WHITE PAPER

Enabling Better Project Outcomes: Six Tips for Faster, More Accurate Cost Estimates

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Executive Summary

Faced with global economic turmoil, untamed competition and large price swings for hydrocarbons, companies in the oil and gas, refining and chemicals industries are pressed to both select projects that ensure maximum return on invested capital (ROIC), as well as execute projects on schedule and on budget.

According to a recent Ernst & Young (EY) study[1], $22.4T USD of investments in megaprojects are bankrolled worldwide. With 64% of these projects facing cost overruns and 73% of them behind schedule, now is the time for Engineering, Procurement and Construction (EPC) and owner companies to challenge and evaluate their current cost estimation methods to achieve better project outcomes and ensure their companies are poised for success over their competition. This white paper provides six tips for optimizing your company's cost estimation capabilities to enable better decision making in less time:

1. Identify what you can do, cannot do, and could do better
2. Eliminate manual data transfer
3. Automate repeated tasks
4. Enable quick and easy change management
5. Leverage historical data and past projects whenever possible
6. Use conceptual estimates as a starting point for detailed estimates

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Reaching Peak Project Performance

Across all industries with large capital investments, project performance can have an immense impact on profit and loss. To achieve better performance, companies need to continually examine how they perform in estimating, benchmark their performance against as-built costs, make adjustments that enable them to improve estimate accuracy, and lower associated risk. Your company can achieve success — whether it's finding a way to reduce project costs, reducing the cost of bidding, making informed decisions quickly, or providing more value to clients — by improving cost estimation methods.

Despite all of this potential, many companies see estimating as a function of their business rather than a strategic element. They don't have enough time or resources to focus on improvement, because their time is spent rekeying data into spreadsheets, manually updating reports, searching for historical data, implementing change orders, and so on. As a result, they are settling for long lead times for estimates, lower accuracy, and higher estimate and project risk.

Taken as a whole, the facts about project outcomes are alarming:

1. A 2013 PwC analysis[2] of 36 companies revealed that after public announcements of a capital project delay or shutdown, a majority of companies experienced a steady decline in share price, averaging 12% over three months. In the most extreme example, one experienced more than an 80% decline in share price.

2. Megaprojects often exceed their budgets by 50% or more.

3. Of 975 light and heavy industrial projects, the Construction Industry Institute found that only 5.4% met "best in class" predictability in terms of cost and schedule.

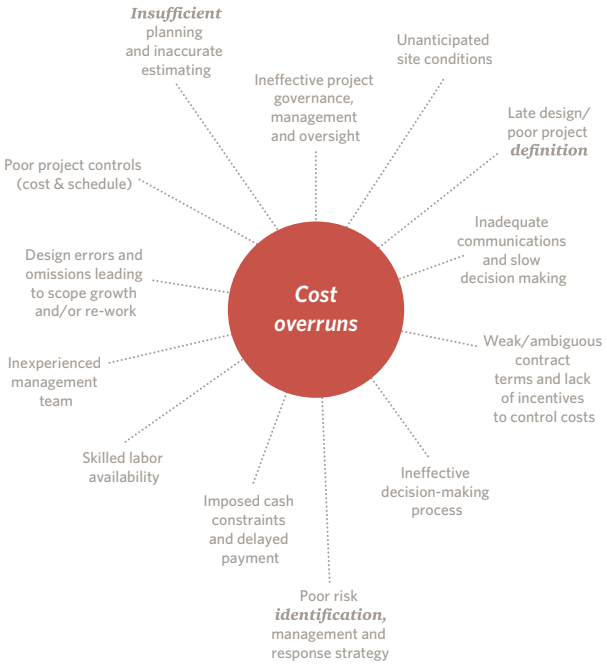

Figure 1: Insufficient planning, inaccurate estimating, poor project controls, and slow decision making can have a significant financial impact on project outcomes[2].

Gaining Control of Project Estimates

So how do you gain control of project estimates and achieve best in class project performance? Having industry-leading tools and leveraging the expertise of experienced estimators are the most important elements to gaining control over your project estimates. Software cannot replace a skilled estimator, but it can allow estimators to be more productive and help generate more accurate estimates.

1 Identify What You Can Do, Cannot Do, and Could Do Better

A careful and thorough assessment of cost estimation from all angles can reveal the enormous potential that exists through establishing consistent, systematic processes utilizing a cost estimation software solution. With the right tools and processes, you can drastically reduce the time to estimate, reduce estimate variability through consistency, and increase estimate accuracy. A cost estimation software solution, partnered with proven implementation methodologies and training, can help you accelerate accurate estimating and improve project outcomes.

You Should:

- Draw out the estimate process. How many different groups and people touch an estimate before it is complete? Where are the opportunities for streamlining and reducing the number of touches?
- Evaluate all of the different software tools that are used to develop an estimate, as well as tools used in other departments that contain information pertinent to an estimate, such as P&ID drawing tools, 3D design tools, plot plans tools, scheduling tools and risk assessment tools. Which of these types of software are integrated with your cost estimation software? Which ones should be?
- Identify internal champions to support the initiative, both in terms of cost, as well as a technical champion to be a resource for others.
- Check whether cost data is included with the software. If it is, how often is it updated? Which project locations is it applicable to? How accurate is the data?
- Evaluate the database capabilities of the software and understand how projects are archived.

Your Estimating Solution Provider Should:

- Analyze and evaluate your company's workflows to determine where greater efficiencies can be achieved.
- Offer support and training solutions that cater to your company's requirements.
- Establish credibility with case studies and examples of how other companies have improved their estimating processes in your industry.
- Provide contacts and references, or offer user group meetings where you can network with existing users and learn best practices.

2 Eliminate Manual Data Transfer

Manual data transfer is time consuming, and introduces room for human error in estimating. It's important to understand how much time you are spending transferring data between spreadsheets, as well as transferring data from PFDs of equipment lists into spreadsheets. Eliminating manual data transfer can greatly reduce the time to estimate, so any optimization opportunities should be explored.

You Should:

- Identify data that should be and can be transferred electronically, including both data that is used in an estimate, and data that is consumed after the estimate is developed.
- Establish a protocol for what should be included in automated data transfers. For example, if you transfer an equipment list from the process simulator, will it include equipment spares?
- Clearly convey which file formats are preferred, and which ones are prohibitive. For example, sending a PFD as a readable file, rather than a PDF.

Your Estimating Solution Provider Should:

- Automate the transfer of equipment lists from process engineering into the estimating software.
- Automate the transfer of scope and quantities from P&ID, and detailed plant design software.
- Be prepared to take an estimate and format it in a way that is easy to utilize for project controls. For example, create an output report using your company's standard code of accounts.
- Export the baseline schedule used in the estimate, including a summary bar chart schedule, with a detailed overview of the engineering, procurement, and a summary overview of the construction phases of the project.
- Agglomerate bulk quantities for piping and instrumentation from P&IDs and 3D models for detailed estimates.

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3 Automate Reporting

Estimators spend significant amounts of time making sure reports accurately encapsulate all of the items in an estimate. Consider how many times you have recast estimates to meet the needs of the consumer, whether in a detailed estimated review or an overview for management. Changes from these reviews often results in changes to the estimate, and these must be implemented in updated versions of the reports. This can be a time-consuming process without automated processes that quickly incorporate changes.

You Should:

- Investigate the process for creating custom reports out of the software solutions you're evaluating for estimating. Is this something that can be done in-house or does this require consulting work?

Your Estimating Solution Provider Should:

- Automatically update all reports as the estimate progresses.
- Generate reports in your company's preferred formats for all levels of estimate reviews, including all relevant estimate metrics, such as unit rates, direct cost metrics, indirects, etc.
- Export reports using tools that you're familiar with, such as Microsoft Excel.

4 Enable Quick & Easy Change Management

Whether it's evaluating multiple plant capacities, project execution scenarios (stick-built or modular), project locations, or whether it's a last minute change to the plot plan, being able to respond quickly with an accurate estimate is crucial.

You Should:

- Establish estimate work breakdown structure (WBS), early in the estimate process and use for all quantity development.
- Associate bulk quantities with equipment items, where possible, in case of changes to the estimate to enable faster decision making, without having to ask discipline engineers for a new material take off (MTO).
- Associate piping and instrumentation with each piece of equipment as much as possible, allowing you to quickly remove equipment and bulks simultaneously if required.

Your Estimating Solution Provider Should:

- For early conceptual estimates, generate bulk quantities and piping and instrumentation for equipment automatically based on your input.
- Automatically associate piping and instrumentation to equipment, allowing you to easily remove items.
- Scale projects or areas of a project by capacity to determine the cost optimum.
- Utilize built-in cost basis to evaluate the cost advantages and disadvantages of multiple locations, including labor and material pricing.

5 Leverage Historical Data and Past Projects Whenever Possible

Historical data can be a competitive advantage for your company, and can be used to help make strategic business decisions by providing insight into actual costs. Historical data is important for not only estimating, but for scheduling, conceptual estimating, strategic planning, and more.

You Should:

- Create, maintain, update, and distribute a well-documented database for historical costs for all procured items, including process equipment.
- Be sure to normalize data prior to entering into the database — remove any data that may be inconsistent with your company's past experience, or an anomaly.
- Create a template for repeated project locations and process types that can be a starting point for all estimators.
- For a template for a project location, ensure the template captures all of the different contractors, wage rates, productivities, soil type, wind loading, seismic activity, currencies, pipe specs and equipment design standards (including ASME, DIN, BS).
- For a template for a process type, ensure the template captures all of the different specialty pieces of equipment required, costs for packages such as water treatment or utilities, and calibrated cost models for the remaining equipment items.

Your Estimating Solution Provider Should:

- Allow for standardization of models, methods, and cost data used in estimating to increase consistency among groups of estimators.
- Encapsulate and consider the complex relationships between cost drivers such as location, design standards, materials of construction and costs.
- Assist in defining and creating customized and calibrated templates.

Aspen Capital Cost Estimator has been used in projects spanning more than 1,300 unique locations and ranging from $10,000 to $30 billion.

6 **Use Conceptual Estimates as a Starting Point for Detailed Estimates**

Capital project estimating operates as a stage-gate process. Estimates are developed for a certain accuracy and AACE classification. Typically after a conceptual estimate is developed and a project is approved, detailed estimating begins with a fresh spreadsheet. As a result, hundreds if not thousands of man hours that were spent developing and organizing an estimate are lost instead of leveraged as a starting point for the detailed estimate. This presents itself as an opportunity to gain efficiency in estimating.

You Should:

- Use conceptual estimate as the starting point for the detailed estimate.
- Overwrite quantities and costs used in conceptual estimates with actual values in detailed estimating.
- When overwriting costs for procured items, such as equipment, be sure to mark the source of the quote: vendor firm quote, vendor budget quote, etc.
- If possible, when obtaining quotes, gather as much information regarding lead time as possible and note in the estimate whether or not it requires a long lead time.

Your Estimating Solution Provider Should:

- Trend costs to show how the estimate changed and what items contribute the largest changes in the overall project cost.
- Report on what percentage of costs have come from quotes versus historical data.

Accelerating Accurate Estimating

AspenTech is the world's leading supplier of software that optimizes process manufacturing, and Aspen Capital Cost Estimator (ACCE) is our solution for accelerating accurate cost estimates. Used in projects spanning more than 1,300 unique locations and ranging from $10,000 to $30 billion USD, Aspen Capital Cost Estimator, formerly Kbase, leverages technology originally acquired from the ICARUS corporation to help EPC and owner companies in the oil and gas, refining and chemicals industries make better capital decisions and deliver projects on schedule and within budget.

AspenTech has partnered with Strategic Estimating Systems, a global leader in delivering and implementing economic evaluation and estimating solutions, to help our customers maximize their software investment. Strategic Estimating Systems estimates over $50B of projects each year in Aspen Capital Cost Estimator and helps companies implement best-in-class work practices and methods utilizing their expertise of the industry, the software and cost estimation.

Aspen Capital Cost Estimator addresses challenges in estimating by helping companies transition estimating from a business function to a strategic asset by reducing the time to estimate and enabling better, faster decisions. Below are just a few examples of how our customers have benefitted from ACCE.

A mid-size EPC, **S&B Engineers**, challenged by shrinking client budgets and tighter project schedules, adopted and implemented ACCE for estimating capital process projects. Using ACCE, they've been able to reduce the time to estimate by up to 90% — allowing them to meet tighter schedules and budgets — while maintaining best-in-class levels of accuracy and risk.

Australia's **ThyssenKrupp Industrial Solutions — Plant Technologies** standardized on Aspen Capital Cost Estimator for conceptual and detailed estimates. Their biggest value-adds from ACCE are the ability to leverage conceptual estimates as a starting point for detailed estimates, the ability to provide detailed estimates with minimal engineering and pricing data, and the ability to deliver additional value to their clients by evaluating more project execution strategies in less time.

PEMEX, the National Oil Company of Mexico, has utilized Aspen Capital Cost Estimator on more than 30 projects, and has achieved accuracy within 10% for more than 11 projects for Class II estimates, and accuracy within 15% for more than 13 projects for Class III estimates, allowing them to outperform industry benchmarks for estimating major capital projects.

To learn more about Aspen Capital Cost Estimator and how it can improve cost estimation in your company, please visit **http://www.aspentech.com/faster-estimating**.

References:

1 Ernst & Young (October 2014), Spotlight on Oil and Gas Megaprojects
http://www.ey.com/GL/en/Industries/Oil---Gas/EY-spotlight-on-oil-and-gas-megaprojects#.VpkWkKMo6mQ

2 PWC (October 2013), Correcting the Course of Capital Projects
https://www.pwc.com/sg/en/capital-projects-infrastructure/assets/cpi-correcting-the-course-of-capital-projects.pdf

AspenTech is a leading supplier of software that optimizes process manufacturing — for energy, chemicals, engineering and construction, and other industries that manufacture and produce products from a chemical process. With integrated aspenONE® solutions, process manufacturers can implement best practices for optimizing their engineering, manufacturing, and supply chain operations. As a result, AspenTech customers are better able to increase capacity, improve margins, reduce costs, and become more energy efficient. To see how the world's leading process manufacturers rely on AspenTech to achieve their operational excellence goals, visit **www.aspentech.com**.

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