

Benchmarking Organizations During Lean Times: How Does Your Organization Stack Up Against Your Peers in Bidding, Estimating and Project Performance?

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Executive Summary

The capital projects business is evolving rapidly at the macro level but is slow to change within engineering departments. Most executives in the engineering, procurement and construction (EPC) industry and their clients know that the current downturn in capital projects workload is a critical time to drive innovative business processes. This has some urgency, because the window to invest in change is already beginning to show signs of narrowing. Improving organizational performance in the areas of bidding and front end project execution are strategic topics in many oil and gas, chemical and engineering contractor boardrooms in 2016. This past summer, a key executive from one of the largest EPC companies globally expressed that the estimate is “one of the most critical FEED deliverables.”

Recent industry studies conclude that (a) capital project costs are rising too fast in the process industries, (b) a high percentage of these projects are running over budget and behind schedule, (c) a lack of good communication between the owner and contractor during bidding and FEED is a systemic problem and a causative factor of the above two issues, and (d) large numbers of individual spreadsheets continue to be a common practice and a significant concern to project and estimating managers (spreadsheets are the primary estimating tool used by 37% of organizations worldwide, and 52% in the Asia Pacific region) (Figure 1). Better estimating software technology, combined with more collaborative business processes, are widely understood to provide a huge opportunity for improvement.

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To respond to the above opportunity, several key areas are being addressed by leading organizations (both EPCs and the capital projects groups within owner-operators). These include addressing ways to:

- (a) Reduce or eliminate dependency on spreadsheets, especially “custom spreadsheets” which is a code word for spreadsheets containing factors and calculations that lack transparency and are expensive to maintain.
- (b) Increase the electronic transfer of engineering data between engineering disciplines and estimating.
- (c) Standardize estimating methods between estimating groups in a company and between individual estimators.
- (d) Use common systems between the client (“owner”) and the contractor (“EPC”).
- (e) Improve the training of a new generation of estimator professionals, especially in areas such as risk assessment, benchmarking past projects for better future results and in thinking outside the box to anticipate unexpected road blocks.
- (f) Get beyond the rudimentary and labor-intensive, factor-based estimating to more advanced engineering model based estimating.

To understand how the industry views these challenges and to identify the barriers to progress and how to overcome them, AspenTech performed a benchmarking survey this year in 2016. The rest of this paper summarizes that survey in the context of the key business process bottlenecks, or “pain points”, best available technology and current best practices that enable organizations to improve and eliminate bottlenecks, a maturity model for bidding and economic evaluation for an organization to measure itself against, the results of our industry survey, and our recommended pathway for your organization to improve.

A Bird’s Eye View: The Questions That Arise

Aspen Technology has been working closely with a number of process industry owners and contractors to help them adopt improved, innovative and more advanced business processes and software solutions to address these critical issues.

Estimating as a function is highly interdependent with almost every other engineering group within a project, and should be closely tied with project controls and construction management.

Most executives, bid managers, capital project managers and the like know that the linkage between estimating and the rest of the organization is a weak link, and in today’s business environment it’s even a key bottleneck to company success. Industry consultants who look at capital project performance have identified a clear definition of front end engineering design (FEED)

criteria by the client, a process to manage change with the same FEED criteria and a commitment to invest sufficient time and manpower to do a complete job of FEED design are all crucial success factors (and that this isn’t happening today).

Again, this FEED ambiguity can often be tied back to the estimating process and its extremely poor lines of communication with functions like process engineering.

However, why is it that when we talk to heads of estimating groups we are often told that “everything is OK” and that “we do a great job of estimating”?

We were curious, so we set out to conduct a survey of what is happening in the estimating business processes for both owners and EPCs. The results were clear cut and surprising. Out of over 160 senior estimators and directors answering the survey, only about 50% are satisfied with estimating performance overall in their organizations today, and 60% identified increasing estimating accuracy as a key strategic issue in their organizations.

Some key questions that industry, and suppliers like AspenTech need to answer are:

- Why are so many organizations dissatisfied with current estimating practices?
- How can we achieve improvement on that metric?
- Together, how do we improve industry estimating accuracy and project risk management?
- If there is such a large opportunity for improvement, how do owners, contractors and suppliers jump start some initiatives to achieve that improvement, leading to better CAPEX performance?



A New Way to Look at the Bid Process

Why do estimating organizations need to change today? The survey reveals that less than 50% of estimating groups surveyed are satisfied with estimating methods in use today in their organizations, with 20% dissatisfied or very dissatisfied.

There are several reasons from our point of view:

- (1) Brain drain - There is a change in the demographics and experience level of estimators. Existing methods used by the preponderance of companies are extremely manual, non-standardized and labor and time intensive. They are highly dependent on one or a few experienced estimators and counted on by particular organizations to “keep the methodology and knowledge”. Those experts are retiring, which is making proprietary spreadsheet-based approaches unsustainable.
- (2) Economic pressure on CAPEX - There is external pressure to improve CAPEX performance and speed of project execution. With all the scrutiny and dissection of how process plant projects are being executed, contractors need to address areas such as standardized, repeatable design, increased transparency, increased agility, and modularization. Existing organizations and methods do not effectively support these. Organizations are not able to be agile enough to win without changing their methods.
- (3) Market leaders are using better software - There has been a stepwise change in available modeling technology. While there is huge friction within the conservative (justifiably so!) estimating community and EPC bid teams to change, the business pressure to change is too high. The business value and analytical power of model-based estimating (Aspen Capital Cost Estimator™) is too compelling for organizations to ignore during this business climate. Estimating teams can achieve up to a 70% reduction in estimating man hours and can save up to 50% on cycle time for a bid, pre-FEED or FEED estimate. This is putting organizations who rely on spreadsheets and factored estimating at a competitive disadvantage.

It is not only about estimating by itself, it also concerns the interface between process engineering and estimating. Increasingly, clients are rewarding both the quality of the design, as well as the ultimate capital cost. There is also an increasing focus on lifecycle cost; balancing OPEX and sustainability with CAPEX.

Enabling close collaboration between process and estimating is an absolute key opportunity during bidding. Improving bids and reducing risk cannot be solved by estimating on an island. It is a joint result of looking at the process, predicting reliability and operability and understanding the costs concurrently. Through better, integrated solutions, the contractor can challenge the client’s design and achieve better results for both.

This is why AspenTech has focused heavily on closely tying process with capital costs and the cost estimating model, and tying operating costs with the energy and utility model. These areas are exposed in Aspen HYSYS® and Aspen Plus® as Activated Economics, Activated Energy Analysis, and Activated Exchanger Design & Rating (EDR) to achieve more powerful optimization.

There is also a broader imperative to tie together bidding and front end conceptual estimating with the entire EPCM lifecycle.

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What We've Learned With 35 Years of Experience

The good news is that forward-looking organizations across the industry have achieved impressive and measurable success in adopting better ways of performing feasibility studies, bidding and estimating. Through collaboration with a worldwide spectrum of over 1,700 customers, AspenTech has developed a well-informed picture of the levels of maturity in these organizations, with respect to their business processes, work flows and utilization of software systems.

AspenTech Maturity Model

Combining and synthesizing the knowledge of our collaboration with many owner-operator, engineering and EPC companies, AspenTech has developed a point of view of best practices and best available benefits achievable through a combination of technology and organizational evolution to achieve competitive advantage. This is reflected in 15 different maturity models that show various aspects of the asset creation business processes.

Summarized below in Figure 1 is the maturity model for economic evaluation and estimating over the asset creation lifecycle. At the lowest level of maturity, estimating performed through the use of spreadsheet-based factored estimating.

The individual estimator likes using spreadsheets, because calculations and formulas are built-in and can be adjusted which makes his job easy. However, a director of major projects at a large process industry EPC told us recently that he had audited a recent project and found an alarming artifact of the project. Over 40,000 separate spreadsheets had been used in the development of that engineering project. This was a cause for significant alarm. As helpful and powerful as a spreadsheet is to an organization, it is a weak link in a large multi-year, multi-step engineering project, or even, truth be told, in a small plant improvement project. There is little ability to control or provide oversight of changes, information copying, versioning, spreadsheet interdependence, hidden changes made in formulas by individuals, and the like.

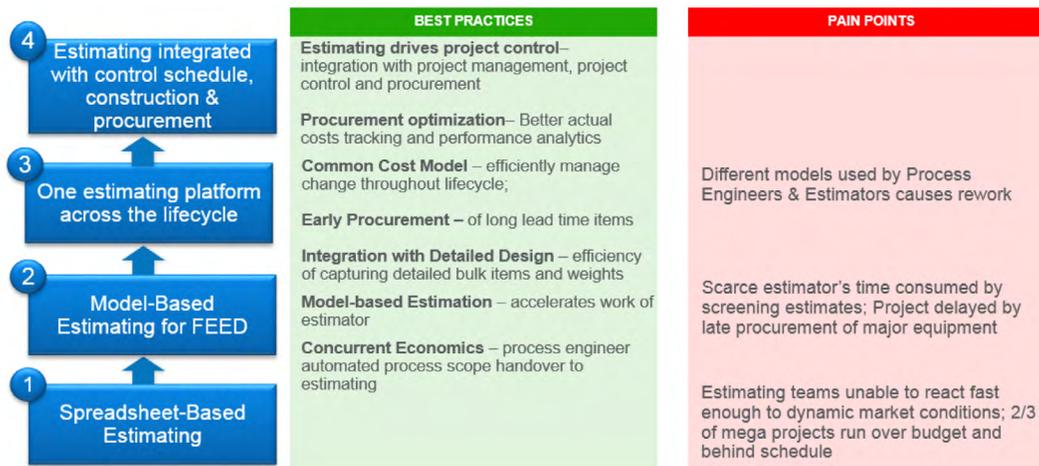


Figure 1: Maturity model for economic evaluation management

As an organization moves up the maturity model, a key element required to achieve improved efficiency, accuracy, consistency and transparency in estimating is integrating estimating software tools with engineering disciplines. This supports collaboration, automated information handoff, design optimization, and ultimately better cost performance of projects reducing project and organizational risk.

Figure 2 provides a view of best practice workflows that are abstracted from those of top-quartile asset development organizations.

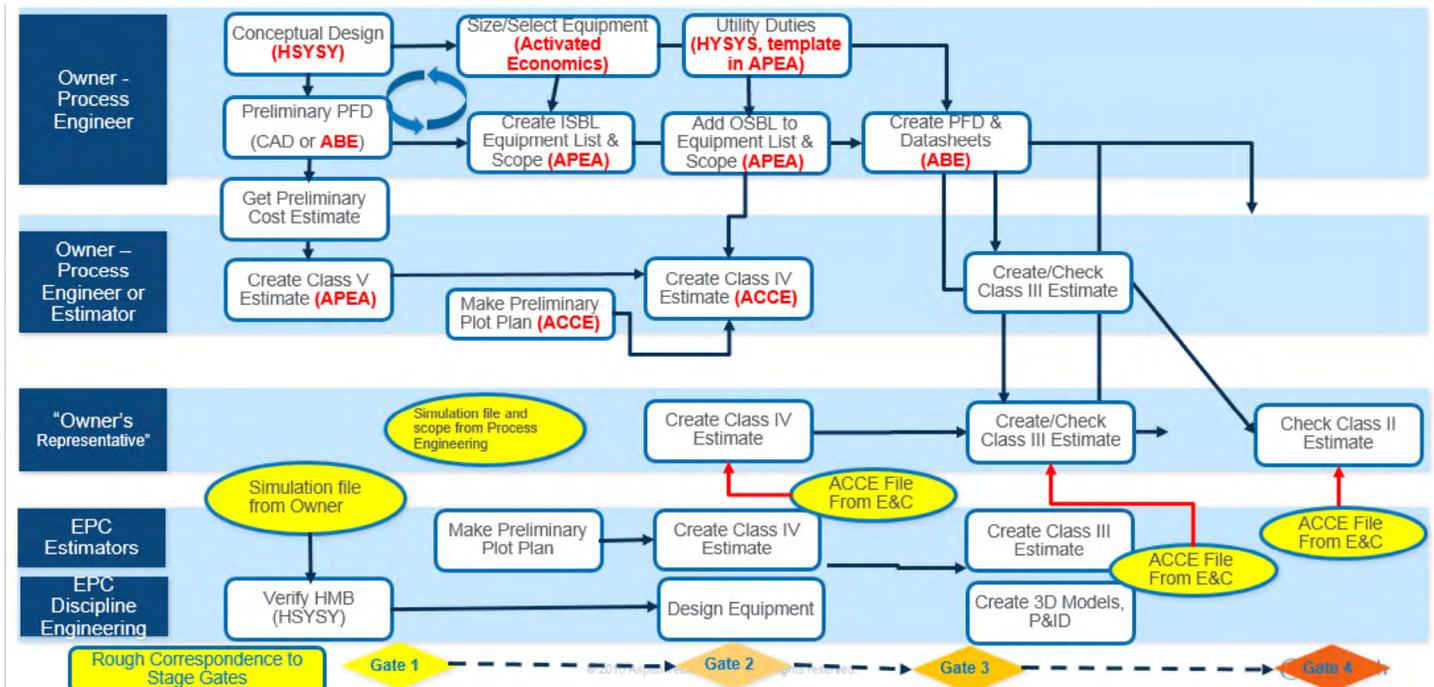


Figure 2: Owner and EPC CAPEX estimating workflow

The Survey

To understand how organizations stand vis-a'-vis our estimation maturity model, we performed a survey of over 350 estimating groups in EPCs, chemical, upstream, midstream, and refining organizations. 161 organizations responded to our survey, giving us a strong worldwide, representative sample of industry practices.

Through the survey, we learned that 37% of organizations are currently using Microsoft Excel®-based estimating and another 19% are using similar in-house, custom-built tools (Figure 3). This finding is even more pronounced in the Asia-Pacific region, where 52% of organizations are using Excel-based tools.

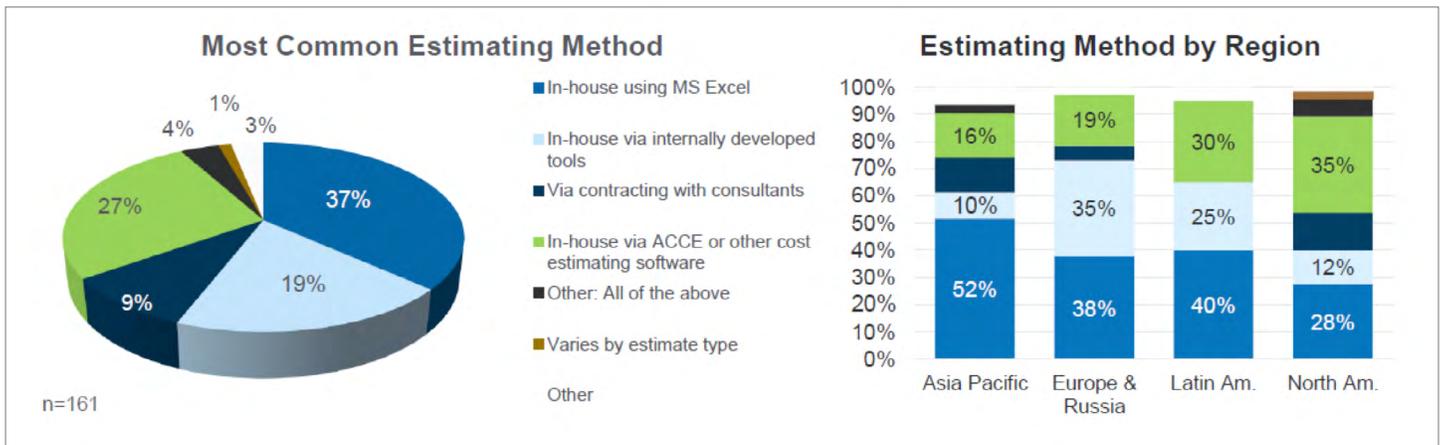


Figure 3: Currently employed estimating methods, globally and by region

We also learned through the survey that today, only 50% of organizations are satisfied with the estimating product that they develop. This is reported, by type of estimating activity (Figure 4).

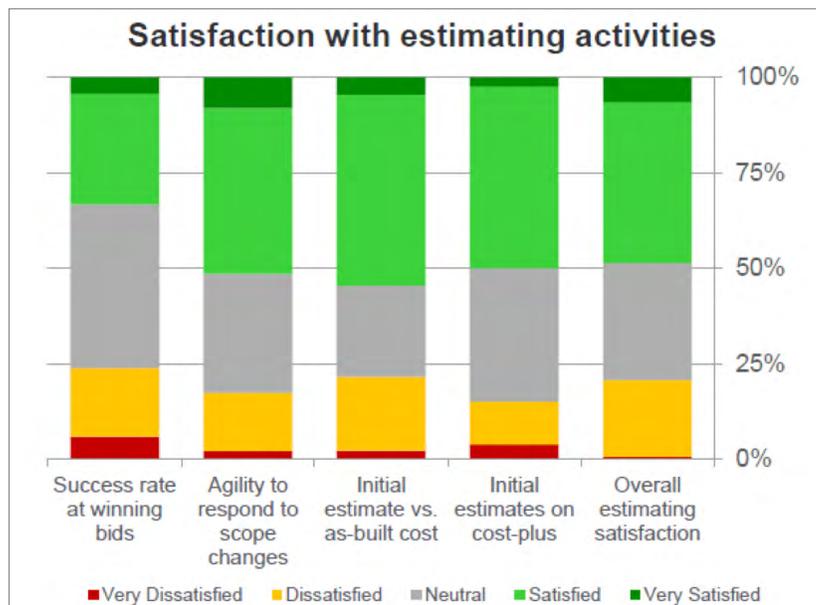


Figure 4: Current satisfaction with estimating activities

If 50% of respondents indicate that their organizations are not satisfied with estimating today, what are the areas that are most important to improve? Some insight into that is provided in Figure 5.

Finally, the survey examined how well integrated estimating is with other engineering disciplines and engineering software, namely the key sources of information for developing an accurate and complete estimate (Figures 6 and 7). Surprisingly, a very high percentage of information that's needed to develop an estimate is handed over, in most organizations, by manual copying of information or by cutting and pasting between spreadsheets. AspenTech has invested significant R&D resources to enable automated information transfer, especially between process engineering and estimating. This is a major target for business process improvement.

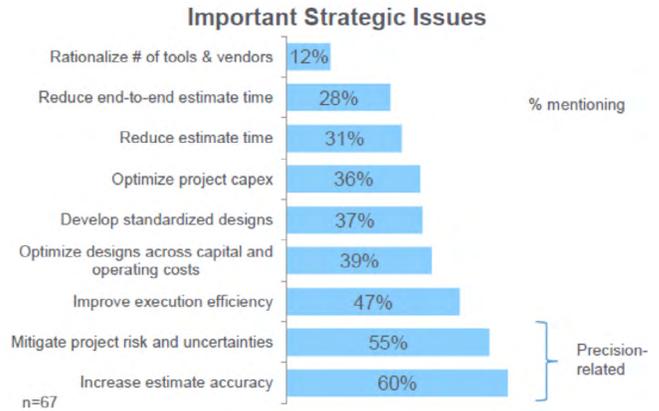


Figure 5: Priorities for improving estimating business processes, as answered by 67 respondents in the survey

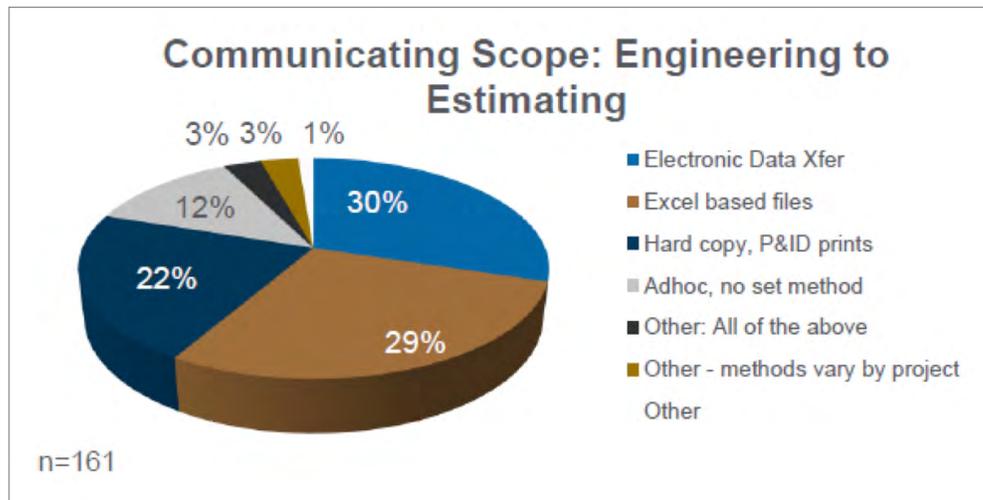


Figure 6: How is engineering data communicated to estimating?

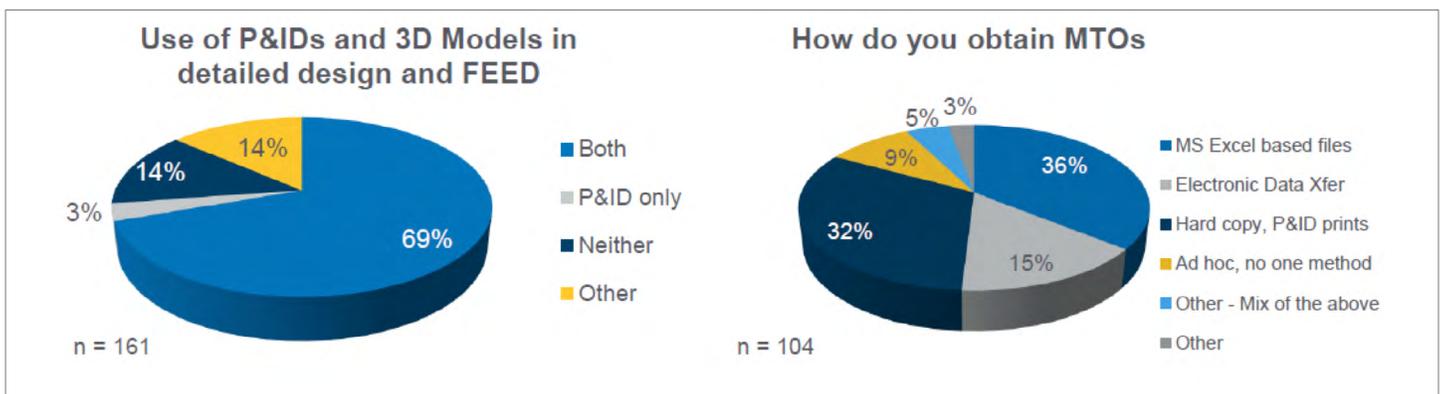


Figure 7: How are material take-offs obtained from detailed engineering and handed off to estimating?

The Payoff

Measurable results reported by a number of organizations who have standardized on Aspen Capital Cost Estimator (ACCE) demonstrated what can be achieved through best practices.

- Research and development commercial viability studies: Mitsubishi Chemicals reduced the time to perform commercial business reviews by 75%, from two months to two weeks.
- Feasibility and pre-FEED integrated workflows between process and estimating: Burns and McDonnell were able to evaluate more design alternatives, effectively and transparently communicate with clients, and propose brownfield solutions that reduced anticipated CAPEX by 15-30% on debottlenecking projects. Kuwait Oil Company (KOC) saved 50% CAPEX and 40% OPEX on a plant improvement process, achieving over 60% in total lifecycle cost improvements.
- Bidding cycle time: Technip USA reduced the total time to develop bid and pre-FEED estimates by 50%.
- Conceptual estimating man hours: S&B Engineers and Constructors are producing estimates with 70% less man hours for FEL I and II estimates and 50% less man hours for FEL III estimates.
- Accuracy over the complete estimating lifecycle: PEMEX benchmarked 30 major refinery capital projects estimated using ACCE over a five-year period. Over those 30 projects, PEMEX's estimating organization achieved accuracy at a consistent level of approximately 21% for Class IV estimates and approximately 8 to 16 % for Class III estimates. ConocoPhillips, a downstream organization (now Phillips66), benchmarked their estimating results over a five-year period during which they switched from using a factor-based estimating approach to using ACCE. Phillips66 reduced their capital estimating variance (at the FEL 3 stage) from a 40% variance with factor-based estimating to a 12% variance with ACCE. They concurrently were able to improve the productivity of their estimators by a 10:1 ratio.



Conclusion

How do contractors and owners manage risk in today's environment? There is intense pressure to understand estimating uncertainty and deliver better designs and lower bids. The pressure falls on the estimating department. Executives making bid decisions expect estimating to deliver them faster bids and more transparency into the levels of risk and uncertainty associated with the estimate.

Estimators, the group of engineers I'm talking about today, are extremely conservative. They work with large amounts of capital cost, millions, hundreds of millions or even billions of dollars, and must assess material capital risk to projects and companies. In today's stressed business environment, that conservatism is not affordable. These estimating teams need to take their heads out of the sand.

It is even more important to get past those engrained points of friction and conservatism; and look to improve and optimize business processes and business performance in the estimating arena.

To learn more about best practices, view case studies, and read more information related to bidding and estimating with Aspen Capital Cost Estimator, you can explore a wide range of resources at: www.aspentech.com/epcperspectives/bidding-estimating. You can also request an executive workshop to explore how your organization can move up the maturity curve www.aspentech.com/epcperspectives/workshop.

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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