FROM THE FIELD

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THE FALSE ECONOMY OF SKIPPING DESIGN

Focus Point

In large, complex industrial projects, design gets treated as the line item nobody defends: small share of CAPEX, no visible progress, easy to compress.

The risk doesn't vanish. It relocates.

It returns as change orders, schedule slip, cost overruns—and, most critically, lost operating revenue.

This isn't theory.

It's pattern, observed consistently across industries and geographies.

The illusion of control: some projects appear, at least initially, to be set up for success.

Governance structures exist. Investors are credible. Advisors are visible and engaged. Presentations tell coherent stories, language is aligned, decisions appear rational. This is the reassuring landscape of large industrial capital: complex, yes, but seemingly under control.

In early phases, there's a clear sense of order. Roles are defined, processes look robust, responsibilities are allocated. Experience from other contexts is treated—implicitly—as transferable assurance: it's been done before; we understand how it works. The project doesn't emerge improvised. It takes shape within a decision-making framework that, from the outside, looks solid.

It's precisely within this "ideal" setting that some of the most consequential decisions begin to crystallize.

From foundation to variable

Early on, everything is broad and conceptual. Volumes are indicative, layouts remain schematic, technical solutions are described more than defined. This is natural: at the outset, an industrial project is primarily a vision.

At some point, however, that vision must solidify. That transition requires time, discipline, and investment.

Here the atmosphere shifts—almost imperceptibly.

As attention turns to overall CAPEX, upfront design begins to be viewed differently. No longer the foundation on which everything rests, but one cost item among many. In relative terms, it weighs little. It doesn't create square meters, install equipment, or generate visible physical progress.

It becomes a natural candidate for reduction.

First compressed. Then accelerated. Finally, fragmented.

Certain issues, the argument goes, can be clarified later. Some details can be resolved during execution. Contractor experience will compensate for what remains undefined.

The shift isn't abrupt. It's gradual. That's what makes it dangerous.

Engineering as commodity—until it isn't

At this stage, a common assumption surfaces: engineering is, ultimately, a commodity. A capable EPC contractor, backed by a solid contract, can absorb the remaining complexity. The project can be "closed out" along the way.

The logic is understandable. Time is critical. Capital carries cost. Every month gained feels like progress. So the decision is made to move directly to EPC, relying on the contract as the primary risk control mechanism.

Let's be clear: the EPC model isn't broken. It's misapplied.

When applied within a well-defined technical perimeter, it works—often very well.

The problem arises when it's asked to compensate for what was never properly defined upstream.

Without robust project definition, the contract doesn't eliminate risk. It makes it invisible.

When packages stop talking to each other

The first warning signs emerge consistently in the same place: at the interfaces between packages.

Civil works, architecture, process systems, utilities—disciplines that, without strong upstream design, progress in parallel rather than true coordination.

Foundations move forward while process requirements evolve. Clear heights become issues after layouts freeze. Interferences surface when resolving them requires demolition and rework.

Individually, none of this is dramatic. Collectively, the impact is severe.

Without integrated design, package management becomes continuous negotiation. Local decisions generate system-wide consequences. Each correction triggers cascading delays. Complexity hasn't been eliminated—it's been deferred.

When risk materializes

At this point, risk stops being abstract.

Change orders accumulate. Decisions meant to be taken "later" return to the table under the pressure of an active construction site. Timelines slip—first by weeks, then months.

The issue is no longer just higher direct costs. It's time.

Every on-site correction requires redesign, approvals, re-coordination. Every delay in physical progress pushes back commissioning, start-up, production.

In a complex industrial facility, delay isn't neutral. It means foregone revenue, missed market windows, capital tied up without generating returns.

And while this unfolds, it's often said that such outcomes are part of project complexity. True. But much of this complexity was entirely predictable.

The real cost of the "initial saving"

Field experience isn't the only evidence pointing to early-stage engineering reduction as false economy. The same conclusion emerges consistently from research on large industrial and infrastructure projects.

One of the most authoritative sources is Independent Project Analysis (IPA), led for years by Edward W. Merrow, which has examined thousands of industrial capital projects worldwide. IPA research shows, with striking consistency, that front-end maturity—advanced design prior to final investment decision—is one of the strongest predictors of cost and schedule performance.

The pattern is clear:

- Projects entering execution with mature front-end definition experience limited cost deviation, typically within a few percentage points of approved budget
- Projects proceeding with weak or incomplete definition suffer cost overruns frequently exceeding 20–30%, with significant schedule slippage
- Average schedule slip increases from roughly 5–7% in projects with mature front-end definition to well above 20% where design maturity is insufficient

What isn't resolved upfront is paid for later—once construction is underway.

Similar findings emerge from historical studies conducted within Bechtel and reported by the Project Management Institute, drawing on research from the Construction Industry Institute (CII). The implication is counterintuitive for management: starting earlier doesn't mean finishing earlier. More often, it creates the illusion of speed—an illusion lost later, with interest, during execution.

When translated into operational terms, the message is direct. Compressing upfront engineering to achieve immediate savings—typically 30–40% of the design budget—doesn't eliminate risk. It displaces it. That risk reappears as change orders, inefficiencies, rework, and, most critically, delays.

Experience consistent with IPA and CII benchmarks indicates such choices result in overall CAPEX increases of 5–10%—even in projects not considered failures. Where front-end definition is weak, the impact can be far greater.

For a €500 million industrial investment:

- 5–10% CAPEX increase = €25–50 million in additional direct cost
- Time-related indirect costs: delayed commissioning, postponed market entry, operating revenues pushed out

In capital-intensive sectors with margins sensitive to time-to-market, these effects can equal—or exceed—the additional CAPEX itself

The initial "saving" reveals its nature: upfront engineering represents a small fraction of total investment, yet governs a disproportionate share of economic risk. Reducing it may improve a budget short-term; it rarely improves project value over the medium to long term.

The paradox is obvious: a few million saved early becomes tens of millions lost later. With one difference—the early saving appears in reports; the eventual cost remains embedded in the project.

Execution as strategy

At this point, the issue stops being technical and becomes strategic.

Pasquale Pistorio, my CEO in the early years of my career, would have framed it this way: in high-technology manufacturing, execution is strategy.

This wasn't a slogan. It was a principle embedded in how decisions were made. The distance between an idea and a functioning plant is measured in engineering rigor, discipline, and integration capability. If execution is strategy, then everything enabling execution—upfront design, consolidation of technical decisions, early resolution of interfaces—is itself part of industrial strategy, not technical overhead.".

Short-term focus, incentives, and organizational memory

There's another dimension, less technical but equally important.

Decisions to compress upfront engineering are rarely made by those who will live with the project during its operational life. They're shaped by short-term considerations: financial milestones, annual targets, incentive structures linked to rapid start-up.

Procurement performs its role. Finance does the same. Each optimizes against the metrics by which it's measured. The fact that, years later, the project suffers from

higher costs or operational delays becomes someone else's issue—or, more often, absorbed by the organization's short memory.

This isn't cynicism. It's systemic.

Designing in unfamiliar territory

All of this amplifies when projects are developed in contexts not fully understood. Regulatory frameworks, permitting practices, implicit liabilities, local supply chains—factors that rarely surface clearly in early decision-making, but become decisive once construction is underway.

In such environments, strong upfront design isn't merely a technical exercise. It's a translation tool. It makes implicit assumptions explicit, identifies where informal rules outweigh formal ones, clarifies where adaptation must occur before construction begins rather than through correction later.

Skipping or compressing this phase means forfeiting a critical layer of contextual understanding. When the context hasn't been understood, the project adapts in motion—at the cost of structural delays, inefficiencies, and friction.

A pattern that cuts across sectors

This isn't an isolated story. It repeats with striking regularity across complex industrial facilities, energy infrastructure, and advanced manufacturing environments.

Technologies change. The underlying dynamic doesn't.

Upfront engineering isn't an insurance policy guaranteeing success. But it's one of the few levers that materially reduce the probability of failure at the worst possible moment.

What's systematically underestimated isn't the cost of engineering—but the cost of not having done it when it mattered.