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FROM COST CONTROL TO VALUE REALIZATION: THE STRATEGIC INTEGRATION OF COST ENGINEERING WITH OPERATIONAL READINESS AS A SECOND-ORDER CAPABILITY

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Without a doubt, Cost Engineering is one of the most powerful enablers of disciplined capital project delivery. Through structured methodologies such as Class 5 - 1 estimating, Earned Value Management (EVM), and the Total Cost Management (TCM) framework among others, AACE has provided organizations with the tools to deliver increasingly complex projects with a high degree of financial predictability (AACE International, 2015). These practices enhance decision-making, strengthen governance, and enable organizations to allocate capital with greater confidence. As evidenced in many industries, this has successfully translated into tighter cost performance, improved transparency, and more resilient execution environments.

On the other hand, the transition from project completion to live operations is the most critical and uncertain phase in the asset lifecycle, where value is either realized or irreversibly lost (Tain, 2026). While cost engineering has significantly advanced how projects are delivered, a systemic challenge remains unresolved: the recurrent gap between project delivery and operational performance. Organizations continue to deliver assets on time and on budget, only to encounter delayed startups, unstable ramp-ups, and operational inefficiencies once the asset is brought to life. Evidence from projects across the world show that this is a recurring issue, leading to one of the most important statements emerged from the complexities of contemporary project execution: technical completeness should no longer be confused with operational readiness.

From a leadership point of view, there's a structural challenge associated with how success is defined and managed. Cost engineering, as currently applied, is optimized for execution efficiency: it ensures that organizations answer the question "Are we delivering the project correctly?" However, by itself, it does not fully address the more strategic question "Will this asset perform as intended in real-life conditions?". This distinction is fundamental, thus organizations that fail reconciling this challenge risk achieving execution excellence while simultaneously underdelivering on value.

A Capabilities Lens: Bridging the Transition of Projects to Live Operations

The strengths of cost engineering practices remain essential and should be reinforced. Probabilistic estimating and quantitative risk analysis enable decision-makers to understand uncertainty and make informed investment decisions (AACE International, 2018).

EVM provides a real-time lens into performance, allowing early detection of deviations and reinforcing accountability across project teams (Fleming and Koppelman, 2016). The TCM framework further supports a lifecycle view, aligning financial planning with execution realities. Together, these capabilities establish a strong foundation for control, discipline, and predictability, hallmarks of effective project governance.

On the other hand, the introduction of the Three Orders of Operational Capability framework (Tain, 2026), theoretically founded in the concept of dynamic capabilities (Teece, 2007) provides a structured way to understand how organizations deliver and sustain value based on an organization's ability to sense signals, seize opportunities, and engage transformation in response to evolving environments. The following points summarize the key insights in the Three Orders of Operational Capabilities framework:

- Operational execution capabilities, or first-order capabilities, enable routine performance under stable conditions.
- Operational Readiness capabilities are considered of second order. These capabilities are oriented to manage the transition from project to operations, ensuring alignment across systems, people, and processes.
- Outcome Assurance capabilities, or third-order capabilities, provide adaptive governance, continuous monitoring, and organizational learning to sustain performance over time.

It is important to understand that these layers are not independent, they are interconnected. weaknesses in one layer propagate across the system, often with amplified consequences.

Under this framework, Cost Engineering practices belong to what can be described as first-order capabilities. They are designed to optimize execution within defined parameters. What they do not inherently provide is the ability to integrate, adapt, and transform across the complex transition from project delivery to operations. This transition is not simply a continuation of execution; it is a shift into a fundamentally different environment: one characterized by uncertainty, evolving system behavior, and real-time decision-making under pressure.

It is precisely here where Operational Readiness must be reframed, not as a late-stage activity, but as a second-order organizational capability. Operational Readiness operates above execution. It integrates technical systems, aligns operational teams, embeds governance structures, and ensures that the organization is prepared to receive and operate the asset effectively. It is the mechanism that converts project outputs into operational performance. Without it, even the most well-executed projects remain exposed to value erosion during startup and early operations.

In a nutshell, Operational Readiness enables organizations to anticipate risks, mobilize resources across functions, and adapt operational systems in real time. It is not static, and it is not procedural. It is an active, integrative capability that governs how value is realized from capital investments. It represents a critical leadership lever in managing complexity and uncertainty during the most consequential phase of the project lifecycle (Tain, 2026).

Reconciling Cost Control and Readiness: Value Realization and Risks in Complex Environments

Complexity Theory offers a compelling lens to understand transformative processes in organizations. Organizations can be conceptualized as complex adaptive systems where outcomes emerge from the interaction of multiple elements that include technical, human, and organizational (Holland, 1992; Perrow, 1984). In such systems, performance cannot be guaranteed only through linear planning processes. It requires capabilities that enable sensing emerging risks, coordinating responses, and adapting dynamically as conditions evolve. This is particularly important during the transition assets into live operations: as the new organization will not simply be the linear integration of the project into the organization. Instead, it will be the live entity capable to create a value, derived from the transformation, that is greater than the sum of its internal components.

On the other hand, a critical insight for leadership is the central role of risk management across all these layers. Risk management is not simply a control function; it is a strategic capability that underpins Operational Readiness and Outcome Assurance. During transitional phases, risks emerge simultaneously from technical uncertainties, human factors, system interactions, and organizational processes.

The ability to identify, assess, and respond to these risks in a timely manner becomes the defining factor in successful transitions (Tain, 2026). Risk management, therefore, enables the sensing-seizing-transforming continuum required to effectively navigate project transitions to live environments.

At this point, we can appreciate a fundamental challenge for traditional cost engineering. Cost frameworks typically conclude at project closeout, leaving an open spot during the most value-critical phase: startup and early operations. The financial consequences of delayed ramp-up, operational instability, and post-handover rework are rarely identified in formal cost reporting. This creates a disconnect between reported project success and actual business performance.

To address this, a broader perspective is required to reflect the true cost of investment. For this reason, we propose the conceptualization of a Readiness-Adjusted Cost (RAC) defined as:

RAC = CapEx + Cost of Non-Readiness

It is important to highlight that determining the Cost of Non-Readiness requires special considerations as it does not follow a traditional estimating mindset. Treating cost of non-readiness with the same aggregate approach as a normal CapEx estimate, where a precise number is obtained with deterministic methodologies, will be misleading. Instead, computing the cost of non-readiness require the integration of contextual variables to frame it as a risk-adjusted estimate of the financial impact of performance gaps during startup and early operations. In other words, the objective is to appreciate the difference between planned and expected operational outcomes.

At a tactic level, the estimate process to arrive to a cost of non-readiness should incorporate scenario-based analysis, where potential startup delays, ramp-up inefficiencies, operational instability, and post-handover rework are quantified using meaningful operation-related analysis mechanisms. These mechanisms include production curves, unit margins, probability-weighted risks, time series analysis, among others.

At its core, cost of non-readiness represents the economic value of the gap between technical completion and operational performance. This will allow to translate

levels into financial exposure, enabling organizations to extend cost engineering from measuring what was spent to understanding what is at risk of not being realized.

Final Thoughts

In summary, the analysis above allows to appreciate, firstly, that operational readiness must be elevated from a procedural requirement to a strategic capability embedded within the organization that ensures projects and assets are delivering the value there were conceived for. With this, it will be possible to build the stage that extends cost engineering frameworks beyond project delivery and include operational performance, with risk management as a central mechanism for decision-making under uncertainty. In a nutshell, cost engineering estimates what it takes to build the asset. Cost of non-readiness estimates what it takes to make it work.

Overall, success is no longer defined by delivering projects within cost and schedule constraints alone. It is defined by the ability to deliver assets that perform reliably, safely, and sustainably from the moment they enter operation. This is the true measure of value realization. Therefore, in an increasingly complex and capital-intensive world, organizations that develop higher-order capabilities will differentiate themselves as they will not only deliver projects efficiently: they will consistently convert those projects into operational success. Cost engineering will remain as critical foundation, and Operational Readiness and Outcome Assurance will determine whether that foundation translates into lasting value.

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