Westney
Consulting Group

# Project Predictability

## *Myth and Measurement*

**ANNUAL CAPITAL PROJECT PERSPECTIVE**

FEBRUARY 2011

"Management has expectations not grounded in reality… the project will cost what it will cost"

- Project manager
as the Board approved the project

# Project Predictability

## *Myth and Measurement*

Now that funding is flowing back into capital project portfolios, the issue of capital project predictability is front and center. There are good reasons to be skeptical of cost predictions; more often than not, major projects have cost far more than was promised.
One thing is clear: *predictability cannot simply be mandated. Instead, it is a variable that must be continuously managed.*

Managing predictability requires understanding the drivers of project cost.
Key considerations include:

- The steady decline in engineering and construction productivity over the past 25 years
- The failure of the severe drop in commodities to significantly reduce project costs
- The overconfidence that reliance on best practices often creates
- The need for metrics to proactively manage predictability

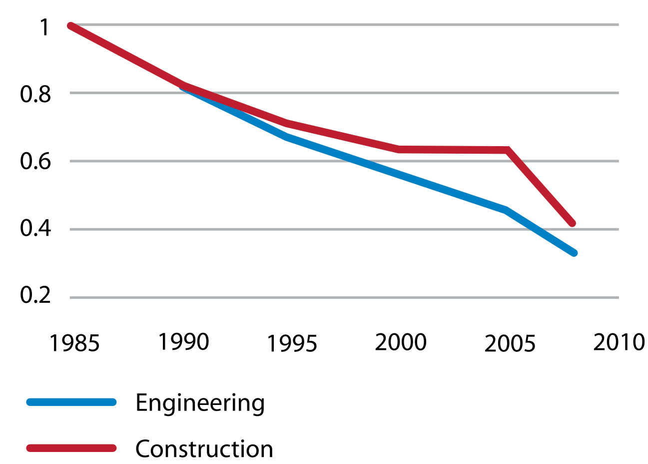
# Engineering and Construction Productivity Has Been Steadily Dropping Worldwide… And Improvement is Unlikely

Many expected the technical advances over the past 20 year to improve engineering and construction productivity. However, Westney data (measured in work hours per unit of measure) shows that both these critical drivers of cost, time and predictability have steadily decreased over the past 25 years.

***Engineering productivity*** has trended downward for two reasons: increased project complexity and loss of expertise. Gains in operating efficiency and environmental compliance require designs with more piping and controls for each piece of major equipment. This is exacerbated by the increased volume of the engineering data required. Contractors have had difficulty in attracting and retaining engineers to replace those lost through attrition, due to the industry's reputation as an insecure place to work.

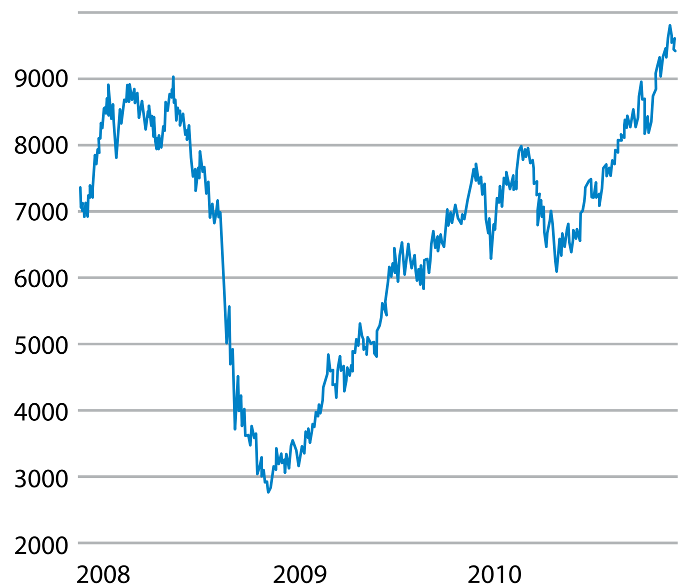
***Construction productivity*** has declined largely due to global demographic and economic trends that limit the supply of skilled labor. One of these trends includes declining birthrates in most of the developed world, forcing constructors to source construction labor from non-traditional locations. Another is the increased strength of emerging economies that can now offer increased opportunities at home. Finally, constructors increasingly find it difficult to compete with other labor opportunities that are indoors, less dangerous and offer more secure employment.

**Productivity Trends**



# Neither the Severe Drop in Commodities Nor the Great Recession Significantly Reduced Project Costs

Many expected the "Great Recession" and the drastic fall in commodities pricing 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.

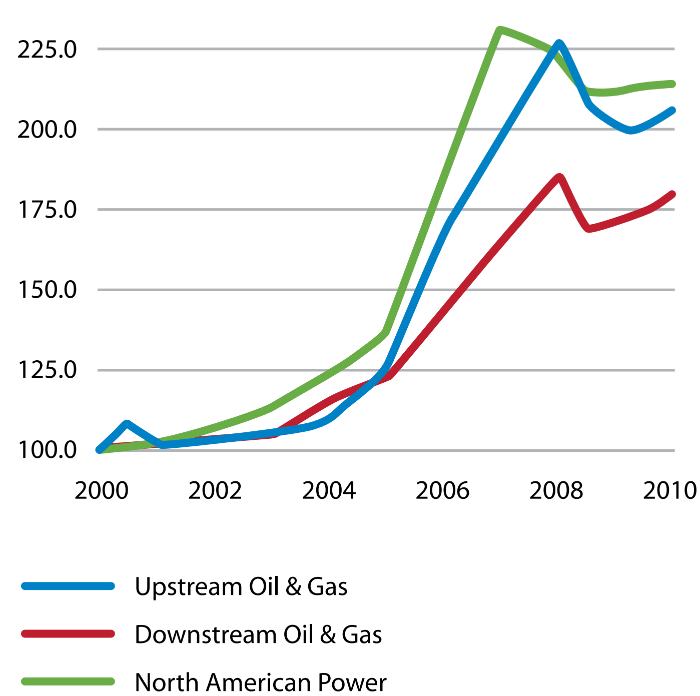



Prices in US$/metric ton
Source: London Metal Exchange

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

In spite of these and other favorable trends, overall project costs did not drop significantly. 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.

**Capital Cost Index**




As it turns out, the expected reduction in commodities pricing was offset by the cost of other project components whose suppliers used various strategies to protect their pricing. And the impact of new equipment suppliers has been offset by another trend: the consolidation among suppliers of engineered equipment with the highest engineering and manufacturing content. Driven by the industry's capital intensity and cyclical workload, the net effect of consolidation has been that overall cost reductions to date have been minimal.

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.*

# Over-Reliance on Best Practices Can Institutionalize Overconfidence

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 table below provides an example of best practices and how they can produce a false sense of confidence in a project's predictability.

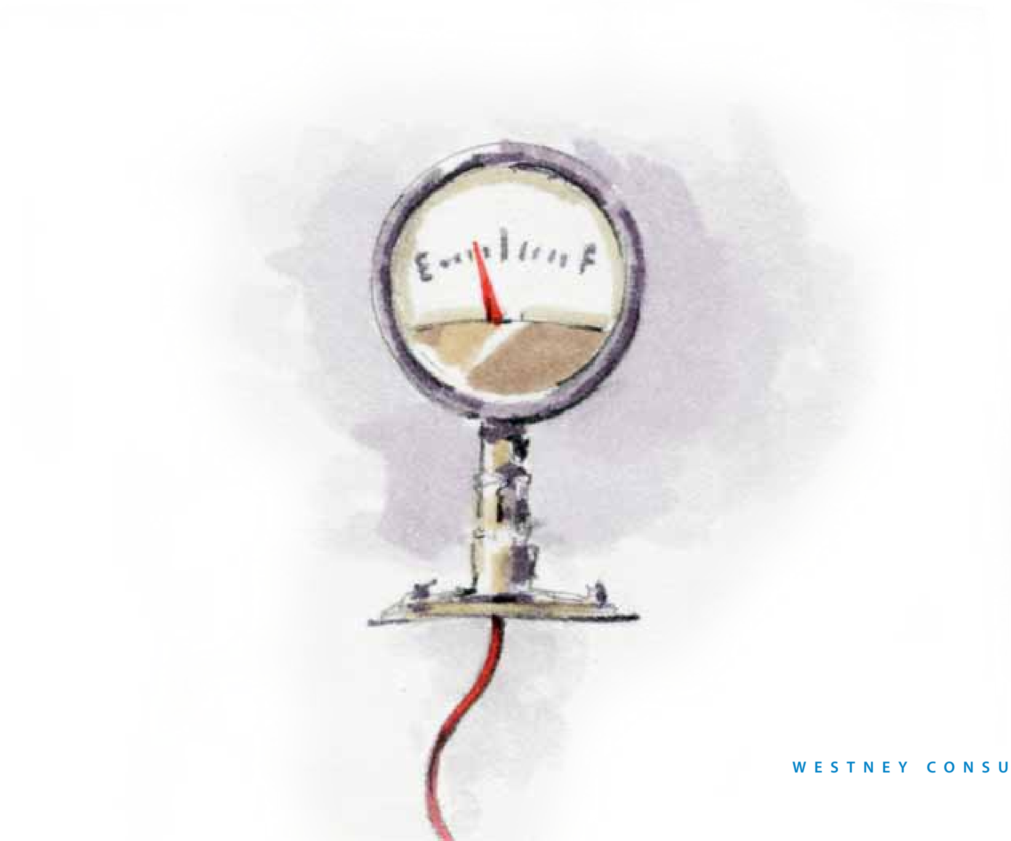
# Over-Reliance on Best Practices Can Institutionalize Overconfidence (cont'd.)

| Best Practice | How a False Sense of Confidence Occurs |
|---|---|
| Use gated processes to ensure front-end loading (FEL) | 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. |
| Use normalized, historical data to predict the outcomes of current projects | 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.<br><br>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. |
| Use "bottom-up" cost estimating since detailed estimates are the most accurate | 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. |
| Categorize risks and develop risk registers to ensure all risks are accounted for, and to facilitate risk mitigation | 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.<br><br>This best practice can create a false sense of security by understating a project's true risk exposure; this happens in two ways:<br><br>■ 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.<br><br>■ 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. |

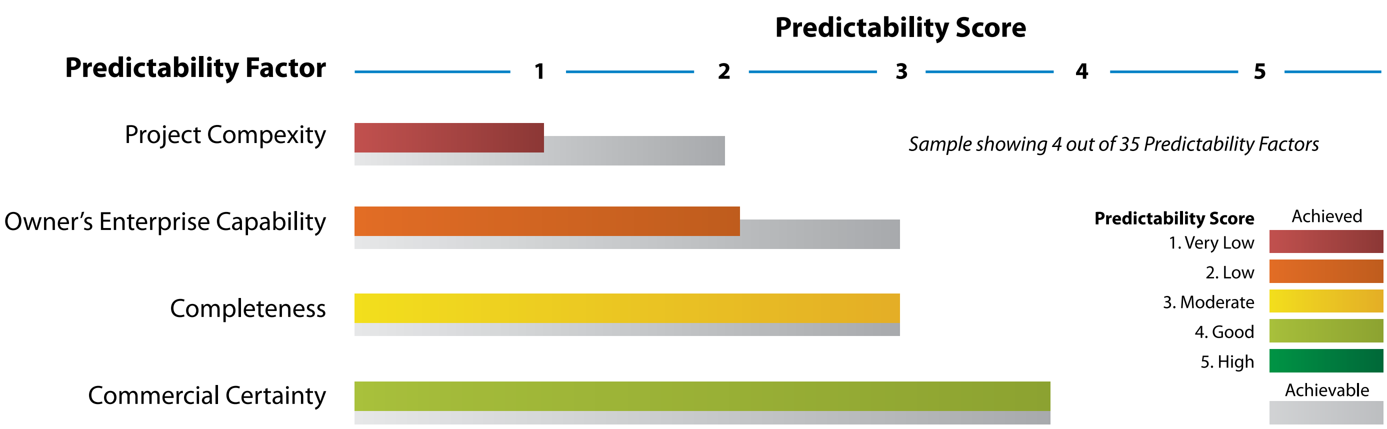
# Metrics Provide the Basis for Managing Predictability

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*. Westney suggests a calibration method using 35 Predictability Factors as shown below. Each of these Factors is calibrated in an integrated way to determine a project's actual predictability and compare that to the predictability that could be achieved.

| | | |
|---|---|---|
| Commercial Certainty | Site Physical | Completion Date Estimate Quality |
| Completeness | Site Labor | Completion Date Commitment |
| Definition | Financial Stakeholders | Unaccounted-for Weather |
| Definition Commitment | Interface Difficulty | Contracting Strategy |
| Technical Maturity | Owner's Enterprise Capability | Execution Planning / Execution |
| Facility Performance | Owner's Team Competency | Economic and Commodities |
| Project Complexity | Safety Culture | Market Demand - Eng. & Const. Management |
| Project Size | Environmental Commitment | Market Demand - Fab. & Manuf. Mgmnt. |
| Business Agreements | Contractor's Enterprise Capability | Market Demand - Construction |
| Country / Political | Contractor's Team Competency | Commissioning & Startup Assurance |
| Country / Taxation | Project Cost Estimate Quality | Operations Planning |
| Social / Community | Budget Commitment | |



# Metrics Provide the Basis for Managing Predictability (cont'd.)



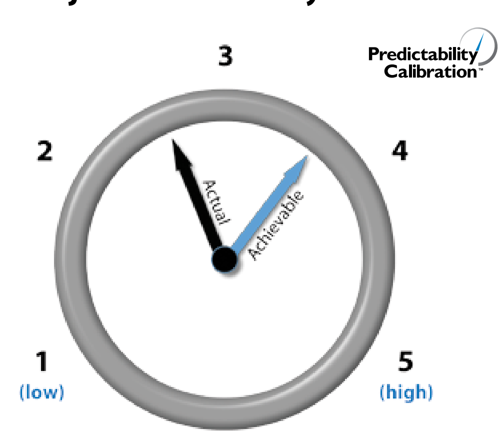

This chart illustrates how the scoring for each Predictability Factor can be presented. A color code indicates the score achieved, and the shaded bar indicates what is achievable. The difference between the two scores clearly indicates areas, such as Owner's Enterprise Capability, in which issues exist 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 this 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 may involve the integration of several process units or of common utilities. With this knowledge of how Project Complexity impacts predictability, management can make decisions with full awareness of the uncertainties involved.

The detailed scores and findings are summarized into an overall score (as indicated by the Predictability Gauge illustrated here), as well as Key Findings that describe those areas in which predictability can be improved.

**Overall Project Predictability Score**



# Summary

Much of the current practice for predicting the cost of a major project results in a view that is not objective and has generally proven to be optimistic and overconfident.

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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