Improving the Predictability of Major Projects

Myth and Measurement
“Management has expectations not grounded in reality... the project will cost what it will cost and I’ll be retired when all this comes unwound.”

- Whispered by a project manager as the Board approved the project
There is good reason to be skeptical of the cost and schedule predictions for large capital projects. In spite of industry best practices and a major recession, cost overruns and schedule delays continue to be a fact of life. Past project performance makes it clear that predictability cannot simply be mandated. Instead, it is a complex problem that must be continuously managed.

Now that profits, CapEx budgets, and investment opportunities have been restored, this issue has moved to the front burner for decision-makers.

“If I had one hour to save the world, I would spend 55 minutes defining the problem and 5 minutes finding the solution.”

- Albert Einstein

Carefully framing the issues of project predictability is the first step in managing them.

Understanding the Issues That Drive Project Cost

**Overall Project Costs**

Cambridge Energy Research Associates (CERA) provides a widely used cost index for energy industry projects that is shown here. It illustrates the sharp rise in project costs from 2005 – 2008, followed by a mild drop and leveling off from 2008. Given the expected improvement in global economic conditions, it is not surprising that a gradual upward trend is evident. The data suggests there is a floor under project costs: although they can escalate dramatically, there is a “ratchet effect” that limits the extent to which they can decline.
Commodities Cost

The drastic fall in commodities pricing was expected to reduce project costs. Copper is a good representation of the commodity prices that generally drive capital project costs. As the chart shows, there was a sharp drop in the price of copper in 2008, a pattern shared with other related commodities, but this trend was offset by the cost of other project components whose suppliers used various strategies to protect their pricing.

Engineered Equipment Costs

The trend to new entrants into the supplier market for engineered equipment was also expected to reduce project costs. Located mostly in Southeast Asia, China, Brazil and Eastern Europe, these new suppliers have, to date, been focused on the less-engineered equipment, offering lower prices in exchange for less predictable performance.

The impact of these new entrants has been offset by another trend: the consolidation among suppliers of engineered equipment with the highest engineering and manufacturing content (e.g., compressors, turbine and steam drivers, advanced heat exchangers, complex pumps). This consolidation has been driven by the industry’s capital intensity and cyclical workload.

The net result has been that overall cost reductions (at least through late 2010) have been minimal, but deliveries have improved.
Engineering & Construction Costs

Technical advances over the past 20 years, as well as the recent economic slowdown, were expected to improve engineering and construction productivity and reduce costs. Yet Westney data (measured in work hours per unit of measure) shows that both engineering and construction productivity – critical drivers of cost, time and predictability – have steadily decreased over the past 25 years. Why has this happened?

Engineering productivity:

One reason for declining productivity is increasing project complexity. Gains in operating efficiency and environmental compliance require designs with more piping and controls for each piece of major equipment. In addition, there has been a significant increase in both the required accuracy and volume of the engineering data needed for design programs.

Productivity has also declined due to the expertise lost through attrition; this has been exacerbated by contractors’ difficulty in attracting and retaining engineers due to the industry’s reputation as an insecure place to work.

Both of these trends are long-term and unlikely to improve in the foreseeable future.

Construction productivity:

Westney data indicates the root causes of declining construction productivity are associated with global demographic and economic trends. Changing demographic and economic trends are severely limiting the supply of skilled labor and driving the root causes of declining construction productivity, which include:

- **Declining birthrates in most of the developed world.** As a result, much of the construction labor for very large projects in the OECD nations must come from other locations.

- **Increased opportunities at home.** As the economies of emerging nations (such as the “BRIC” countries) continue to grow, the construction labor force that previously welcomed employment anywhere in the world now has employment opportunities in their own country.

- **Competition from other opportunities.** Taking place in difficult conditions and offering unstable employment, construction work is often seen as less attractive than other forms of labor.

These trends have combined to limit the supply of skilled construction labor which, in turn, is driving a long-term trend to lower productivity and less predictable performance.
Understanding the Issues that Drive Optimism and Overconfidence

**Mindsets and Behaviors**

Reward systems and corporate cultures are intended to shape the mindsets and drive the behaviors that are thought to ensure top performance. Unfortunately, in the area of capital projects, much current practice actually encourages optimism and overconfidence, filtering out anything that raises doubts about a project or makes it appear less attractive. For example:

- Owner organizations typically have a limited pool of CapEx funding for which projects must compete. Management often rewards those with a risk-taking, “can-do” spirit and encourages setting “stretch goals.” These practices tend to reward those who appear optimistic and overconfident, while discouraging realistic discussions of project risks and uncertainties.

- Rational economic behavior of contractors and suppliers encourages putting the best face on a project by basing estimates on optimistic or highly qualified assumptions. Since the owner’s project sponsors are inclined to optimism anyway, they seldom challenge these optimistic estimates.

**Over-reliance on “Best Practices”**

A best practice may be defined as one that is widely used and thought to drive successful outcomes. While best practices add value, they can also create a false sense of confidence. This occurs when they ignore or condition away the specific uncertainties and risks of the project at hand. The following table provides an example of best practices and how they can produce a false sense of confidence in a project’s predictability.
<table>
<thead>
<tr>
<th><strong>Best Practice</strong></th>
<th><strong>How a False Sense of Confidence Occurs</strong></th>
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<tbody>
<tr>
<td>Use gated processes to ensure front-end loading (FEL)</td>
<td>Stage-gate processes are good practice, but they routinely create a false sense of security when it is assumed that predictability has been assured if the process was followed. Most external risks are not reduced with time and can reappear later when things do not go according to plan.</td>
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<tr>
<td>Use normalized, historical data to predict the outcomes of current projects</td>
<td>Much of current best practice relies on benchmarking the estimated cost and duration of a given project against normalized databases of past project cost and schedule performance. Because it reflects actual experience, historical data from similar projects can be useful in testing the reasonableness of a cost estimate. Historical data benchmarking can also be misleading; it is a relative measure, not absolute. Even for very similar projects, teams and enterprise project delivery systems may be totally different and not consistent with the benchmark. These areas are rarely tested and teams tend to assume their performance will be better than the benchmark. A true measure of predictability requires an absolute view in which the project is seen in terms of its own circumstances.</td>
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<tr>
<td>Use “bottom-up” cost estimating since detailed estimates are the most accurate</td>
<td>Bottom-up estimating is based on a detailed view of the project’s design and planning. The problem is, that view may exclude potential events outside the estimator’s responsibility or the project team’s authority. As a result, bottom-up estimating often produces a false sense of confidence. Instead, an objective, top-down approach is often a more accurate way to determine a project’s likely cost and predictability.</td>
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<td>Categorize risks and develop risk registers to ensure all risks are accounted for, and to facilitate risk mitigation</td>
<td>Given the large number of risks that impact projects, it is often considered best practice to categorize risks (e.g. Site Risks, Technical Risks, Execution Risks). Lists of risks in each category are developed, forming the basis of a risk register where each risk is rated in terms of probability and impact, mitigation is defined, and responsibilities assigned. This best practice can create a false sense of security by understating a project’s true risk exposure; this happens in two ways:</td>
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<td>■ Risk registers typically focus on discrete, tactical risks that project teams can control. Broader, more strategic risks, such as those associated with economic trends or organization capabilities, tend to be outside the control of a project team and therefore assumed away, understated, or simply ignored.</td>
<td></td>
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<tr>
<td>■ Categorizing risks and managing each risk individually assumes that the risks act independently. In fact, risks in different categories are often highly correlated. This can create a perfect storm of risk exposure that is far greater than if each risk acted alone.</td>
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Understanding Predictability

Decision makers need a fact-based, unbiased view of a project's predictability, and of the issues that drive it. The best way to achieve this is by calibrating a project's predictability. Through the use of a proprietary process called Predictability Calibration™, decision makers can quickly gain an unfiltered, unbiased view of the predictability of any project at any stage.

The Predictability Calibration™ methodology uses 35 predictability factors as shown below. Predictability Calibration™ examines these factors in an integrated way to determine a project's actual predictability and compare that to the predictability that could be achieved. It is applicable to any stage of project development.

<table>
<thead>
<tr>
<th>Commercial Certainty</th>
<th>Site Physical</th>
<th>Completion Date Estimate Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completeness</td>
<td>Site Labor</td>
<td>Completion Date Commitment</td>
</tr>
<tr>
<td>Definition</td>
<td>Financial Stakeholders</td>
<td>Unaccounted-for Weather</td>
</tr>
<tr>
<td>Definition Commitment</td>
<td>Interface Difficulty</td>
<td>Contracting Strategy</td>
</tr>
<tr>
<td>Technical Maturity</td>
<td>Owner's Enterprise Capability</td>
<td>Execution Planning / Execution</td>
</tr>
<tr>
<td>Facility Performance</td>
<td>Owner's Team Competency</td>
<td>Economic and Commodities</td>
</tr>
<tr>
<td>Project Size</td>
<td>Environmental Commitment</td>
<td>Market Demand - Fab. &amp; Manuf. Mgmnt.</td>
</tr>
<tr>
<td>Business Agreements</td>
<td>Contractor's Enterprise Capability</td>
<td>Market Demand - Construction</td>
</tr>
<tr>
<td>Country / Political</td>
<td>Contractor's Team Competency</td>
<td>Commissioning &amp; Startup Assurance</td>
</tr>
<tr>
<td>Country / Taxation</td>
<td>Project Cost Estimate Quality</td>
<td>Operations Planning</td>
</tr>
<tr>
<td>Social / Community</td>
<td>Budget Commitment</td>
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![Gauge Image]
This chart illustrates how the scoring for each Predictability Factor is presented. A color code indicates the score achieved, and the shaded bar indicates what is achievable. The difference between the two scores clearly indicates areas, such as Owner’s Enterprise Capability, in which issues exist and additional work is required.

It is also important to note that there may well be Factors for which the desired level of predictability cannot be reached. For example, while work can be done to improve the score for Project Complexity, it is clear that the project’s complexity presents a level of uncertainty that, even if addressed completely, will still only reach a score of “2,” well below the level of predictability of the other Factors.

The Key Findings for each Predictability Factor provide background on the scoring and frame the key issues. For example, the Key Findings associated with Project Complexity for a recent mega-project are illustrated here. With this knowledge of how Project Complexity impacts predictability, management can make decisions with full awareness of the uncertainties involved.

**Key Findings: Project Complexity**

- The overall project includes a mine, process plant, power plant and port, all at different locations
- The process plant comprises 12 different units to be served by common utilities, and access is limited by a narrow site
- There are 5 sequential processing steps with different unit operations and numerous streams

The detailed scores and findings are summarized into an overall score as illustrated by the Predictability Gauge above. Key Findings describe those areas in which predictability can be improved as well as those for which some unpredictability must be accepted and continuously managed.
Summary

Much of the current practice for defining the predictive cost and schedule of major projects results in a view that is not objective and has been generally proven to be optimistic and overconfident.

As with any aspect of organizational performance, improvement requires understanding the problem, re-defining expectations, establishing performance metrics, making the necessary changes, and continuously improving execution. Similarly, improving predictability requires increasing the understanding of the drivers of project cost, and how organizational mindsets and practices can create a false sense of confidence. By utilizing a structured, unbiased process for calibrating predictability, decision makers can gain an unfiltered view and understand the issues to address if predictability is to be improved.
About Westney Consulting Group, Inc.

Founded in 1978, Westney Consulting Group is internationally recognized for thought leadership in the risk management, strategic planning, and organizational effectiveness of large, complex engineering and construction projects. Based in Houston, Texas, the company advises owner/operator, developer, and financial executives in the energy, chemicals, mining & minerals industries.

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