McKinsey & Company

Operations Practice

Seize the decade: Maximizing value through preconstruction excellence

The capital projects ecosystem has a once-in-a-generation opportunity to support the transformation of economies—and can avoid past mistakes through preconstruction excellence.

This article is a collaborative effort by Matthieu Dussud, Steffen Fuchs, Oliver Kernick, Piotr Pikul, and Christoph Schmitz, representing views from McKinsey's Operations Practice.

September 2023

This decade could see unprecedented levels of capital deployed across many sectors, driven by net-zero targets, improvements in global living standards, and accommodations for supply chains fragmented by geopolitical disruptions. Given the pace of change in these areas, the pace of capital project development and delivery must also accelerate. The construction industry is fighting not just against the clock but also against a historically insufficient approach to project execution, characterized by poor front-end project definition, misaligned incentives, resource constraints, and engrained practices. Without a significant revolution, the required capital projects simply may not get delivered at expected cost and within targeted time frames—and essential goals for energy transition and country GDP growth may be missed.

The need for a revolution is abundantly evident: capital project execution in every sector continues to lead to poor outcomes. Projects run consistently over time and over budget, while under-delivering on outputs. A 2022 McKinsey study analyzed more than 500 projects around the world, each with a total project value of at least $100 million; 62 percent of the project sample were "megaprojects" valued at $1 billion or more. The analysis found that cost overruns, on average, ran at least 79 percent relative to initial budget estimates, while delays averaged out to 52 percent compared against initial time frames.[1] This highlights obvious challenges in delivery but also points to poor cost and schedule estimates at project approval.

For many project owners, the typical response to poor delivery is significant unplanned investment in project recovery, attempting to defend ever-worsening business outcomes. However, a number of project owners are managing to beat the odds in project delivery through a laser-like focus on value before a final investment decision (FID) is made, through preconstruction excellence. This approach is unlocking significant value for individual projects and could prove vital for the world's net-zero and economic development goals.

Preconstruction excellence enables stakeholders to understand the full potential of cost and schedule improvements across a project, and then to build or transform the project delivery system to ensure this potential is delivered. This provides the highest bang for buck across the project life cycle, since relatively low-cost changes to design, delivery model, and financing can result in significant improvements to outcomes across net present value (NPV); risk; and environmental, social, and governance (ESG) factors. In our work, we repeatedly see preconstruction excellence resulting in NPV uplift of 20 percent or more of the total installed cost for owners and investors across asset classes.

As well as supporting on-time, on-budget project delivery during a decade when speed and efficiency really matter, preconstruction excellence may also prove invaluable as stakeholders grapple with new, increasingly complex asset classes. For example, use of first-of-its-kind technology, both within aging brownfield assets and in newly forming sustainability-focused projects and project approaches, is becoming the norm and many project developers have to build an operating business while deploying capital at scale.

In this article, we share what we have learned from helping construction industry players beat the odds against on-time, on-budget project delivery through preconstruction excellence. We explain what preconstruction excellence looks like from the perspective of an investor, project owner, and engineering and construction (E&C) firm, and offer guidance on how owners and E&Cs can begin to implement preconstruction excellence, starting now.

[1] The research drew on a wide range of sources to create a sample of 532 projects, of which 62 percent were "megaprojects," defined as those valued at more than $1 billion. Geographically, 39 percent were located in Asia-Pacific; 25 percent were in Eastern Europe, the Middle East, or Africa; 21 percent were in North America; 9 percent were in Central or Western Europe; and 6 percent were in Latin America. For 504 of the projects, construction started between 2000 and 2020; for the remaining projects, construction started before 2000. The "initial budget" and "initial timeline" figures were based on estimates announced at the feasibility-study stage.

Opportunities to capture value through preconstruction excellence

Preconstruction excellence aims to maximize project economics across every decision, before capital is committed. The decisions before construction are wide-ranging, spanning multiple functions. The following decisions are the top five:

1. selecting and onboarding a winning project team

2. defining an optimized contracting strategy, including delivery model and right level of collaboration with partners and key suppliers

3. distinguishing with relentless clarity mandatory versus discretionary project requirements to select the optimal technical solution that maximizes risk-adjusted NPV

4. finalizing a robust execution plan and preferred option to sufficiently high levels of definition before approving the project to avoid surprises during construction

5. establishing transparent project delivery systems that also consider future operations

In our experience, an optimal approach retains a dual focus: staying fully alert to improvement potential across all cost and schedule elements, while transforming the project delivery system to capture these improvements. This enables the best project on paper and provides a risk buffer against any potential loss of value during construction.

However, we frequently see alternative choices under-evaluated in this critical phase, as time pressures to deliver new assets result in departures from best practices. Projects are procedurally moved through institutionalized stage gates without effective value engineering. For example, an international mining company imposed a tight deadline for developing a new mine feasibility study and, by failing to optimize the project before construction, left around $500 million in NPV on the table. The project was subsequently put on hold by the company's investment committee as the business case did not stand up to scrutiny.

With so much value at stake, can players across the project ecosystem afford to neglect preconstruction excellence and accept substandard project outcomes, when a clearer path to value capture is available?

How stakeholders can capture value through preconstruction excellence

Preconstruction excellence looks different from the perspective of an investor, an owner, and an E&C firm. To unlock the immense potential value of this approach, each stakeholder needs to understand their contribution to the project, and the critical focus areas and actions that fall within their area of responsibility.

For example, an investor's objective before FID is to explore the potential upsides and downsides of the project. Investors can build confidence in committing capital through diligence that ensures no stone is left unturned in defining optimized project capex and schedule baselines focused on economic outcomes. As such, investors should have a perspective on what the project should cost based on comparable benchmarks, and be suitably informed to ask challenging questions of the owner team to seek clarity on the minimum technical solution and value-improving options. This approach is different from the traditional investor's route of trying to increase certainty of outcomes through engineering, procurement, and construction (EPC) lump-sum contracts, which often result in an adversarial relationship and cost overruns.

Of course, investors also need to ensure that risks and opportunities across all functions and project phases are well defined, managed, and mitigated as much as possible. Supply chain risk, where investors typically have less influence, is often a key area of focus for investors.

And finally, investors require assurance that the project team delivering the asset has proven capability and will be fully committed to successful outcomes.

Next, we explore in more detail what preconstruction excellence means for project owners and E&C firms.

Project owners: Building the right teams and relentlessly driving value improvement

For project owners, the first objective of preconstruction excellence is to assemble an "A team" of business- and technical-focused leaders to align project requirements to business outcomes. And it turns out that a project team that has worked together before makes an even better A team than one made up of individual stars. We frequently see that assigning project teams (or agreeing to supplier teams) that lack the required expertise and experience working together results in significant value loss.

With the right team in place, partnerships can be established across key supplier ecosystems supporting project development and design activities prior to front-end engineering design (pre-FEED). Contracts can be shaped early in project development phases with win–win outcomes and aligned objectives to increase transparency and prevent disputes later in delivery.

A recent McKinsey study shows that collaborative contracts lead to a 15 to 18 percent improvement in cost and schedule performance on average, versus the baseline. This is particularly important in supply-constrained sectors where new technologies are being deployed. For example, owners looking to establish hydrogen production at scale are limited by the number of possible electrolyzer technology partners with proven capability, and the current scale of their production capability.

With key resources secured, another primary preconstruction objective for owners is to maximize certainty across all possible threats and capture opportunities that could influence execution. This includes determining the business rationale for the project, ensuring alignment to overall enterprise strategy, and deciding the appropriate funding route. Other important focus areas include FEED, specifications, and proactive process management for permitting and selecting technology.

Optimizing the business case through project value improvement

As project objectives are validated, owner-led project value improvement (PVI) then presents the greatest opportunity to improve project economics. Here, different opportunities are targeted to improve NPV across the life cycle of the project (exhibit).

At the early stage, PVI focuses on business case optimization, fundamentally challenging, validating, and optimizing macroeconomic project drivers (such as capacity, location, technology selection, make-versus-buy considerations, feedstocks, specifications, and synergies with existing assets). As design progresses, owners must ensure only mandatory requirements are being delivered, with all decisions having clear links back to the business case. Importantly, this is not about limiting scope or simply making "yet another value engineering effort" but about identifying a minimum technical solution that meets requirements and ensuring all options above this solution are evaluated on their individual merit to derive the optimal project.

Later on, PVI should continue along the project life cycle as further decisions get locked in, reducing degrees of freedom to make changes. Even the best engineering teams need checkpoints to reevaluate the premise and prevent myopia.

The benefit of structured PVI can be significant if owners challenge traditional solutions and build a collaborative ecosystem with their E&C partners, with aligned incentives for value creation. One industrial company, for example, achieved capex savings of 35 percent by executing targeted PVI sprints on the largest cost areas.

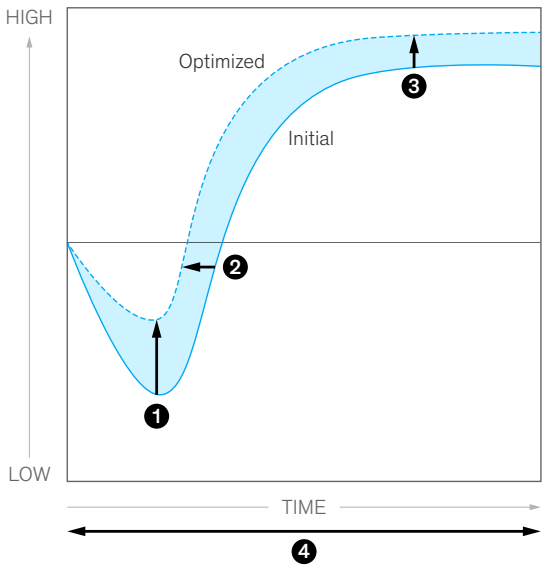
Looking for opportunities to accelerate the schedule in this period can also be important. Here, an early focus on the overall construction and commissioning schedule against ambitious but realistic rates of productivity can enable early activities (such as material takeoffs and enabling works) to progress, resulting in time gains in later execution phases.

Before making the FID, owners can also conduct detailed functional premortems, assessing what-if

Exhibit

Preconstruction excellence addresses all drivers of net present value across the project life cycle.

Project cash flow, illustrative



Create an enabling project planning and execution environment, through robust tracking tools, well-designed organizational structures, strong governance, and stakeholder management.

1 Reduce initial capital requirement

2 Accelerate project timeline/ ramp-up

3 Maximize life-cycle cash flow by optimizing cash costs (eg, trade off operating and capital expenditures, reduce working capital)

4 Identify, analyze, and mitigate risks

McKinsey & Company

scenarios for project delivery based on internal and external intelligence. Defining the project delivery system for execution complements this process and encompasses the processes, data, and systems to track, monitor, and manage performance across all project phases.

Critical preconstruction focus areas for owners

For owners, committing to preconstruction excellence starts with setting ambitious business targets for projects and seeking buy-in from all project stakeholders (including operations) to ensure there is shared commitment to the investment. Once targets are set, owners can then assess the full potential of cost and schedule improvements across all project phases. This is initially focused on top-down benchmarking of performance requirements, before transitioning to detailed bottom-up improvement initiatives that ensure targets are realized.

Decisions can then be taken quickly and effectively by ruthlessly challenging project scope, requirements, and specifications—with the same type of focus and commitment stakeholders would invest if it were their own funds on the table. Inevitably, this exercise presents trade-offs around key project attributes for debate and decision.

After major decisions on scope are made, PVI can then assess a minimum technical solution for delivery, with any additional options on top assessed for NPV benefit on their own merit. Once the project is locked in for FID, it is critical that decisions remain decided and are not treated as options subject to change later as detailed design commences.

E&C organizations: Collaborating for rapid solutions

For E&C organizations, which often find themselves engaged late by owners taking FID, preconstruction excellence requires them

‘We created $1 billion of value on P&G’s capital program by deploying Lean Integrated Project Delivery.’

—Mike Staun, former associate director of capital management at P&G

to be ready to rapidly establish new technical solutions and management practices that maximize NPV for their clients and profit for themselves.

Taking a truly collaborative approach with their clients to shape scope, feasibility, and execution strategy can enable fast decision making and value maximization for E&C firms. This requires agility and the use of lean execution and industry-leading digital tools in planning and design from day one to bear fruit later on in construction.

Selecting and deploying the right contract model is a key mechanism for enabling E&C players to access the project and support early optimization. A range of models can be considered here, with convertible lump-sum models and integrated delivery approaches most often setting up projects for true collaboration in delivery. “We created $1 billion of value on P&G’s capital program by deploying Lean Integrated Project Delivery,” says Mike Staun, former associate director of capital management at P&G.

Ultimately, the selection of the contracting model is dependent on the capability of the owner and the preferences of the market in which the work is taking place. Irrespective of model selection, for E&Cs, full transparency around cost and schedule assumptions can support trust-based relationships with owners and help increase certainty in joint delivery.

Looking to the future, the use of generative system–based (as opposed to discipline-based) design is likely to become increasingly important for E&C players as a lever to enhance project design and delivery.

Critical preconstruction focus areas for E&Cs

E&Cs can approach preconstruction excellence by first interrogating their current strengths and the improvement areas required to fulfill the needs of potential clients and to set them apart from their competition. They must also focus on building their plans for execution across schedule, procurement, and resourcing.

E&Cs can also seek long-term, performance-based partnership arrangements with an ecosystem of suppliers and clients, whereby they can improve transparency on needs and outcomes.

Finally, E&Cs may also need to identify and secure the talent needed to deliver on new ways of working with potential customers, especially as construction activity ramps up in the coming years. The potential value at stake is almost beyond comprehension. Wasted efforts designing and building things that are not needed are resulting in trillions of dollars of value loss annually and an unnecessary environmental burden for one of the most polluting industries in the world.

The global capital projects ecosystem is faced with a once-in-a-generation challenge. A changing climate and populations in poverty demand that capital be deployed better than ever before.

For owners, failing to exercise due diligence before FID could leave significant value on the table and see suboptimal projects taken into construction. For E&C organizations, it could mean missed opportunities to position themselves as market leaders and improve project margins. For investors, continuing to overtrust project teams to deliver may result in lower returns on invested capital, time and again.

In all cases, it is critical to incorporate real trade-offs into executive decision-ready materials that allow decision makers to understand the choices in front of them and the implications of each choice.

Thoughtful implementation of preconstruction excellence can deliver value for all stakeholders in the project life cycle, and help close the gap between what the world expects to spend and what it needs to spend, to improve infrastructure and reach net-zero targets.

Matthieu Dussud is a partner in McKinsey's Paris office, **Steffen Fuchs** is a senior partner in the Dallas office, **Oliver Kernick** is an associate partner in the London office, **Piotr Pikul** is a partner in the Toronto office, and **Christoph Schmitz** is a senior partner in the Frankfurt office.

The authors wish to thank Becca Kuusinen, Francesc Roca, Natali Naegle Ruban, and Mike Staun for their contributions to this article.

Designed by Global Editorial Services