IPA

Independent Project Analysis Newsletter

Independent Project Analysis, Inc. is the preeminent organization for quantitative analysis of capital project effectiveness worldwide. At IPA, we provide practices you can use to ensure your success.

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Deciding When to Develop Large Reservoirs

Strategic Portfolio Issues and Tactical Realities

By Neeraj Nandurdikar, Director, IPA Oil & Gas Practice

With oil prices at the time of this publication's release hovering just around $45 per barrel, oil and gas companies are understandably re-examining organizational issues, resources, and capital to identify opportunities for improving margins. However, more attention should be paid to the company's portfolio of opportunities and asking the right questions before precious resources are committed. In particular, oil and gas industry executives should not be asking questions such as "Where should we play?" They should instead ask, "Where should we NOT play?"

Consider the technology-driven rush to pursue deepwater projects—one of those new frontiers. Operators chased opportunities in deepwater in the hopes of finding large accumulations that could be significantly accretive to their production and cash flow. Many operators, in fact, found these large accumulations. But the more important question for the long-term is whether bigger is always better. As the **Figure 1** suggests—maybe not!

The figure illustrates the relationship between the estimated reservoir size (P50 hydrocarbons in place) and the profitability index (How much value does each dollar of capital generate?). The data represents real projects, contained in IPA's proprietary Oil and Gas Databases, which are currently in various stages of planning or execution and focused only on deepwater projects globally.

Most companies use the profitability index as a hurdle to decide which projects move forward and which don't. The figure shows that bigger reservoirs aren't always the most profitable. The profitability index increases with larger reservoirs—more reserves, more production, more revenue, etc.—up to a point when the capital expenditure required outstrips the gain in higher production. Beyond this "inflexion point," larger reservoirs make a company's portfolio increasingly capital intensive. In fact, something interesting happens as the reservoirs get larger. Very large reservoirs in deepwater require higher capital investment. Companies who use net present value (NPV) as a value metric are then driven towards building facilities for the highest peak production possible—higher production, higher revenue in early years, better NPV.

Once the peak is past, the facilities often remain underused. The empirical data suggest that companies are either better off developing things just below the inflexion point or developing reservoirs to the right of the inflexion point in a phased manner.

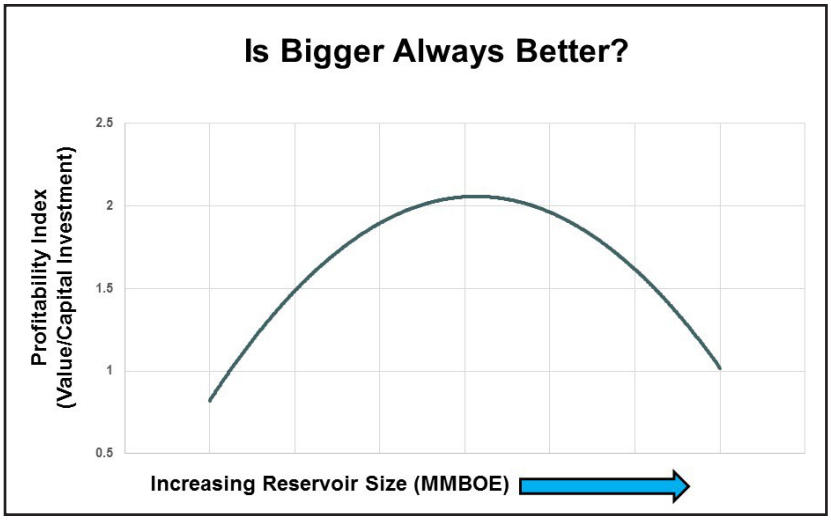

Figure 1

While this chart depicts the profitability index for all deepwater oil developments, similar relationships exist for each individual company's portfolio(s). In other words, each company has its own inflexion point that needs to be assessed and understood. A company's specific inflexion point depends on its ability to deliver projects relative to its peers. This should then be a basis of dialog among the Executive Leadership, Strategy, Exploration, and Development functions to reach alignment on where the company should focus, given its delivery capability.

If a company delivers very competitive projects—the lower denominator in the profitability index—it can probably afford to develop larger reservoirs relative to a company that delivers projects less competitively, *ceteris paribus*. Such an informed portfolio analysis, which marries strategic (portfolio) issues with tactical realities (project delivery), should then be the basis to decide other long-term efficiency initiatives.

Interested in learning more about IPA's Oil & Gas Practice? Neeraj Nandurdikar can be reached at nnandurdikar@ipaglobal.com.

Merrow, Nandurdikar to Speak at SPE's Annual Technical Conference and Exhibition in Houston

IPA will be well represented at the Annual Technical Conference and Exhibition (ATCE), presented by the Society of Petroleum Engineers (SPE), September 28-30, 2015, in Houston, Texas.

IPA President and CEO Edward Merrow will deliver remarks during the ATCE Projects, Facilities, and Construction Dinner. He will also participate in a panel discussion on managing project complexity and the potential value of, and internal barriers to, standardization.

IPA Oil and Gas Practice Director Neeraj Nandurdikar will participate in a session focused on addressing what companies can do to mitigate the effects of current cost cutting as a consequence of lower oil prices while maintaining an eye toward the future.

The ATCE is SPE's flapgship event and annual meeting for its members. For more information about the event, visit http://www.spe.org/atce/2015/.

E&P Industry Cost Engineers Assemble at Upstream CEC Conference

Cost engineers and other project team professionals representing 13 exploration and production (E&P) companies met for two days in June at the Hess Tower, in Houston, to improve competitiveness in the cost engineering space.

Attending the 2015 Upstream Cost Engineering Committee (UCEC) conference June 24-25, committee member companies received updated metrics compiled and assessed by IPA that can be used by projects groups to support conceptual estimate development and reviews, assess company metrics against industry norms, and support the calibration of internal company tools and databases.

"UCEC provides a historical look at industry project cost and schedules," said IPA Research Analyst and UCEC Coordinator Jonathan Walker. The metrics, based on a core dataset of more than 300 completed upstream projects stored in IPA's projects databases, are useful for project estimate comparisons during the appraisal, select, and define phases of asset development. The metrics this year reflect the database as of December 2014, which includes more than 40 newly completed projects, plus projects authorized in 2014. This year, UCEC members received additional onshore metrics and fabrication cost and duration metrics, Walker said.

Two new research studies were presented at this year's conference. One study examines significant project cost differences for projects of the same scope but located in different world regions. The study quantifies current location differences in E&P facility development and identifies and analyzes the sources of the variances. The second study, "Fast and Furious Project Schedules," takes a close look at the characteristics of "fast projects," ones that had aggressive schedule targets and were completed with less than 20 percent schedule slip and less than 10 percent cost growth.

In addition, UCEC company representatives attended a session focusing on various issues relating to the effects of the lower oil prices that have rattled the Industry. Breakout sessions for participants wanting to learn more about how to work with the UCEC metrics and tools developed by IPA were available at the conference, as were several networking opportunities.

For additional information about the UCEC, a subcommittee of the Upstream Industry Benchmarking Conference (UIBC) facilitated by IPA,contact Jonathan Walker at jewalker@ipaglobal.com.

This article first appeared in the August 2015 edition of IPA's EPC Market Forecast Newsletter.

Research Corner

Untapped Value in Capital Projects Research Solutions

IPA's Project Research Division at a Glance

By Tom Mead, Deputy Director, IPA Project Research Division

When it comes to oil extraction, more oil is left in the ground than is produced, which, if you consider the volumes produced today, is a staggeringly large amount of oil left behind.

In some ways, this is analogous to the value contained in IPA's database of capital projects. We extract enormous value from the data which support our research, our evaluation of projects, and our mission to improve the capital efficiency of our clients. But if you consider the scale of the data at our disposal—tens of thousands of projects, each with many thousands of pieces of information captured electronically—you quickly realize that much of the potential of this database remains untapped.

Unlike oil reservoirs, which face technical barriers in how much more value can be extracted, pulling more value out of our data is simply a matter of deepening our collaboration with you—our clients. To understand why, let's review the four critical elements of providing data driven solutions: the database, IPA's methodology, our research staff, and our collaboration with our clients.

Database: As highlighted above, we have an enormous database, the product of more than 25 years of evaluating projects. And this reservoir of data is constantly being fed by a river of new information from project evaluations and other engagements. The information we store electronically is really just the tip of the iceberg—the information captured in client documentation is perhaps an order of magnitude bigger than our database and is another resource we have at our disposal.

Methodology: The database, while the bedrock of everything we do, requires normalization and sophisticated analytical techniques to extract insights. Whether normalizing costs to a common base period or base location, or controlling for a multitude of factors that influence a metric of interest, our analytical methodologies cut through the noise and unlock the true relationships hidden within the data.

Research Staff: IPA employs a team with specialized skills to apply these analytical techniques and extract value and insights from the data. Our research and project analysts combine deep statistical knowledge with extensive experience studying capital projects. IPA analysts and researchers have a variety of educational backgrounds, including engineering, economics, the natural sciences, mathematics and statistics, and operations research. Many also possess several years of professional experience in the process and manufacturing industries they support.

Client Collaboration: The key piece of this puzzle is engagement and collaboration with clients. While we have years of experience studying projects, hearing directly from active industry representatives about the biggest challenges facing projects, organizations, or industry is essential to extracting key insights that can help you today. Without this dialogue we will be less effective in connecting your needs with our capabilities. We fully appreciate the challenges you face, and we want you to benefit from our experience and capability in providing data driven solutions.

Hopefully, this summary gives you not only a better sense of the information at our disposal but also of the importance of our interactions with you, our clients. Our research and analysis are best when they directly connect with the issues you face. So let us know what your biggest obstacles are and we'll work together to create solutions.

To learn more about IPA's Projects Research Division, contact Tom Mead at tmead@ipaglobal.com.

IPA Research Initiatives & Solutions

USGC Construction Labor Market Intelligence (A New Subscription Service)

Decline in crude oil prices is affecting capital investment in many industrial sectors. However, prior to the fourth quarter of 2014, a dramatic increase in oil and gas production in the United States spawned one of the largest planned build-outs of industrial projects, including the construction of several large ethylene crackers, LNG export facilities, and fertilizer projects. The USGC is the primary target for most of this investment. What will be the extent of the CAPEX reductions and project cancellations/delays, and how will they affect the state of the USGC labor market?

To help answer these questions, IPA is introducing a subscription service to provide market intelligence to owner companies on aggregate construction labor demand and supply, and the quantified effect of the market's response to labor wages and productivity in the USGC industrial construction market.

For more information, contact Aditya Munshi, Study Principal Investigator, at amunshi@ipaglobal.com.

Just Give Me the Money Already – Best Practices for Project Authorization

IPA recently published the results from a joint industry study on authorization durations and trends. The study developed norms for authorization durations based on project size and other characteristics, identified practices that can speed the authorization process, and established optimal approval levels based on project size. The study also identified areas where companies are making rational authorization decisions and where companies are perhaps less cognizant of risk factors.

These issues were examined through the lens of quantitative metrics about this critical phase in a project's lifecycle. The study is complete but its results and associated system evaluation are still open to new participants.

For more information, contact David Purzer, Study Principal Investigator, at dpurzer@ipaglobal.com.

'Best of the Best' Projects Executed by the Oil & Gas Industry

IPA from time to time comes across an oil and gas project that delivers superior results compared to a client company's average project results. Collectively, these individual top performers are known to IPA as the "best of the best" projects. How were these projects developed by the project team and executed differently? What is it about these projects that make them stand out from the rest of the company's projects?

IPA offers a study for projects teams and senior management to find out how their project practices and systems stack up against the best of the best projects. By examining this class of projects, it is possible to understand common themes and practices that drive superior performance.

For more information about the research, contact Tom Mead, Deputy Director of Research, at tmead@ipaglobal.com.

Managing Non-Operated Ventures

Companies are good stewards of capital when they consistently identify and develop the most promising investments and execute them well. Many organizations, however, struggle to drive the performance of their non-operated ventures (NOVs). IPA has launched a study with a core group of clients to explore how governance, oversight, and organizational practices contribute to NOV success.

IPA will accomplish these goals by analyzing a sample of NOV projects using elements of IPA's Upstream Project Evaluation (PES®) system, interviewing non-operating partner companies, and surveying operating companies. Several operators have joined the study which is now underway. The study remains open to new participants and is expected to be complete in December 2015.

For more information, contact Katya Petrochenkov, Study Principal Investigator, at kpetrochenkov@ipaglobal.com.

IPA's Project Research Division (PRD) examines the functioning of capital projects and project systems and applies the results to help our customers create and use capital assets more efficiently. PRD brings a deep understanding of what drives the successful development and delivery of capital projects.
For a complete listing of PRD's research initiatives, visit IPA's website at www.ipaglobal.com/services/research.

A Life Less Predictable

Target Setting for Middle East Projects Isn't Working

By Mark Etchells, IPA Middle East Team Leader

Some of the largest, most complex projects ever devised are either under development or have been completed in the Middle East. Although projects can and have been delivered with world class results on many levels, the majority are less successful. In fact, cost and schedule predictability is getting worse. Meanwhile, the average competitiveness of projects in the Middle East is stagnant and continues to lag the global industry.

The strong trend shown in **Figure 2** for execution schedule slip is especially surprising considering the heavy emphasis many regional companies—particularly those that are nationally owned—have historically placed on predictability in general and schedule predictability, in particular. Why is this happening and what needs to change to fix the problem?

The Situation. Like much of the world from 2005 to 2008, the project market in the Middle East was hot. The escalating demand for equipment, materials, and experienced professionals to support the unprecedented wave of capital project work in the region stretched supply chains as never before. The regional market cooled down following the global financial crisis of 2008 but recovered quickly and has remained warm until very recently.

The regional data show that the overall cost and schedule competitiveness over this period actually has remained fairly stable with no significant change to the average, albeit conservative, performance. However, if we look at predictability metrics by referencing the authorized targets, the story is very different.

Broken Schedule Target Processes. By comparing the schedule predictability of large Middle East projects authorized since 2005 with that of the earlier projects in the region, we find that average schedule slip has increased from 6 percent to over 25 percent.

The variability around these *Continued on page 7*

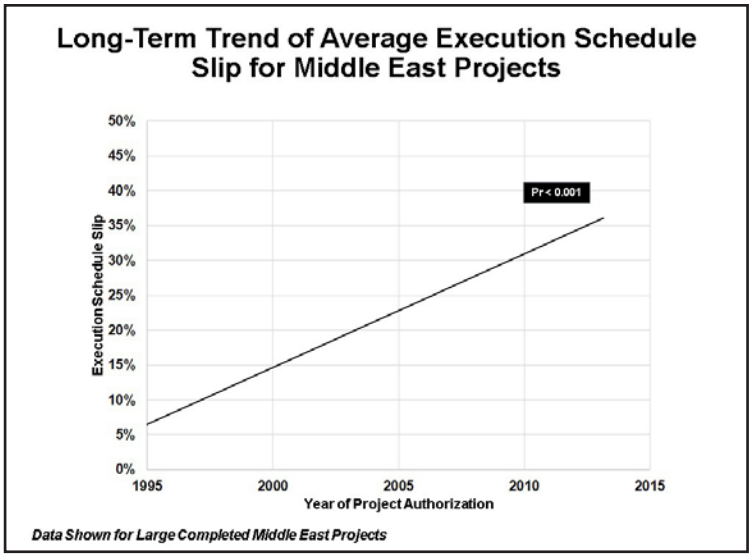

Figure 2

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averages has also increased significantly (**Figure 3**).

Counterintuitively, the average execution schedule targets became appreciably shorter during the hot market when resources were stretched thinly; slip due to late contractor mobilization was especially common. The contractors increasingly struggled to find adequately experienced staff for new projects with the situation compounded by previous projects overrunning and tying up resources much longer than expected. Few owner companies made appropriate allowances in their own target setting to account for market realities like this during the era.

Figure 4 shows how execution schedule targets for Middle East region projects authorized after 2005 were actually 18 percent more aggressive than those of earlier projects. Competitive target setting is a Best Practice but is only effective in promoting better results when those executing the projects acknowledge that the targets are reasonable and, more importantly, achievable. During the boom, this vital link was lost and has not been reestablished.

A key driver behind the trend of setting ever more aggressive schedule targets was the understandable desire to get projects into execution as quickly as possible to beat both the rapidly escalating project services market and capitalize on high commodity prices. Notably, projects groups spent less time planning and defining accelerated project schedules. As a result, the average Front-End Loading (FEL) index—a measure IPA uses to rate project definition prior to execution—in the region fell from an average *Fair* to *Poor* rating.

Owner companies have been unsuccessful at improving project definition activities to this day. The

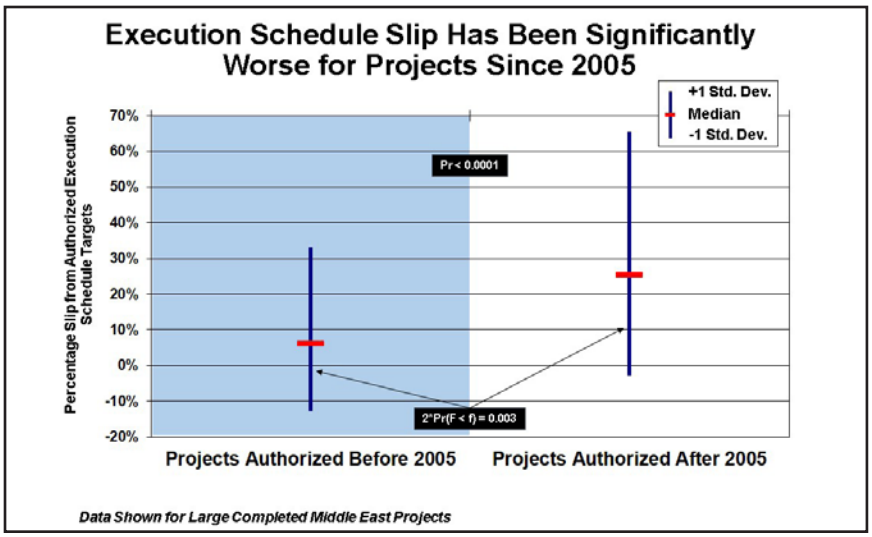

Figure 3

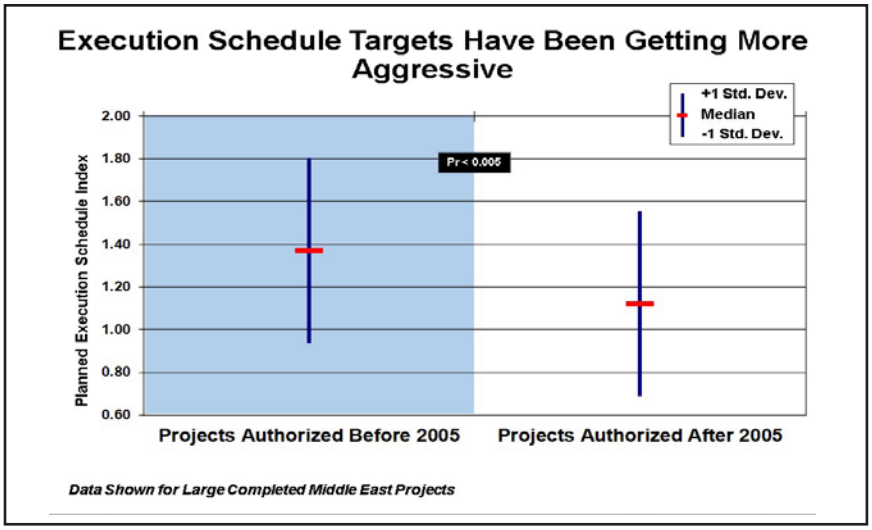

Figure 4

targets promised at authorization are considerably undermined by the approximation in data that comes from incomplete definition.

The situation is further complicated by the popular and widespread use of unqualified end dates on projects as a management tool to make teams go faster. Projects in the Middle East too frequently have end dates imposed on the project team by either business or government without suitable tradeoff qualification or recourse to challenge them once the project scope is frozen. This has had the tendency over many years to fuel poor scheduling habits and in particular the back-planning of activities from the imposed end dates.

Although schedule targets have become much more aggressive, actual schedule competitiveness has stayed stubbornly poor. This disconnect underscores how broken many companies' target setting processes have become. When correctly applied, however, competitive target setting should drive better performance by motivating teams to beat their targets. This has not been happening widely in the Middle East for a long time, with teams routinely not

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believing that the schedule targets they must meet are achievable.

Conservative Cost Target Practices. Most projects in the Middle East executed for regionally based companies are expected to underrun their estimates and the vast majority still do. It is an ingrained regional culture that is difficult to change. Historically, this has meant that most cost estimates for projects in the region have been conservative compared to Industry, and they still are.

The effect of these poor cost target setting practices was exacerbated during and since the boom years and has resulted in much more unpredictable cost deviation at present, despite average cost underruns remaining at around 9 percent (**Figure 5**). It is interesting to note that the contingency allocation for projects has not changed appreciably over this time and is still set on most projects at or just below the magic 10 percent threshold.

What Change Is Needed? Target setting mechanisms need to be re-connected with the current project environment. They need to be useful again in promoting incremental improvements in project performance over the long term. For some companies, this will require a considerable cultural shift and even an organizational change. Primarily, project teams need to believe again that their targets are both competitive and realistically achievable. If teams are not actively aligned with and bought into their targets, they are unlikely to be motivated to stretch for them and long-term portfolio performance will suffer. An ongoing issue in this area is that many regional companies still do not have established target setting processes during FEL that include an open discussion between business and project teams on key areas.

In addition, measurable targets are rarely set for anything beyond the basic cost and schedule metrics. As such, project-specific success criteria should include not only cost and schedule targets, but also workable metric targets for safety, operability, reliability, and/or other locally important factors like local content. At present, they rarely do.

Emphasizing the importance of appropriate target setting by establishing a structured process is an important first step to setting more appropriate targets and to improving long-term competitiveness. Using an active target-setting process that is referenced clearly within historical performance ranges and to real market conditions represents a considerable advantage that few regional companies have yet to take up. ■

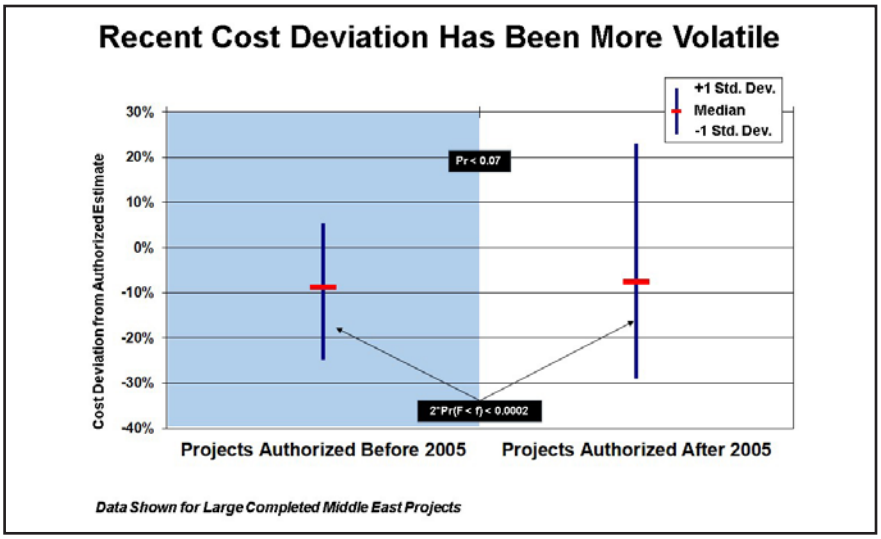

Figure 5

CRC Finalizes First Set of Research Conclusions

The IPA-coordinated Contractor Research Consortium (CRC) is wrapping up its first full year of research.

The consortium's work is focused on improving project outcomes by shedding light on practices and performance issues and sharing gained knowledge with their clients, so all involved are better positioned to promote capital effectiveness.

The following three tasks were conducted in 2015:

- **Industry Average Schedule Performance:** The purpose of this document is to provide industry average schedule durations for capital projects so that initial schedule expectations are reasonably accurate. Overly aggressive schedules (planning to deliver projects fast) often lead to unnecessarily expensive projects and/or operational difficulties as quality is sacrificed to keep pace with the fast schedule. The document is intended to help contractors work with their owner clients to establish appropriate schedule durations.
- **Avoiding and Coping With Surprises:** Through consolidation of past IPA research on risk management and a review of publicly available information, the report documents how using risk management clearly improves project outcomes. Best Practices seen in the use of these techniques include both the depth and breadth of risk management. Recommendations for implementation are reviewed, including timing, format, and categories for inclusion. The document is intended to help project teams better manage project risks and realize better performance.
- **Best Practices for Measuring Engineering Progress:** This document provides a research approach for addressing the declining performance of engineering services in the development of capital projects. Following the belief that "you get what you measure," several metrics are discussed for tracking critical project activities and deliverables. A second phase of work is planned that entails industry endorsement of these metrics and the collection of actual project data so that the link between improved project outcomes and the new metrics can be statistically tested.

IPA retains ownership of these deliverables, but IPA has granted CRC members a license to share these documents with their owner clients as long as a non-disclosure agreement is executed to prevent the information from flowing into the public domain.

The CRC Steering Committee includes Fluor Enterprises, Inc.; Jacobs Engineering Group, Inc.; and Kiewit Corporation.

For more information regarding the CRC, contact Dean Findley at +1 703 726-5332 or dfindley@ipaglobal.com

IPA Germany Forum to Focus On Industrial Competitiveness, Capital Project Effectiveness

IPA invites German company representatives interested in discussing strengths and threats to German industrial competitiveness and opportunities to improve capital project effectiveness to attend a 1-day forum that will held later this year.

During the forum IPA analysts will discuss the following topics:

- German industry project performance and productivity trends
- Capital project market risks, including high energy and resources costs
- Increasing demand for experienced engineering and specialized project talent
- Effective use of new technologies
- How organizational effectiveness and staffing structures can drive better project development performance and outcomes

With more than 600 projects located in Germany included among its proprietary database of more than 17,000 global projects, IPA delivers quantitative insights into what processes and Best Practices drive capital effectiveness. Through empirical research into the functioning of capital projects and project systems, IPA produces findings that companies can begin acting on immediately.

For more information about the Germany Forum, please contact Jordan Sealock, Manager, Chemicals, Life Sciences & Nutrition, at jsealock@ipaglobal.com, or David Purzer, Advanced Associate Project Analyst, at dpurzer@ipaglobal.com. Both can be reached by phone at +1 703 729 8300.

The Best Country for Low Costs? Why Projects in Mexico Are Looking More Attractive

As Project Costs Increase in China, Mexico Stands to Gain

By IPA Analysts Pablo Cabezas and José Haaker

Mexico is re-emerging as the "go-to" country for improving project cost competitiveness while capital project cost trends strongly suggest that China's reputation as an attractive, low-cost location to build new manufacturing capacity is losing its luster. Western manufacturing companies were once eager to take advantage of China's low labor costs, competitive material prices, tax exemptions, and favorable exchange rate associated with developing and building projects, but these conditions are changing.

The economic uncertainties in China, including the real estate bubble and a stock market that has floundered all summer, mean that the prospect of "reshoring" manufacturing capacity in Mexico is gaining traction. Several U.S. companies have recently announced plans to expand operations in Mexico, including Caterpillar, Chrysler, Stanley, Black & Decker, and Callaway Golf—just as many U.S. firms moved their operations to Mexico in the 1980s and early 1990s.

IPA's capital project cost data and research[1] show that the cost of doing projects in China is increasing (See story on page 13). According to IPA's database, projects in China were, on average, 19 percent cheaper than those on the U.S. Gulf Coast (USGC) in 2013. Yet, the cost savings was about 32 percent in 2005. IPA's research suggests that the major driver of this change is increasing labor costs in China. In Mexico, project costs have been relatively constant at around 17 percent cheaper than the USGC.

A review of market conditions in both countries since 2001 offers some insights into why Mexico's position as a global destination for investment is improving.

Manufacturing Wages. Since its entry into the World Trade Organization (WTO) in 2001, China's industrial development and economic growth has been rapid. From 2003 to 2010, China's GDP annual growth averaged 11 percent, according to the World Bank.[2] *Continued on page 11*

[1] Neil Frederick, Christina Yip, and Pei-Hsing Seow, *Developing Successful Projects in China: Phase 2—Local Companies and Asset Quality*, IPA, 2012.
[2] World Bank, http://databank.worldbank.org/data//reports.aspx?source=2&country=CHN&series=&period=

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Standards of living in China have steadily increased, and so too have wages. In fact, manufacturing wages in China have increased at a whopping average of 18 percent per year since 2002.

Meanwhile, the strengthening of the U.S. dollar to Chinese yuan exchange rate has hurt Western investments in China. The currency exchange rate, which held at around CNY8.3/US$1 until 2005, was CNY6.2/US$1 in July 2015. After conversion to U.S. dollars, China manufacturing wages in 2012 were over five times higher than they were in 2002. According to the U.S.-China Business Council,[3] the minimum wage in Shanghai and seven other major Chinese cities increased 26 percent just from 2012 to 2014. China is, therefore, losing its competitiveness as a low-cost place for investing capital in new manufacturing capacity.

Recently completed IPA research shows that although construction labor wages in China are still much lower than on the USGC, they are increasing. The average all-in[4] wage rate was about US$5.50/hr in 2009, but in 2014, the average was about US$7.20/hr.

In contrast, Mexico's wages have been relatively stable in the last decade (**Figure 6**). Current IPA data indicate that, until recently, the average all-in rate in Mexico was around US$12/hr. However, current exchange rate trends could result in lower wages in U.S. dollar terms if the Mexican peso continues to lose strength versus the U.S. dollar.

From 2005 to mid-2008, Mexican pesos were stable at around MXN11/US$1. From mid-2008 to June 2014, there was another stable period at around MXN13/US$1. But since July 2014, the Mexican peso has been losing value against the U.S. dollar once again and now the exchange rate is reaching the MXN16/US$1 mark.

Wages in Mexico, meanwhile, have remained relatively stable. If these trends continue, the shrinking difference between the all-in wage rates in Mexico and China will make Mexico increasingly more competitive.

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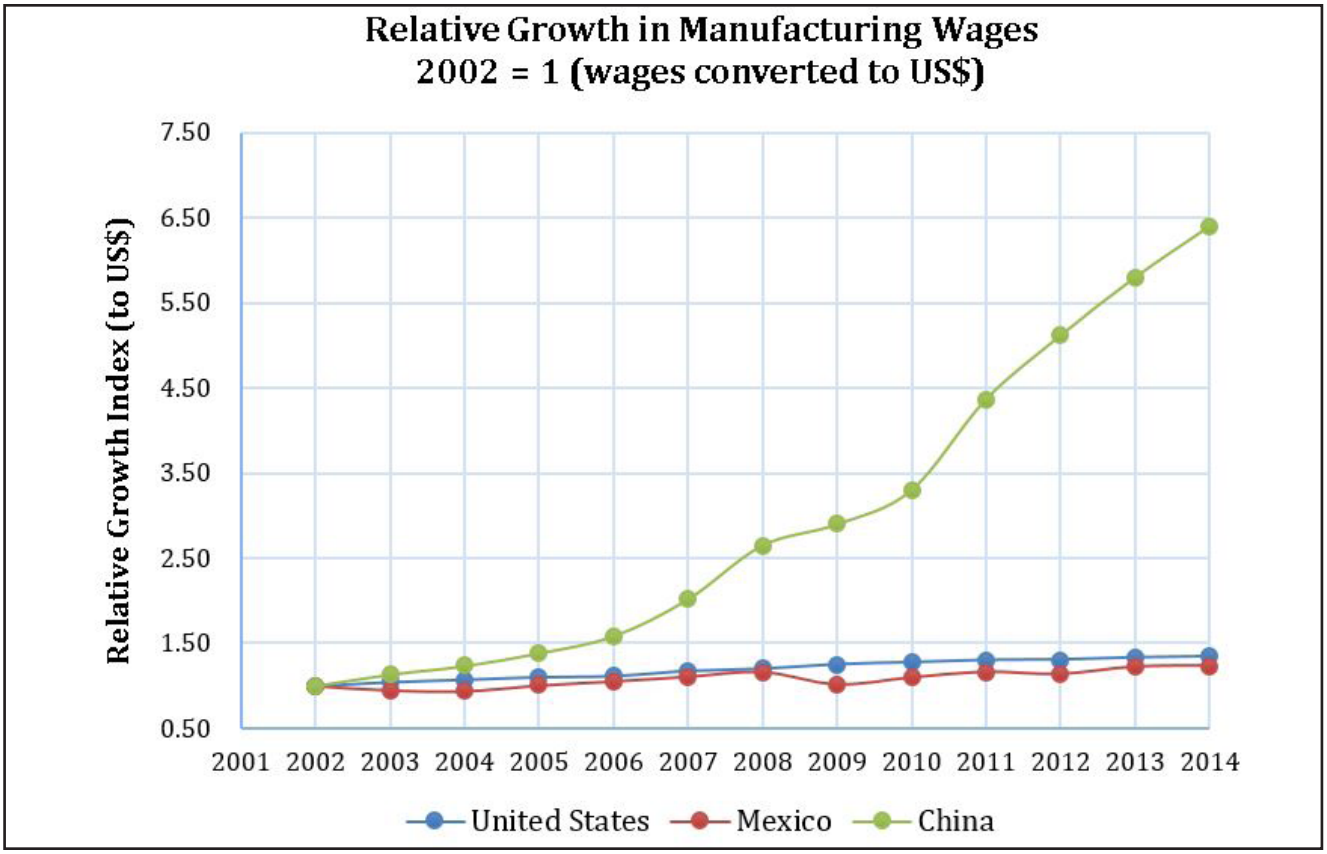

Figure 6: Data from the U.S. Bureau of Labor Statistics, The Conference Board, international labor comparisons, and trading economics.

[3] U.S.-China Business Council, https://www.uschina.org/china-raises-monthly-minimum-wages-shanghai-shenzhen-beijing

[4] Base wage plus indirect costs (fringe benefits, payroll taxes, insurance, bonds, small tools, consumables, taxes, wage benefits, subcontractor overhead & profit).

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Engineering and Project Management Costs. Another trend we have observed is a change in office costs for projects in China.

The increasing labor costs, and thus project costs, in China are being partially offset by a decrease in project management and engineering costs. Work that used to be performed by expatriates is more and more being performed by local professionals.

However, under the current Chinese economic scenario, these local engineering and project management costs are also following the wage increase trend in construction labor, which will likely make the China project cost upward trend even steeper.

Projects in China also suffer from quality and safety issues, low intellectual property (IP)[5] protection, and corruption.[6]

Location. Mexico's shared boarder with the United States makes it attractive for major U.S. companies.

Proximity drastically reduces logistics costs and the "time-to-market," and also improves communications because of shared time zones with the United States.

Further, the North American Free Trade Agreement (NAFTA) allows for tariff-free trade between Mexico and the United States, making the process of getting products to the market faster and cheaper.

Energy and Other Issues. In addition, current (excess) shale gas production in the southern United States has the potential to be transported using existing infrastructure and processed in existing plants located in the states of Nuevo León or Monterrey. Access to cheaper energy sources has a positive effect on projects developed in Mexico.

Indeed, the shale gas boom in the United States is helping to lower energy and raw materials costs in Mexico, resulting in a cost advantage over China. Mexico's industrial natural gas price is tied to the United States (which is exceptionally low). China pays from 50 to 170 percent more for industrial natural gas than Mexico.[7] This energy cost advantage is expected to improve further with Mexican energy reform, which will allow private developers to participate in oil and gas production.

However, Mexico also faces corruption at a similar level to that in China,[8] and security is a major concern.

Although originally concentrated in northern Mexico, drug cartels are spreading violence across the country, and Mexico's current safety indicators are worse than those of most Organization for Economic Co-operation and Development (OECD)[9] countries. These issues affect cost as additional security is needed for bigger projects in Mexico (e.g., pipelines and transmission lines). Similarly, corruption adds cost to capital projects.

Looking Forward. Based on IPA's recent research, it is reasonable to conclude that Mexico has strengthened its project cost competitiveness environment compared to China, which has seen its economy and markets change significantly since the turn of the century.

Given these trends, how many more companies will start looking to Mexico as a favorable place to do business? We have already noted that car manufacturers are already going back to Mexico. In addition, the new energy reform mentioned will likely change the E&P industry scenario in North America. The question for companies is whether this reshoring should aim at building new manufacturing capacity in the United States instead of Mexico.

Although proximity to shale is beneficial, there is competition with the United States as manufacturing capacity is already being built. We believe derivative chemicals and plastics are more likely to reshore, which will mark a shift from China.

IPA will continue to monitor these market trends.

For more information about this Mexico-China projects cost competitiveness analysis, please contact José Ramón Haaker at +1 703 726 5480 or jhaaker@ipaglobal.com

[5] From IPA research and experience in China, the consensus is that after 9 months in the market, technology is usually stolen.
[6] Transparency International; https://www.transparency.org/cpi2014/results
[7] Bloomberg Business, http://www.bloomberg.com/bw/articles/2013-06-27/four-reasons-mexico-is-becoming-a-global-manufacturing-power
[8] Transparency International; https://www.transparency.org/cpi2014/results
[9] OECD; http://www.oecdbetterlifeindex.org/topics/safety/

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If you have any questions or comments about this newsletter, please send them to IPA-Newsletter@ipaglobal.com.

China's Projects Market Is Getting More Expensive

A Changing Projects Market Landscape Amid Economic Turmoil

"The increasing cost of projects and shifting domestic consumer demand preferences have altered the capital investments landscape in China," according to Greg Ray, the senior analyst assigned to many of IPA's in-country client engagements there.

Multinational owner companies once drawn to the lower costs of building commodity chemical producing plants in China have completed their projects. Those projects are now mostly in production. What multinational owner companies and domestic Chinese entities are spending capital on today are specialized projects in China to meet local consumer demands, Ray said during a recent discussion.

The capital investment swing from commodity chemicals projects to more technically complicated projects represents "a transformation of the people's demand for healthy and safer products," particularly for items such as the technically complicated ingredients for food products, advanced coatings, sealants, and other improved construction and architectural products, Ray said.

However, projects are getting more expensive in China. Several factors are at play. Although the cost of equipment procured from domestic sources remains relatively inexpensive, other project costs, particularly bulk materials and construction expenditures, are on the rise. In addition, it is difficult to separate out the additional costs for quality control and quality assurance that are required to support onshore procurement from Chinese vendors versus competitors overseas. Simple sticker price comparisons do not consider the additional owner administration costs inside China to ensure on-time delivery of quality materials and equipment from domestic suppliers.

Additionally, Chinese government subsidies that were attributed to keeping bulk materials prices lower than the rest of the open world market are slowly being removed, Ray said. Construction costs, meanwhile, are increasing as the result of field productivity changes. More man hours are now needed to perform comparable construction activities than were needed in the past.

Some recent reports suggest that the slowdown in productivity is related to the Chinese economy shifting from an abundance of construction activities to more professional and consumer services work. Despite China's 1.3 billion population, the availability of experienced and skilled construction workers may be declining as more workers are performing various customer services jobs in China's burgeoning cities. These jobs are considered easier, safer, and more lucrative. The question of slowing capital project construction productivity is an area of interest IPA will continue to monitor.

In addition to the shifting landscape of new entrants into the workforce preferring service industry jobs over construction jobs, an additional factor may be significantly affecting the labor force: China's one-child policy. Enacted in the 1970s, China's regulation of "one child per married couple" has now had four decades of enactment. Single-children from single-children parents are the norm these days in China, and these days, there is no lack of media reporting on the "Little Emperor" issue in China wherein no expense is spared in spoiling the children. It follows that the grandparents and parents of these single child households would much prefer their Little Emperor to work in hospitality, real estate, or even the tumultuous stock market, than work on a dangerous construction site.

Furthermore, China's "pushing outwards" strategy of entering into engineering, procurement, and construction (EPC) contracts internationally opens the average construction laborer up to the opportunity to work overseas instead of inside China. When all else is held constant, an opportunity to work overseas provides construction laborers with a larger percentage of disposable income than if they worked inside China. Simply put, Chinese construction workers would rather go overseas than work in China because

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they have the opportunity to pocket more money.

The end result is that the EPC contractors in China are struggling to find adequate, trained, skilled labor for construction. As a consequence, they end up hiring less skilled labor, which is less productive, and also more transitory (i.e., turnover is increasing).

In addition to this effect on productivity, urban real estate prices have skyrocketed over the past decade. Most EPCs have their central offices in city centers and, therefore, are struggling to maintain margins as their office employees' salaries have been escalating to match living expenses. One common strategy to maintain margin has been to sub-sub-contract construction services and select more "mom & pop" organizations to perform piecemeal portions of the construction phase. These organizations are poorly organized and lack typical processes and procedures that more mature construction firms have established. This, in turn, also affects the construction labor force's productivity; although costs are reduced, both quality and efficiency are penalized.

Going forward, there are three major trends for China: increasing technological complexity within capital projects, increasing cost, and increasing involvement by the central government in keeping the economy stable and progressing towards the future. The last of these should never be forgotten: Beijing will use all the ammunition it has to stabilize the Chinese economy and keep the country on its current path of economic development.

IPA's Footprint in China. In the almost two decades since establishing its presence in China, IPA has completed three comprehensive studies of the nation's capital projects market. These studies resulted in the creation of the location factors necessary for IPA to measure the drivers of project success for its clients' projects in China, as well as to collect project wage, bulk materials, and equipment cost data. These detailed studies form the basis of IPA's understanding of the changes in the project landscape throughout China.

IPA engagements in China have shed light on how joint ventures involving foreign firms and China's state-owned companies operate, such as in developing engineering designs, deploying technology, working with vendors, and delivering construction packages to construction teams. Still other IPA engagements have examined issues in quality and the effect on the construction, commissioning, and startup phases.

As foreign multinationals invest in projects to increase downstream production capabilities so too are domestic China entities. Spurred by government spending, domestic entities are becoming increasingly experienced working on Chinese-operated and regional exploration and production (E&P) and onshore projects. IPA maintains a domestic China projects database of 30 projects completed by wholly domestic organizations. Quantitative data from IPA databases combined with empirical project research specific to the region can be used to evaluate practices and outcomes of foreign firms versus their domestic China competitors.

Separately, IPA recently completed a study examining the performance of Chinese EPC contractors who are becoming more active players in the global projects marketplace. In addition to assisting owner companies with these EPC providers, Chinese-owned EPC companies can use the study's findings and tools to improve their planning and bidding process when trying to win international projects.

For more information about IPA's capital projects benchmarking, research, and training solutions in China and throughout the Asia-Pacific region, please contact IPA Asia-Pacific Regional Director Rolando Gächter at rgachter@ipaglobal.com.

— Staff Writer Geoff Emeigh contributed to this report

Stemming the Tide of Mineral Project Value Losses

Understanding Uncertainties to Improve Performance Outcomes

By Staff Writer Geoff Emeigh

Earlier this year before a gathering of engineers, geologists, metallurgists, and other mining industry professionals, Baqun Ding, Ph.D., a member of IPA's Core Review Board, presented a few sobering slides illustrating mineral asset project outcomes predictability.

Based on a review of approximately 30 mining projects completed over a 7-year period from 2006-2013, actual project outcomes for asset operability, cost, and schedule expectations were often wildly off target. Indeed, analyses of actual projects show that Industry ranges of variation are significantly wider than the ±10 to 15 percent that Industry typically uses for sensitivity analysis as presented in financing decision documents.

The uncertainty of mining project outcomes is not properly captured and assessed, according to Ding. "Performance is much worse than expected. In other words, industry is overly optimistic."

Ding described the following project outcomes during a presentation and panel discussion at the Society for Mining, Metallurgy & Exploration Inc. (SME) 2015 Finance Conference.

Planned asset operability—overly optimistic. Planned production targets for projects from 7 to 12 months after startup fell short by an average of 20 percent. Some hardly produced anything.

Capital costs—not predictable. While projects overran cost plans an average of just under 10 percent, a vast majority experienced significant cost overruns, offset by some others with massive underruns.

Schedule expectations—too confident. Projects, on average, experienced schedule slip of nearly 20 percent. Poor performers on average slipped their schedule as much as 80 percent.

Tellingly, compared with other industry sectors, mining industry projects experience higher net present value (NPV) losses, and much higher NPV gain/loss variation (**Figure 7**).

It is commonly understood across the Industry that project fundamentals, including the project scope, ore body definition, mining and facilities process technology, and operational management systems, affect NPV certainty. But what the Industry regularly overlooks, Ding explained, are the ways in which project development practices drive project value changes.

"Our data show that most of the leading performance drivers of mining projects are less defined than other industries," he said.

IPA has quantified the effects of mining project practices to improve the Industry's understanding of key NPV drivers. By collecting and analyzing project knowledge and work practices data, such as basic engineering and team development planning information, as well as reviewing a team's understanding of the ore body to be mined, IPA can rate the definition and planning work process (Front-End Loading [FEL]) completeness for a project. As a project's FEL rating gets closer to Best Practical, its cost performance is shown to improve, Ding said (**Figure 8**). However, from facilities definition, to team integration, to project execution planning—also drivers of project performance outcomes—the minerals Industry lags behind other industry sectors.

"A lot of fundamental project definition work is simply not getting done. As a consequence, projects are losing value that, in many instances, could be preserved," Ding said.

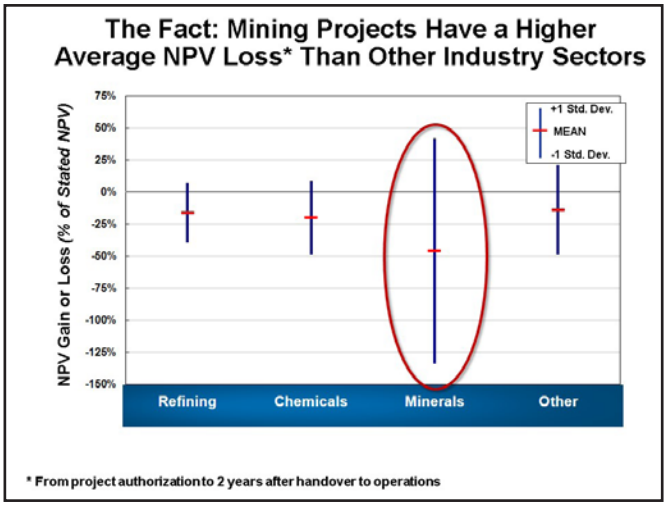

Figure 7

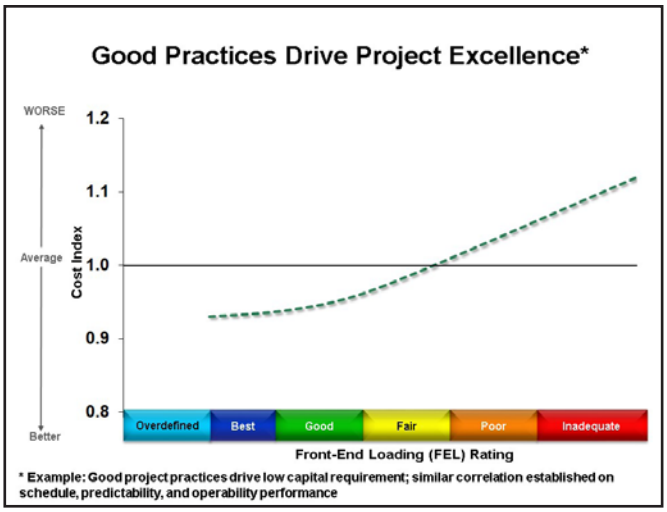

Figure 8

For more information about IPA's Mining, Minerals, and Metals (MMM) business area project evaluation services, please visit IPA's website—ipaglobal.com.

Upcoming IPA Events & Presentations for 2015

September 16	***IPA North America Regional Director to Present at CURT Workshop*** *IPA North America Regional Director Phyllis Kulkarni will deliver a presentation on global trends for capital project construction, including best practices for international brownfield projects and new-to-region projects, at the 2015 Fall International Construction Workshop in Bonita Springs, Florida.* *Visit http://www.curt.org/events.aspx?, for more information about the event.*
September 28 - 30	***SPE Annual Technical Conference and Exhibition Presentations*** *IPA Oil and Gas Practice Director Neeraj Nandurdikar will join a panel discussion on managing the future effect of current cost cutting, and IPA President and CEO Edward Merrow will deliver remarks on the potential value of and internal barriers to standardization at the Society of Petroleum Engineers (SPE) Annual Technical Conference and Exhibition (ATCE), in Houston, Texas.* *For more information about the event, visit http://www.spe.org/atce/2015/.*
October 5	***IPA President & CEO Merrow to Deliver AWP Conference Keynote*** *IPA President and CEO Edward Merrow will deliver a keynote presentation on what it takes to properly frame a sponsor's objectives for a successful project at the Advanced Work Packaging (AWP) Conference, in Houston, Texas.* *Visit http://www.awpconference.com/ for more information.*
October 8	***Merrow Headlines AVEVA Speaker Series Event*** *IPA President and CEO Edward Merrow will talk about how owners can forestall project execution problems during the earliest days of the project's development at an AVEVA Speaker Series Event in Houston, Texas.*
October 14	***IPA COO to Speak at Calgary Energy Roundtable*** *IPA Chief Operating Officer Elizabeth Sanborn will speak at the 12th annual Calgary Energy Roundtable in Calgary, Canada. The title of her presentation is: "Improving Capital Project Outcomes in a Cost Driven World."* *Visit http://energyroundtable.net/calgary/, for more information about the event.*
October 25 - 28	***Tailings and Mine Waste 2015 Conference Presentation*** *IPA Associate Analyst Jennifer Nicolaisen will deliver a presentation, "Oil Sands Tailing Management Projects: Low Returns, Business Critical," at the Tailings and Mine Waste 2015 conference, in Vancouver, Canada.* *For more information, go to http://tailingsandminewaste.ca/.*

Upcoming IPA Events & Presentations for 2015

November 16 -17	***Refining Capital Projects Conference & Exhibition Presentation*** ***IPA Hydrocarbon Processing & Transportation Manager Andras Marton will deliver remarks and be a panelist for a discussion on the "Impact of Key Drivers on Refining Strategies & Capital Project Requirements" at the Refining Capital Projects Conference and Exhibition, in Houston, Texas. For more infomration, visit http://www.petchem-update.com/refining-projects/.***
November 16 - 18	***UIBC 2015 Annual Meeting in Leesburg, Virginia*** ***The annual meeting of the Upstream Industry Benchmarking Consortium (UIBC) provides an independent forum for each participating company to view its performance against the performance of other companies. For more information, contact Neeraj Nandurdikar at nnandurdikar@ipaglobal.com.***

"What Is FEL?" Subject of CURT Professional Development Briefing

IPA Senior Project Analysts José Miguel Bolívar led a webinar-based training session for upcoming leaders in the construction industry earlier this summer. Sponsored by the Construction Users Roundtable (CURT), the presentation delivered by Bolívar on June 16, 2015, provided up to 20 young professionals with a high-level briefing on "What Is Front-End Loading?"

During the hour-long presentation and the question and answer session that followed, Bolívar spoke about the three phases of FEL, the major objectives and activities for each phase, and the importance of IPA's descriptive scale for rating project definition—called the FEL Index—that ranges from *Inadequate* to *Best Practical*. The presentation also covered the advantages of implementing and adhering to a stage-gated process of project governance.

The professionals were introduced to the field of project evaluations in terms of assessing project risks and measuring project readiness, Bolivar said. "It was very instructive for them to understand that there's a method out there to measure uncertainty" in the process of defining capital projects and deciding whether they should be sanctioned.

Bolivar explained how clients have come to depend on IPA's project evaluation and benchmarking services and tools, empirical research, and educational resources to promote capital effectiveness. IPA delivers the final assurance for many of its clients before its executives authorize funds for the execution of multi-million dollar projects, he said.

In addition, many of the public and private courses on a wide range of capital projects topics offered through the IPA Institute are accredited by the Project Management Institute (PMI).

IPA has teamed with CURT on other occasions to provide professional development opportunities to executives of construction owners as they relate to current capital projects topics and trends.

— By Geoff Emeigh

Webinar Training: José Miguel Bolívar spoke to Industry professionals about FEL and project governance.

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ADVANCING PROJECT KNOWLEDGE

Public Course Schedule

The IPA Institute, a division of Independent Project Analysis (IPA), develops and delivers educational seminars to further IPA's mission to improve capital effectiveness. IPA Institute courses are derived from IPA's extensive research and quantitative analysis of capital projects, linking statistically proven Best Practices to business value. To view full course descriptions, pricing, up-to-date registration details, and special discounts, please visit our website at www.IPAInstitute.com.

Best Practices for Small Projects (22 PDUs)

September 22-24: The Hague, Netherlands	**October 13-15: Orlando, Florida**

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October 5-7: London, United Kingdom	**November 3-5: Denver, Colorado**

New Course! *Industrial Megaprojects: What to Ask Before Investing*

October 8, New York City, New York *(2 Sessions, Morning and Afternoon)*	**An opportunity for investors to learn about the risks involved with complex inductrial projects.**

Gatekeeping for Capital Project Governance (16 PDUs)

October 8: London, United Kingdom	**November 10-11: Calgary, Canada**

Project Management Best Practices (22 PDUs)

December 8-10, 2015: Shanghai, China

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To be kept informed regarding upcoming IPA Institute programs and courses being developed for capital project improvement, please join our mailing list at www.IPAInstitute.com.

Study: Equipment Procurement Slip on the Rise

Extended Procurement Durations Spell Trouble for Many Projects

By IPA Associate Analyst Josh McClellan

An increasing number of large capital projects are contending with engineered equipment procurement delays, according to a recently completed IPA study.

The uptick in planning procurement durations, coined "procurement slip," is among several findings relating to major engineered equipment procurement trends and practices identified in the study. Measured from the time the first major order for equipment is placed to the last major delivery of materials to the site, procurement slip was found to have increased by more than 10 percent during a 10-year period, from 2002 to 2012. Bid cycle time is not included in the procurement duration measurement.

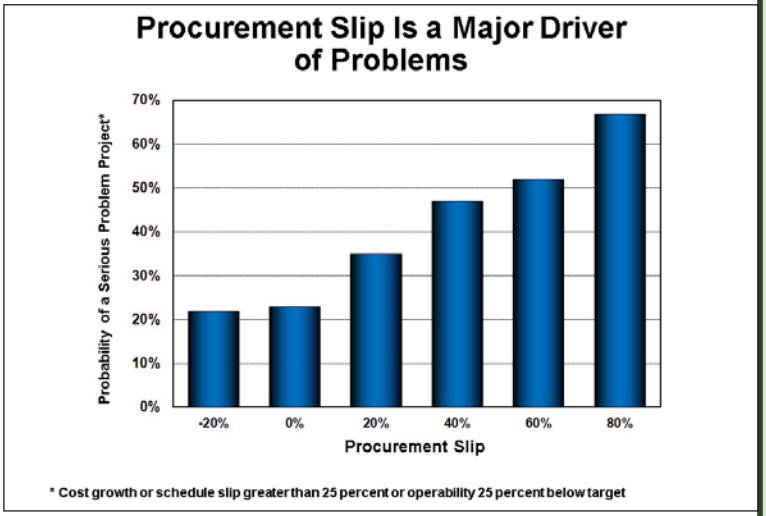

Figure 9

The fact that more large capital projects are experiencing procurement slip in recent years concerns project organizations because procurement slip is a known driver of serious problems during a project's execution and construction. Such problems include site laydown area issues and logistics challenges.

Project startup and operation targets are more prone to be missed, regularly by a wide margin, as a consequence of procurement problems. The study reviewed 270 completed projects authorized between 2000 and 2013, and determined that projects experiencing 30 percent procurement slip from plan at authorization have about a 40 percent probability of suffering significant project failures—defined as cost growth or schedule slip greater than 25 percent, or operability 25 percent below target (**Figure 9**).

Additionally, the study found that procurement organizations are consistently underestimating the time actually needed to invite, receive, select, and negotiate bids from equipment vendors. Worse, the average bid procurement cycle time is getting longer.

The study also examines how organization structure, procurement practices, and project practices can mitigate procurement risks.

For more information on the study, please contact Josh McClellan at jmcclellan@ipaglobal.com.

IPA North America
The IPA Institute

44426 Atwater Drive
Ashburn, Virginia 20147
PH: +1 (703) 729-8300
Fax: +1 (703) 729-8301

IPA Latin America

Rua Pasteur, 463-salas 1201/1202
Curitiba, Paraná 80250-080, Brazil
PH: +55 (41) 3028-9028
Fax: +55 (41) 3028-9024

IPA United Kingdom

Wellington House,
First Floor, Worton Dr.
Reading, RG2 0TG
PH: +44 (118) 920-7800

IPA Netherlands

WTC The Hague Business Center, Prinses Margrietplantsoen 33
2595 AM The Hague,
The Netherlands
PH: +31 (070) 335-0707

IPA Singapore

1 International Business Park
#10-02 The Synergy
Singapore 609917
PH: +65 6567-2201
Fax: +65 6567-2231

IPA China

#36 Chuangye Middle Road #502
Haidian District, Beijing 100081
China
PH: +86 (10) 5880-1970
Fax: +86 (10) 5880-1957

IPA Australia

Level 1, 56 Burgundy Street
Heidelberg, Victoria, 3084
PH: +61 (39) 458-7300
Fax: +61 (39) 458-7399