.
- Use **standard methods to measure progress** in design, procurement, and construction
- Consider **early awards or construction prep** to reduce schedule risk.
- Consider **performance incentives** instead of liquidated damages.



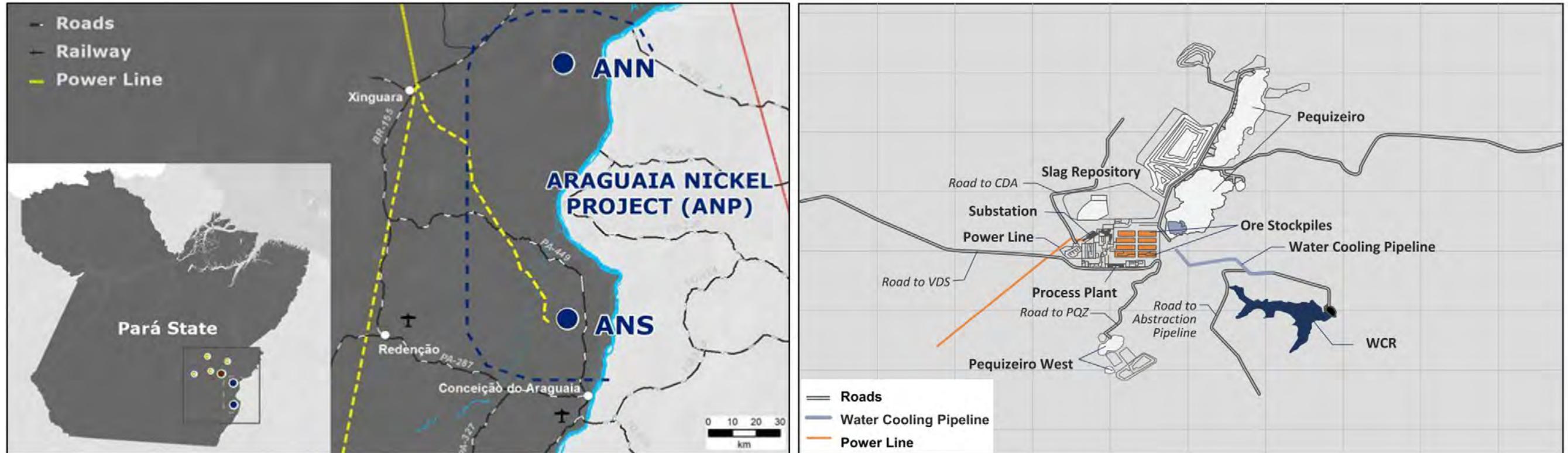
- Set up **accurate** cost and schedule productivity and performance reporting.
- Maintain cost and schedule forecasts with **visible contingency management**.
- Include updates on **critical path** and **risk treatment** in reporting.
- Ensure **industry-standard evaluation and monitoring tools and practices** are in place.
- **Support execution teams** with strong management and technical oversight.
- **Engage experienced 3rd parties** for performance monitoring during execution.



■ Case Study: Araguaia Nickel Project

Project profile

- The Araguaia Nickel Project (ANP) was a ferro-nickel project developed by Horizonte Minerals, located outside of Conceição do Araguaia in the Pará State of Brazil and south of the Carajás Mining District.
- The project contemplated the development of an open pit mine providing ore to an RKEF processing plant with supporting infrastructure including, a cooling water dam, water transport infrastructure, and other ancillary support facilities.



Project Profile

- The process plant included crushing and material handling, rotary kiln and electric furnace, metallurgical refining, and utilities.
- The facility was designed to process 900 ktpa to yield 52,000 tonnes of ferro-nickel containing 14,500 tonnes of nickel and accommodate a future expansion of an additional and identical RKEF line which would duplicate production.



FTI Scope of Services for Financial Restructuring and Project Status Due Diligence

- **FTI was engaged by counsel on behalf of the senior lenders in October 2023 due to cost concerns.** The initial FTI scope included:
 - Review and evaluate proposals in connection with credit agreement as well as contingency alternatives
 - Assist in negotiations with the company, sponsors and its shareholders
 - Analyze liquidity forecast and evaluate finance and capital raising alternatives
 - Develop potential long-term business plans
 - Assist in restructuring proceedings
 - **Evaluate project execution issues and provide a funding gap analysis**
 - Meet with the company’s project team to understand the issues
 - Assess to-go capital cost requirements and schedule to complete the project
 - Work with the Lending Group and its technical advisors to challenge key project completion assumptions
- **After an initial assessment of EPC activities, the lenders further tasked the FTI construction team with:**
 - Evaluate capabilities of new EPC contractor
 - Provide feedback on leadership changes by the company
 - Validate project status and remaining scope for engineering, procurement and construction
 - Monitoring development of the revised capital cost estimate and construction schedule
 - “Hands on” assistance as needed to assure that the rebaseline was comprehensive and achievable
 - Prepare a report detailing “what went wrong” and lessons learned

Project overview and timeline

- The project completed a **Feasibility Study in November 2018** resulting in a **US\$ 443M capex** and **32-month execution schedule** for engineering, procurement, construction and commissioning.
- The project was further evaluated, and an **updated capex** was prepared in **September 2021**, totaling **US\$ 477M** and the **schedule was revised down to 25 months**. This update was presented as the basis for project sanctioning and **approved to proceed in January 2022**.
- The project execution strategy was **EPCM by an ECA-assigned consultant with limited regional mining experience** for detailed design, procurement and contracts, and construction management on behalf of the company.
- The project moved forward and due to reported “inflationary pressures” a **cost re-baseline was implemented in September 2022** **increasing capital costs to \$506 million**.
- The schedule maintained the baseline completion dates **though construction had only progressed to 4% complete vs. plan of 10%**.
- To hold the completion dates, **construction was compressed with 55% of progress to be earned in a six-month period**.
- The project continued to absorb delays and incur cost overruns through September 2023 when an updated **forecast of \$704 million was published including a five-month delay to completion**.
- A number of consultants and technical advisors had been engaged by the lenders, sponsors and company throughout the project to evaluate performance and provide organizational, cost, schedule and risk assessments. **Some potential issues were captured but were not quantified or appropriately escalated**.
- A rebaseline was finalized with a new and qualified EPC **in Q2 2024** with a revised total **forecast exceeding US\$ 1B and a December 2025 First Metal date**.
- **By March 2024, the continuing the project was determined to be unfeasible due to nickel prices and inability to attract new capital**.
- **All site work concluded in September 2024** with the deconstruction of the cooling water dam and demobilization from the site.

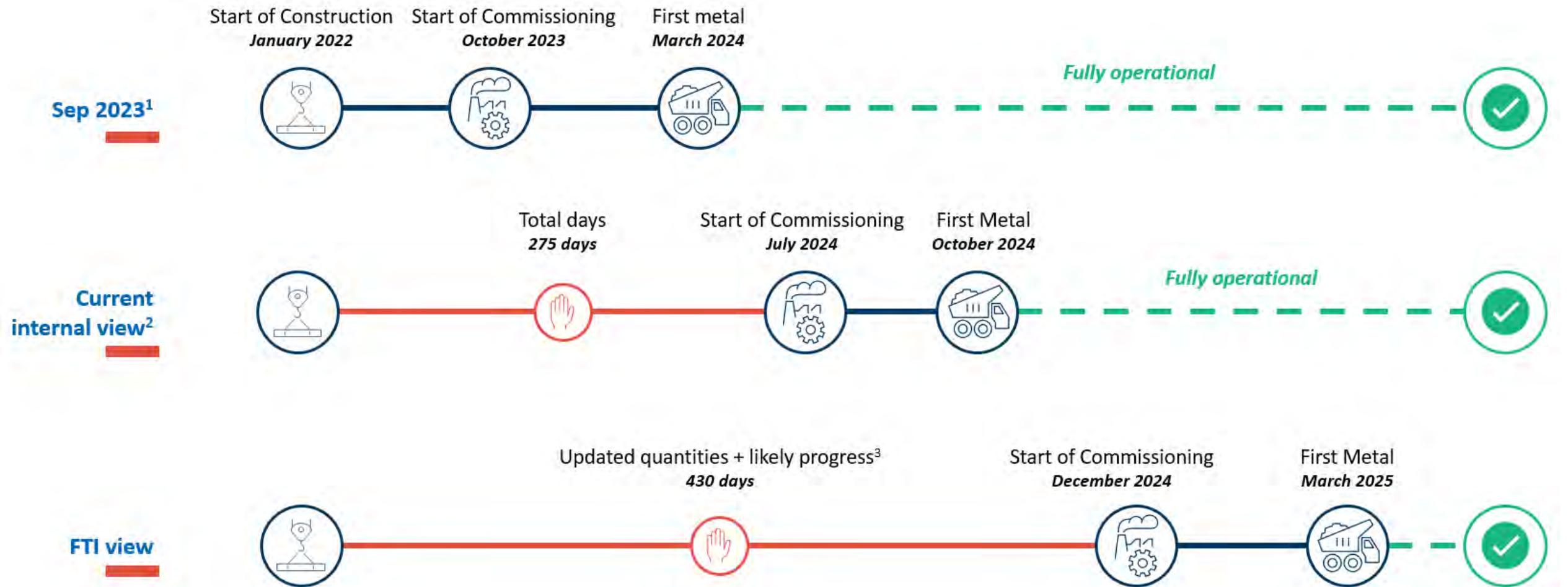
Initial assessment and project suspension

FTI performed a due diligence review and site visit in early November 2023. The company's most recent progress report available at the time of the review reported construction progress at 61%. FTI's assessment was that construction progress was likely between 35-40%.



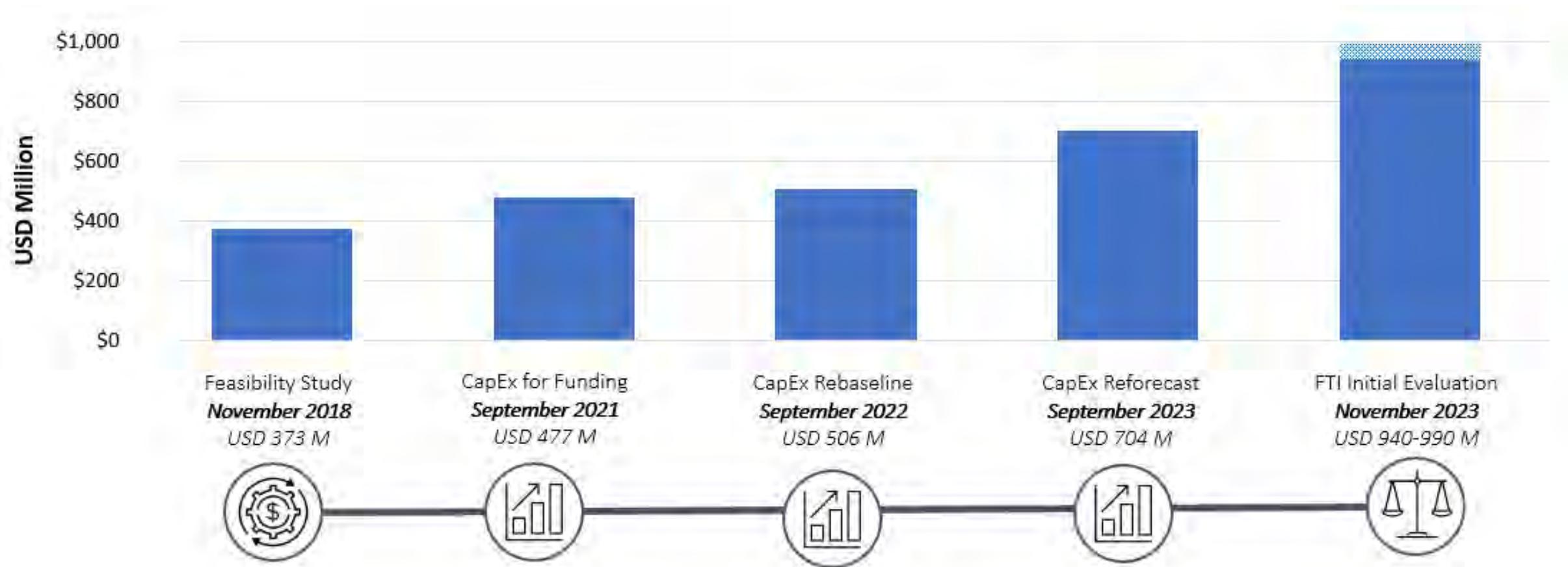
Initial assessment and project suspension

In addition to an area-by-area review of construction progress, as well as engineering and procurement, the initial assessment based on available information was that First Metal would be achieved **no earlier than March 2025 with a potential cost increase of up to \$285M.**



Initial assessment and project suspension

Based on FTI's high-level assessment of progress, schedule and remaining risk, we estimated **an additional incremental cost increase of \$245 - 285M.**



Initial assessment and project suspension

- **FTI's assessment identified reporting inaccuracies, mismanagement of risk, and uncertain cost and schedule outcomes due to:**
 - Incomplete or understated/outdated design quantities
 - Cost exposure due to the electro-mechanical contract commercial structure
 - Deficient management by the owner and inexperienced EPCM
 - Ineffective project controls processes and tools/systems
- **FTI's initial recommendations included:**
 - Continuing work at low-complexity work fronts (cooling water dam and other select infrastructure and utilities).
 - Pausing work in all other areas for a two-month period for a “reset” to reestablish scope, schedule, cost and address risks
 - Renegotiating the cost reimbursable commercial terms with the electro-mechanical contractor
 - Implement an appropriate badging system to track onsite labor
- Based on the initial assessment, combined with limited access to capital, **the owner suspended most of the work** and demobilized contractors and suppliers **on November 23, 2023, with an incurred cost to date of US\$480M** .
- Limited work continued at the cooling water dam while **all other construction activity was paused and the EPCM contract was terminated**.
- This was followed by a **significant reduction to owner site and home office** with a skeleton team remaining for environmental monitoring and basic site and corporate office services to minimize ongoing costs.
- The **owner also made key organizational changes** including appointment of a new board members, CEO, COO and **engaged a Canadian-based mining company with proven self-perform experience in Brazil** to develop the rebaseline with FTI oversight.

“What Went Wrong” – Unrealistic cost estimates

- **November 2018 Feasibility Study**
 - Given the level of project definition, the capex was incorrectly represented as a Class 3 with an accuracy range of -10% to +15%
 - AACE standards for Class 3 estimates on industrial plants is -20% to +30% and may be 2-3 times higher for high-risk projects.
 - Contingency was set optimistically at US\$ 41M based on the “P50” results of a quantitative analysis
 - The base estimate and contingency evaluation specifically exclude items like scope changes, escalation, and labor availability.
- **September 2021 Estimate (Basis for Sanctioning)**
 - Updated estimate of US\$477M was again reported as -10% to 15% with P50 contingency (US\$ 45M).
 - This update was based on an increasingly aggressive plan that reduced the execution schedule by 7 months.
 - The schedule was based on construction progress with a sustained peak of over 8%/month for a six-month period.
 - An unrealistic schedule artificially reduces fixed costs like construction indirects, contractor overheads, EPCM and owner staff.
- **September 2022 Re-baseline**
 - Due to “inflationary pressures”, the project re-baselined cost and schedule September 2022 with an increase to US\$ 506M.
 - The incremental increase of US\$ 30M included contractor increases of US\$ 75M, largely offset by a US\$ 25M reduction in contingency, US\$ 14M owner’s cost reduction, and a US\$ 20M in “business improvements”
 - **FTI’s view is that the cost offsets were artificial, as was forcing the planned completion date**
 - Reductions in owner’s cost had no documented basis
 - It is irresponsible to “bake in” potential cost opportunities
 - Construction’s already-aggressive schedule was further compressed – progress was only 4% vs. a plan of 10%.
 - It is imprudent to reduce contingency when nearly all of the construction risk remained

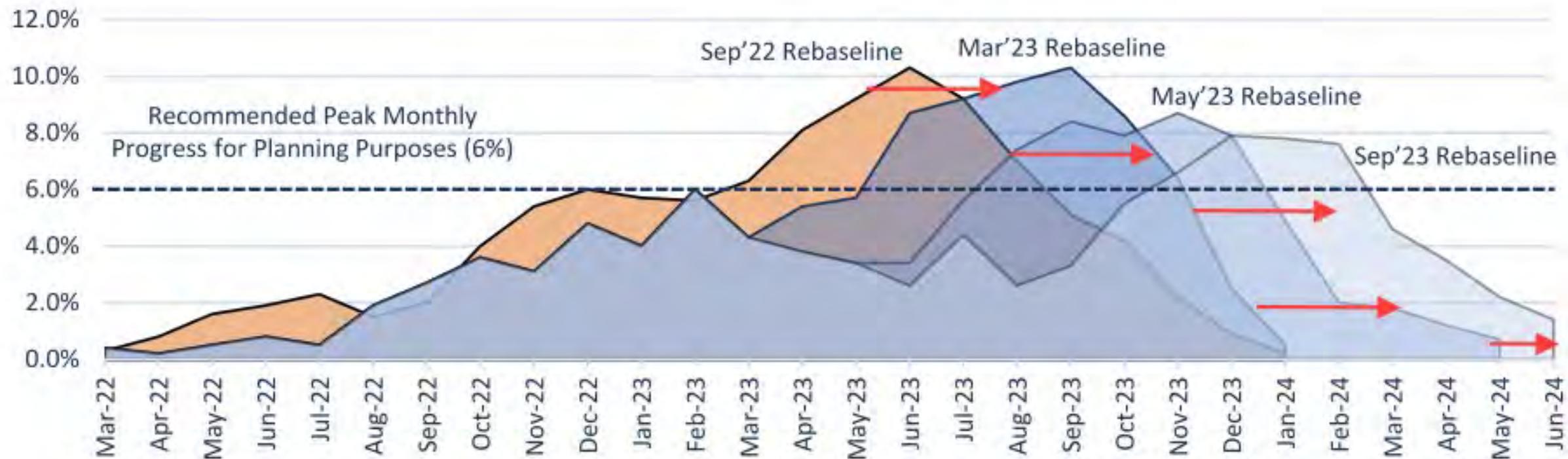
“What Went Wrong” – Flawed execution schedule

- Limited detail was provided in the feasibility study related to **schedule basis and any evaluation of schedule contingency**
- The construction and commissioning **schedule was reduced from 27 to 22 months** between the study and sanctioning baseline, and the commissioning period post-construction completion was reduced from 5 to 3 months without justification.
- With no reported decreases in quantities or scope, **this could only be achieved by compressing** construction work and commissioning by decreasing durations, overlapping construction trades and optimistically overlapping commissioning with construction.
- Subsequent updates **artificially maintained the end dates despite accumulating delays**, further compressing an unrealistic schedule.



“What Went Wrong” – Flawed execution schedule

- Construction progress on complex, industrial facilities is driven by quantity installation rates for bulk materials including earthworks, concrete, steel, piping, refractory, and electrical and control cable.
- On a facility of this scale, it would be difficult to achieve a sustained rate of progress over 5-6%/month.
- It is apparent that quantities (and labor) required to achieve the scheduled rates was not reviewed/leveled by experienced personnel.
- As the project incurred delays, the impacts were obscured by increasing installation rates which compressed remaining durations and would have required overlapping of work/trades resulting in other challenges like labor availability and density.



“What Went Wrong” – Poor project management and oversight

As the project advanced into execution, the **risk of a successful outcome was further compounded** by a lack of experienced construction leadership and generally poor project management, governance and implementation of industry-standard practices:

- **Construction managed to and reported progress based on incomplete/inaccurate quantities**
 - Quantities define the scope of a project, and the hours required to build it
 - As design progressed and omissions were identified, the EPCM team failed to incorporate these updates into construction resulting in overstated progress and understated remaining work, schedule durations, staffing and likely completion dates
- **Inadequate construction cost and schedule work processes and systems**
 - Industry-standard work processes and systems should have been adopted to control cost, schedule, forecasts, and accurately report progress and performance
- **Inexperienced construction team**
 - Experienced EPCM staff would be essential to effectively manage a major cost reimbursable contractor
 - Adequate systems and tools are required to monitor contractor personnel and site and validate time charges
- **Electro-mechanical construction contract for the process plant awarded as cost reimbursable**
 - A unit price or lump sum terms would have been advisable given the advanced nature of engineering
 - This would have correctly allocated productivity and schedule performance risk squarely on the contractor
- **Constructability and value engineering reviews to optimize design and care for equipment during construction**
 - No apparent programs in place to ensure cost-effective designs and minimize quantities and installation hours
- **Ineffective independent reviews on behalf of owner, sponsors and lenders**



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Questions

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