

# The Capital Construction Predicament

Why construction cost should now  
be treated as a major business risk  
and a competitive opportunity



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## Capital construction cost for large process plants has risen 60% in little more than a decade

Construction cost as a percent of total capital cost for large process plants on the US Gulf Coast has increased by approximately 60% since 2003. From the 1970s through the early 2000s it was a predictable 20-25% of total cost; today it is 40-45%<sup>1</sup>.

Most owners are generally aware of this dramatic cost increase, but they do not necessarily view it as a competitive issue, since it is assumed that the trend affects all owners equally. However, it is our belief that a significant amount of the new cost is extraneous, and can be substantially reduced if properly managed. Due to its significant impact on ROCE and cash flow, construction cost should now be viewed as a major business risk and a competitive opportunity.

Westney has identified three key drivers of the increase in capital construction cost. In each of the subsequent sections, we offer our view as to the cause(s) of these drivers, and how they can be addressed.

## Available skilled construction resources are not adequate for today's large and complex projects

To take advantage of economies of scale, plants currently being built are generally twice the capacity of those built in the late 1990s and early 2000s. While equipment and control counts may be similar, components are larger, heavier, and more massive.

Meanwhile, worldwide (particularly in North America), skilled construction resources are not available to meet the requirements. The financial and operational economies of scale that are driving the increased size of these plants have created systemic cost and schedule risk due to the contractors' lack of adequate experienced and skilled people to construct these large and complex projects.

The decline is particularly evident in front line supervision and key installation skills. The projects are getting staffed, but production is abysmal. If we calculate project construction cost based on 1995 craft production levels versus production levels being achieved in the current market, the results would indicate an additional cost of several \$100s of millions for current US Gulf Coast ethylene plants.

Figure 1 gives a visual representation of the challenges presented by the current market.

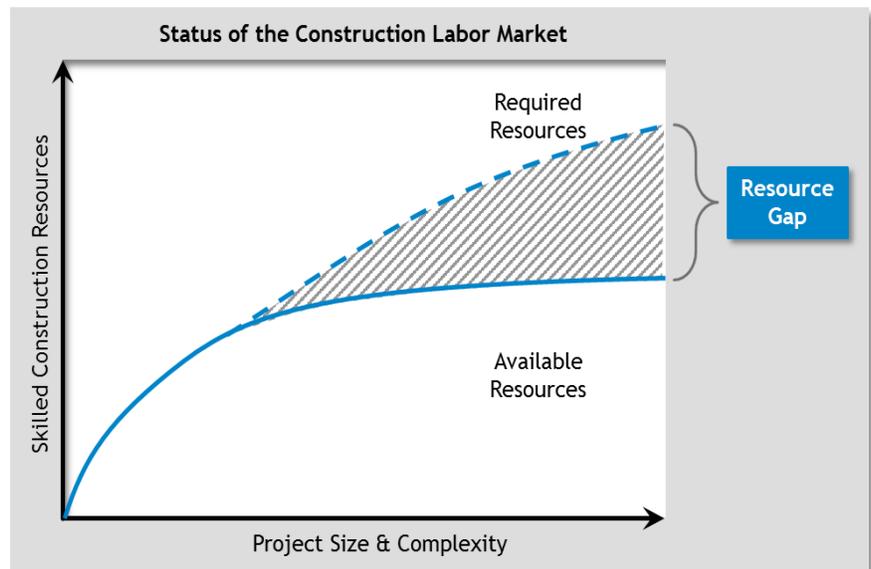


Figure 1

<sup>1</sup> Source: Westney construction cost database

Owners have made it very difficult for contractors to address the construction resource gap by increasingly treating construction as a commodity. Commodities are generally purchased based on price alone – it is assumed that the quality of delivery will be the same, regardless of the supplier. This drives down margins and, in turn, reduces contractors’ abilities to develop and maintain resources.

Contractors have generally yielded poor financial results in fixed price and risk-taking contracts, and the stock market has significantly punished them when these losses are exposed. When not taking risk, contractors can reduce overhead by not retaining critical construction resources between projects and eliminating risk management overhead.

So how can this problem be addressed? Owners and contractors must continue to work together to better plan for, recruit, train and retain the right skilled crafts and supervision, but we believe that contractors are unlikely to solve these problems on their own. Owners should become much more informed and active in the planning process so that they can lead with appropriate decisions that can only be made correctly in the very early stage of a project.

The owner must start during the business planning stage to gain a much better understanding of the proposed project’s construction requirements and the potential limitations of the location. Historically, the owner has waited until the FEED stage or contractor selection to take this step. To be effective, this planning needs to happen during the formative stage of the project, with forward-looking market assessments and evaluation of potential contractor capabilities – i.e., treating construction as a key business risk.

The key aspect is determining if there are contractors and resources that fit the needs of the project. At a minimum, the owner should take action ahead of the competition to secure the contractors that have access to the required resources. Actually solving the problem may require implementation of some owner-driven construction resource concepts borrowed from other industries and some pre-investment at selected sites.

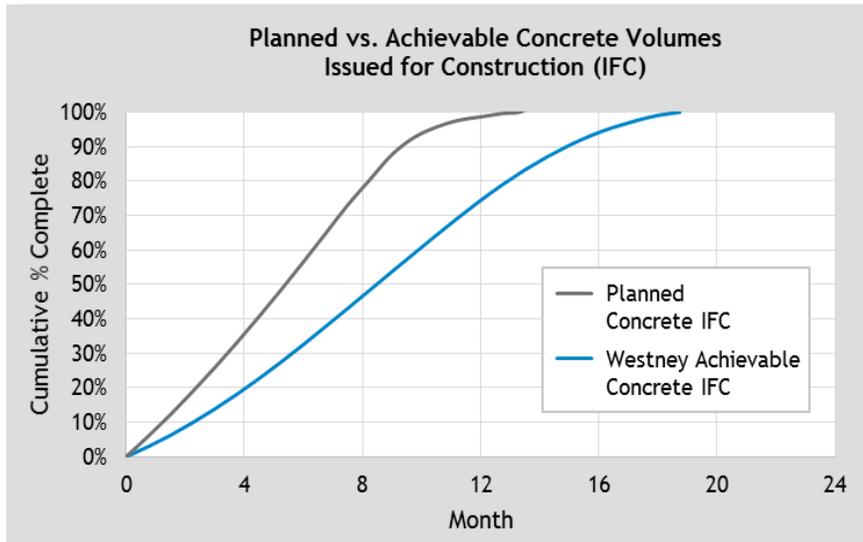
Our experience has taught us that the critical mass of experienced supervisors and critical skilled labor required for a successful project is only about 15% of the total workforce. If this critical mass can be secured, the likelihood of an effective workforce is greatly improved.

## Increased planning and reporting detail drives a sense of “false accuracy”

A second driver of increased construction cost is related to the planning and management of construction. In an attempt to improve declining construction productivity, contractors, academics, and consultants have promoted planning and managing the work to a much higher level of detail. In addition, due to deteriorating project results and the trend to shift more risk to owners, owners have increased oversight and increasingly requested this additional detail. This has resulted in a dramatic increase in the amount of detailed information created, processed, and managed for today’s projects.

A major part of the issue is that, with today’s software, extraordinary detail has become easy to produce. A 30,000-activity schedule or a very detailed cost estimate can be built with relatively minimal effort. The problem with this approach is that many of the inputs (e.g., production rates, durations, etc.), at that level of detail, are created or adjusted largely based on opinion (i.e., not hard data), and are often influenced by optimism. The accuracy of the data is very difficult to verify against historical performance, and the voluminous amount of information that is produced is also very unwieldy to evaluate.

The vast majority of the time, when we examine the details of a project’s schedule, we find significant gaps between production rates in the schedule and what is actually achievable, as illustrated in *Figure 2*.



*Figure 2*

Some of the gap is simply due to the common belief that with good front-end loading and FEED, you have solid definition, and therefore can accurately predict cost and schedule. While you do have definition with respect to the general scope, the level of definition required for accurate installation quantities (upon which you can accurately predict outcomes) only comes when the detail engineering is roughly 60% complete. Until that point, you either have volumetric representations or forced

quantification. Most sanction estimates are actually volumetric quantity representations of equipment factors, with large adjustments at the summary level.

Our analysis indicates that the returns on the added detail are quite negative based on the value it provides versus the cost of producing and maintaining the detail. It is also clear from our observations that management has much more information than can be absorbed, and the information is not realistically fact-based. This level of detail is too granular to be effective as a management tool during execution. This results in a lack of ability to provide clear management direction to address key issues.

Too often when we ask project directors questions on issues such as production rates, they do not have the information readily at hand. The information they do have is generally untimely, and often is not presented in a way that allows action. In other words, we believe that contractors are developing and reporting on detail that is not really utilized by leadership in the owner or contractor organizations. We know of one situation where a phrase was placed in the middle of the monthly report offering a \$100 reward if and when its existence was reported to project leadership. The reward was never claimed.

There is a “manageable level of granularity” around key production rates that can provide effective and timely management. What is needed from the detail that we do have is a focus on production rates and durations of key activities – i.e., managing per the dependencies of key activities, rather than trying to manage by a 700-page schedule. Currently, many schedule summaries are confusing and misleading due to inconsequential activities inappropriately depicting durations as being longer than they truly are, because events such as “prepare job books” are rolled in. Owners should specify that simple, yet accurate (i.e., not overly optimistic) measures – such as the achievable production rate in *Figure 2* – be implemented to plan construction activities, and insist that contractors track their progress using these tools.

This approach saves both the owner and the contractor money by eliminating the cost of producing unnecessary detail. Additionally, by focusing on fewer elements, the information is timely and allows detection of problems in time to take action on them. Where we see this “manageable level of granularity” utilized, the results are improved performance, and construction costs that are a lower percentage of total capital cost – even in the current market.

## Confusion around the definition of an EPC contract leads to uncertainty regarding allocation of project risk

A third driver of the increase in construction cost is caused by confusion about the roles and accountabilities of contractors. Many utilize the term “EPC contract” as a way of defining specific accountabilities for risk assumption and performance, but this can be deceiving. The term “EPC” only defines that the functions of engineering, procurement, and construction are included in the contract. True responsibility and accountability for contractor performance is only evident when you look at the specific contractual terms. EPC contracts can be reimbursable or lump sum with guarantees. Owner project teams often confuse this term.

We find that, in general, contractors can be segregated into two broad categories by responsibility for project outcomes and risk-taking. Our term for the minimal accountability / non-risk-taking type of contractor is “Project Services Contractors.” The other type, where the contractor is willing to guarantee completion and performance to at least 15% of the aggregate project value, we call “Project Delivery Contractors.”

Figure 3 illustrates key differences between the two ends of the contractor spectrum.

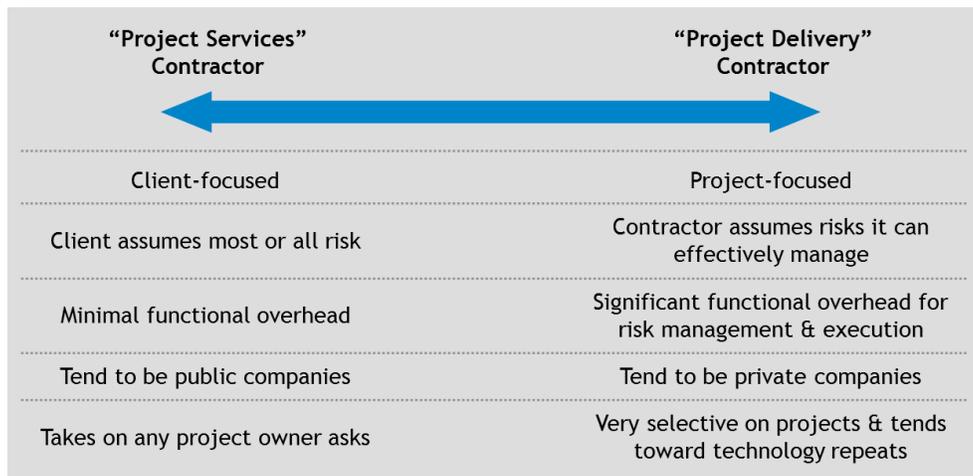


Figure 3

There has been a significant shift in the last 20 years toward the Project Services Contractor side. There are two basic reasons for the shift:

1. Owners buy on price (i.e., commodity services) and want control.
2. Contractors have generally yielded poor results in fixed price and risk-taking contracts.

As a result, the number of Project Delivery Contractors is very limited.

Many owners' capital project delivery organizations also tend to view the Project Delivery Contractors as arrogant, aloof, and not open to doing things the owner's way. Thus, owners often avoid working with them. If the contractor is going to take risks, then they must be allowed to manage them; but the balance is difficult, especially for owners with large organizations or little history of contractor risk-taking contracts.

While owners may prefer not to work with Project Delivery Contractors, many owners do like the idea of the contractor assuming some risk for delivery. This has led to many Project Services Contractors taking on contracts requiring the tools and attitude of a Project Delivery Contractor, but it is extremely difficult for a Project Services Contractor to successfully manage the types of risks affiliated with today's large, complex projects, given Project Services Contractors' minimal overhead and risk management capabilities.

It is no wonder that contractors generally fail to meet expectations in these cases, putting both owner and contractor in an unfavorable situation. There is currently a rash of lawsuits on the US Gulf Coast, where owners have gone outside of the contract to sue the contractor for tortuous misrepresentation of their ability to manage the risks and accountabilities of an "EPC" contract, when in fact these were basically reimbursable contracts.

Early due diligence on contractors' true capabilities and resources can help owners avoid this common problem. It is also important for owners to understand their own capabilities, relative to the nature of the project. If hiring a Project Delivery Contractor, allow them to manage the risk they are taking without significant intervention. If hiring a Project Services Contractor, do not have expectations that they are going to manage risks.

## **The marked increase in capital construction cost represents both a risk and an opportunity**

Many of the factors contributing to the increase in capital construction cost are deeply entrenched via decades of project history and industry practice. However, there are some key adjustments that can be made by owners and contractors to turn this key business risk into a competitive advantage.

A good place to start is to give early consideration to the plan for acquiring skilled construction resources, focus on a manageable level of granularity in project progress metrics, and work to understand organizations' true capabilities for managing construction-related risks. Those who best understand these trends and position their projects accordingly should be able to beat what has become "typical market performance" in capital construction cost.

## Project overview performance metrics for the US Gulf Coast

Westney shares a high-level view of key project overview metrics on an annual basis as a means to improve industry knowledge and project planning. These baseline metrics can serve as the basis for your own project overview analysis.

Below is our view for 2016.

### Work-hours

| 2016 Expectations<br>Work-hours per Unit | Unit                       | Lower Temp /<br>Pressure / Corrosion<br>/ Equip Count<br>Projects | Higher Temp /<br>Pressure / Corrosion<br>/ Equip Count<br>Projects | Recently Observed<br>Projects |
|--|----------------------------|---|--|-------------------------------|
| Engineering and Home Office Construction | Pieces of Major Equipment  | 2,300   | 3,500 <sup>(1)</sup>   | 2300 to 4,400 <sup>(1)</sup>  |
| Concrete                                 | Cubic Yard <sup>(2)</sup>  | 12  | 16   | 12 to 22                      |
| Structural Steel                         | Ton                        | 35  | 45   | 30 to 55                      |
| Pipe                                     | Center Line<br>Linear Foot | 2.7   | 4.0  | 2.7 to 7.6                    |
| Electrical                               | Linear Foot                | 0.25  | 0.35   | 0.23 to 0.45                  |
| Instruments                              | Each                       | 25  | 35   | 35 to 40                      |

(1) Excludes LNG, which is much higher at ~8,000 hours per piece of major equipment

(2) Inclusive of area paving

### Cost

| 2016 Expectations All-in Contractors Rates  | Low Rate <sup>(1)</sup> | Fair Price <sup>(2)</sup> |
|---|-------------------------|---------------------------|
| Engineering and Home Office Construction – Houston<br>(Excludes Travel and Accommodation)                         | \$75                    | \$140                     |
| Engineering and Home Office Construction –<br>High Value Center (Excludes Co-located Project Supervision and T&A) | \$42                    | \$45                      |
| Construction  | \$90                    | \$100                     |

(1) The Low Rate represents services provided for no risk, generally continuous work or project hiring and minimal functional support

(2) The Fair Price represents contractors taking risks and maintaining resources for supervision continuity, functional support, skills advancement and risk management

## About Westney Consulting Group

Since 1978, Westney Consulting Group has advised executives in the oil & gas, power, chemicals, and mining industries, helping them make more informed decisions and achieve more predictable outcomes for their major capital projects.

Recently, Westney was recognized in the Kennedy Research & Consulting Advisory (KRCA) 2015 research & advisory report: *Capital Strategy & Capital Projects Consulting*. KRCA is the world's most influential market research firm devoted exclusively to the consulting industry. In their 2015 report, they ranked the top 19 firms in this sector, including Bain, Boston Consulting Group, Deloitte, Ernst & Young, Jacobs Consulting, KPMG, McKinsey, PwC, and Westney. Westney was one of only four to be ranked in *The Kennedy Vanguard*<sup>TM</sup>, which is the position reserved only for those firms judged highest in terms of breadth and depth of capital project consulting capabilities.

If you would like to discuss the contents of this publication, or hear more about the type of work that we do, please contact us at (713) 861-0800, or [info@westney.com](mailto:info@westney.com).