

IPANewsletter

IPA



Setting Up CCUS Projects for Success How to Overcome Front-End Development Barriers

By Adi Akheramka, IPA Associate Research Analyst, and
Nekkhil Mishra, IPA EMEA Regional Director

To help the industry successfully deliver Carbon Capture, Utilization, and Storage (CCUS) projects, IPA will cover the different project development elements in a series of articles. Based on learnings from past CCUS evaluations and Best Practices from projects with similar complexity, this series will introduce the key factors that drive success, covering the need for clear business objectives, Best Practices for project shaping elements, and learnings from similar technology scale-up challenges. This article discusses why CCUS projects are complex and, importantly, highlights the role of having clear business objectives to steer their development and execution. The next article will dive deeper into the elements of project shaping—stakeholder management, project financing, and getting the Basic Data right.

At a recent industry event in Washington, D.C., owner company representatives, technology providers, and policymakers expressed confidence in the potential of CCUS project investments to help achieve global carbon reduction goals. In fact, many view CCUS projects as key to reducing the emissions from the hard-to-abate sectors, such as cement, steel, and energy. CCUS is also being embraced across capital-intensive industrial sectors as a critical means of carbon removal by capturing CO₂ from the atmosphere and injecting it underground as a negative emissions sink.

At the same time, several governments have announced a commitment to support CCUS projects, either via direct cost sharing, subsidies, or tax credits like 45Q in the United States, signaling an approaching wave of global

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Edward Merrow
Founder and President

Elizabeth Sanborn
Chief Operating Officer

Nekkhil Mishra
Director, Europe, Middle East, Africa & Russia

Phyllis Kulkarni
Director, North America

Paul Barshop
Director, Asia-Pacific

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IPA improves the competitiveness of our customers through enabling more effective use of capital in their businesses. It is our mission and unique competence to conduct research into the functioning of capital projects and project systems and to apply the results of that research to help our customers create and use capital assets more efficiently.



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commercial-scale projects. In fact, several governments are looking to CCUS investments to help meet their Paris Agreement commitments. However, there is still a long way to go. According to Global CCS Institute estimates, more than 2,000 large-scale CCUS projects are needed in the next 20 years to meet climate goals, but only about 1 percent of that, or about 21 projects, are in operation around the world today. Scaling up from 21 to thousands of projects will require a close assessment of the decisions and practices of past developments and the application of lessons learned.

IPA has completed project risk evaluations, including cost and schedule benchmarking reviews, on half of the large-scale CCUS projects currently in operation globally. We continue to engage with many CCUS projects, including some of the world's largest CCUS endeavors, in different planning stages, ranging from early development to commissioning and startup. All of these CCUS projects have similar complexities, but what stands out about the projects IPA has evaluated are their vastly different outcomes. The carbon capture scope cost in these projects ranges from quite competitive (cost outcomes consistent with industry norms) to significantly higher than average (cost up to 35 percent higher than industry norms). The schedule outcomes are not any better, with carbon capture scope execution being up to 40 percent slower than industry average. To help CCUS become a viable solution for climate change, it is important for commercial-scale projects to have competitive outcomes. Therefore, it is critical that we, as an industry, learn from previous projects and improve the performance of those in development to prevent CCUS projects from suffering a fate similar to nuclear projects. IPA worries that if owners and their project organizations do not leverage the known Best Practices for shaping these CCUS projects during early definition, the industry will have difficulty demonstrating the concept of large-scale CCUS as a viable business.

Why Are CCUS Projects Complex?

Before we discuss the importance of having clear business objectives and reviewing their collective effect on project outcomes, it is important to understand why CCUS projects are complex, as this is key to their planning and development. IPA measures the complexity of projects with respect to their size, cost, process steps, stakeholder involvement, design, and engineering and recognizes the following three dimensions of complexity related to CCUS projects:

Scope complexity—In our evaluation of CCUS projects, we observe that, many times, the CCUS value chain is broken up into distinct sub-projects such as carbon capture, compression, transportation, and storage. Although the technology used, particularly for carbon capture, has been tested in other situations, carbon capture technologies must be scaled up considerably for large-scale application. Reservoir complexity is another component that is poorly understood. Technical complexity, multiple interfaces, and challenges in scope development are to be expected.

Shaping complexity—Opportunity shaping issues are common in CCUS projects given that the CAPEX for midsized to large CCUS projects can

Unclear Objectives Hurt Megaproject Performance



Figure 1

competence for executing large capital projects are often missing. The sponsorship¹ for such opportunities is also often weak, which naturally creates an element of organizational complexity and interfaces.

Taken together, these factors suggest CCUS projects behave more like megaprojects and are similarly complex.

Clarity of Business Objectives

As IPA Founder and President Edward W. Merrow explains in his book, *Industrial Megaprojects*,² megaproject success requires crystal clear business objectives from all sponsors (Figure 1).

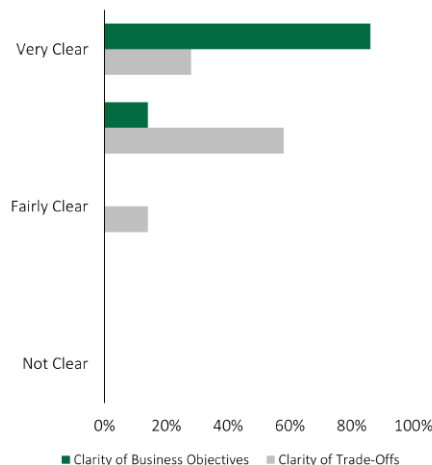
Without clear business objectives, projects cannot have clear and coherent project objectives. Project teams need to know what businesses are trying to accomplish and the attributes that will affect business outcomes, including the trade-offs (cost, schedule, and operability). These need to be documented and communicated widely.

When business objectives or trade-offs are poorly articulated or have a weak rationale, projects suffer. The project sponsor cannot build a collaborative and functional team to deal with the complexity of such large projects. IPA's Business and Engineering Alignment Meeting (BEAM) tool helps resolve these issues and make business objectives consistent internally.

Are CCUS Projects Set Up to Succeed?

When we analyze the business objectives of CCUS projects in IPA's database, interesting trends emerge. During our evaluations, we interviewed

How clear were the business objectives/trade-offs?



Were the project objectives perceived as:

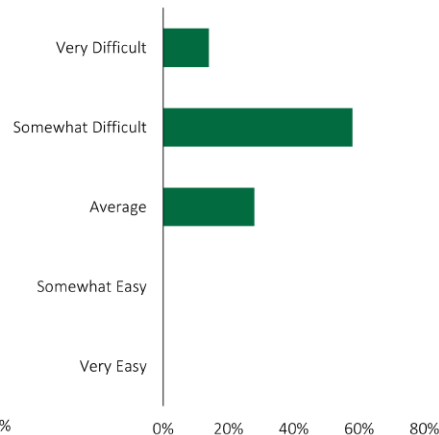


Figure 2

range from US\$200 million to over US\$1 billion. Because a relatively low rate of return is expected, these projects often rely on either government incentives or a robust carbon pricing mechanism in the region to prove their financial feasibility. The involvement of additional stakeholders, including government entities, adds to the shaping

complexity during the front-end.

Organizational complexity—CCUS projects are not typically the core business for the organizations involved with them, meaning multiple organizations usually must come together to create a viable working business for CCUS projects. As such, institutional knowledge and functional

¹An active investor in the project seeking to develop and benefit from a megaproject. The lead sponsor is responsible for pulling the stakeholders together.

²Edward W. Merrow, *Industrial Megaprojects: Concepts, Strategies, and Practices for Success*, Hoboken: John Wiley & Sons, Inc. April 2001.

the project directors and asked them to rate the clarity of the business objectives and trade-offs for their projects. As seen in **Figure 2** on page 3, most project directors have a clear understanding of the business objectives, which is good news. However, they struggle with and are less clear about the trade-offs among cost, schedule, and operability for that project. This is also reflected in the higher difficulty rating for meeting their project objectives.

As one project director put it during an IPA interview, “My bosses want to keep the cost low on this, and we are cost driven. However, we need high reliability and uptime in order to ensure we achieve the transportation and storage we promised, and we really need to get this project approved quickly before the next election at the end of the year as there is a possibility that the support for this initiative changes and disappears.” As expected, that project did not have good outcomes.

Clear business objectives are imperative for projects seeking to demonstrate new technology because the business goals may differ from a standard net present value (NPV)-driven project. In our database of capital projects, we have a subset of over 1,500 projects that deployed innovative technologies. The completed CCUS projects in operation today had outcomes similar to those seen in those innovative projects and can be characterized as demonstration projects. However, a demonstration project does not need to cost much more than a commercial project. The purpose is to get valuable data, but not lose money doing the project either. However, for demonstration projects, in addition to the cost, schedule, and operability performance measurement, sponsors should also define and measure three other areas of success:

Application success—Proving the demonstrated technology works well in the local setting, which is important for all CCUS demonstration projects, particularly because they often intend to attract future potential projects

Diffusion success—Unless the objective is to meet some high-level national policy goal, the demonstration project should help diffuse the technology into general use for the larger market to adopt

Information success—The goal should be to reduce uncertainties to the point at which the lack of information does not prevent adoption decisions

When looked at as demonstration projects, few of the completed CCUS projects IPA evaluated were successful based on the measures above and they also failed to set

up the pipeline of projects to succeed. In most cases, the demonstration worked well at the site (application success); however, the uncertainty around most elements could not be reduced (information success).

So far, the project scopes are not standardized, which would help bring the costs down (diffusion success). For CCUS investments, the supply chain is still evolving, with vendors and contractors lacking the expertise to deliver the scale and efficiency required. Local regulatory bodies have to react to the need for new regulations for subsurface storage and cross-country CO₂ transport and for new mechanisms to incentivize carbon capture. These external factors increase the uncertainty of developing CCUS in most regions around the world, and the major hurdle for wide diffusion of the concept remains CCUS’s cost disadvantage over alternatives. This may be solved partially with a sufficient CO₂ price or by developing some break-through innovative technology.

Overall, CCUS has not become run-of-the-mill and has not been set up yet to be a top mechanism to reduce CO₂ emissions, which raises a question: If the business objectives of these projects were to demonstrate success, what were the particular gaps in their project shaping that fell short?

Conclusions

CCUS projects are difficult to execute given their objectives and trade-offs. Add to that the demonstration complexity, and more factors must be considered than the cost, schedule, and operability. Such projects require a strong sponsor with a clear idea of the business objectives, project objectives, and measures of success and these need to be communicated early and widely. Further, the industry needs to widely share and adopt Best Practices to kick start the next slate of CCUS projects globally. The good news is that repeatable capital project performance success is possible when sponsors, in addition to following opportunity shaping practices and establishing clear business objectives, gather sufficient Basic Data, follow a stage-gated governance process, and staff cross-functional project teams. More than three decades of IPA capital project evaluations and research using real project data have proven that quantifiable performance outcome improvements for complex projects like CCUS, including cost, schedule, and operational performance results, are achievable.

Contact Adi Akheramka at aakheramka@ipaglobal.com for more information on setting up CCUS projects for success.

Reducing Capital Projects Staff Without Long-Lasting Damage

By Sarah Sparks, IPA Product Development Leader, Organizations & Teams

The COVID-19 pandemic has had a major effect on capital projects and will likely continue to influence company portfolios for at least a year, if not longer. With revenue down across many industries, companies have dramatically cut capital portfolios and are (or will likely be) looking to reduce their costs. As a consequence, project organizations across the industry will be faced with a mandate to reduce headcount. This is not a new situation to be in; in fact, many have been here before in times of crises, with the most recent example being the Global Financial Crisis. Unfortunately, past approaches to reducing capital projects staff have done serious, long-lasting damage to industry capability.

Historically, Reactions Placed More Emphasis On Reducing Cost Than Strategic, Informed Decisions

With the magnifying glass focused on keeping the company healthy in the short-term, the industry's approach to reducing capital projects staff was done with expedience in mind rather than long-term strategy. Few took the time to question what the right size and composition of the organization should be given the current portfolio and what might be required in the



future. Consequently, staff across entire competencies were eliminated under the assumption that when work picked up again, the services could be purchased from the market. However, the reality is contractors faced similar challenges and responded in the same way as owners, leaving the entire market devoid of the competencies required to effectively execute projects.

This approach to cost reduction did lasting damage to the projects industry as a whole. All companies—owner and contractor alike—were left with major gaps in the core capabilities required to effectively execute projects. Because no one had staff in the roles, no one was developing personnel with the required capabilities for an extended period of time. Thus, when companies went looking for people to fill gaps, the talent they were seeking was not available because it simply did not exist.

We Must Make Staffing Decisions With a Long-Term View in Mind

The reality of the current situation is difficult decisions will have to be made as cost reductions are inevitable. So if you have to cut staff, how can you do better? What should you consider to make smarter staffing decisions?

Assess the State of Your Project Organization

Start by taking stock of what you have. This means gaining a deep understanding of your people and your portfolio.

How many people in each function do you have across your organization? Do you have a clear, objective way of assessing each person's knowledge, skills, and abilities? This information will equip you to understand what you have and compare it to what is needed now and in the future so you can make smarter, more strategic decisions.

Do you know what the critical mass is for your portfolio (i.e., the minimum owner staffing required to effectively execute the portfolio)? It is our experience that the majority of organizations tend to be understaffed for their portfolio. So, it is possible with cuts to the project portfolio, the organization may now be right-sized. Do you have an objective way of determining what is required for your portfolio?

Do not completely eliminate any core competencies without fully understanding the consequences. Once a competency is eliminated within an organization, it will take years to rebuild. This means companies

¹Lucas Milrod and Sarah Sparks, "Making Intentional Staffing Decision to Preserve Core Owner Functions," Independent Project Analysis, April 3, 2020, <https://www.ipaglobal.com/news/article/making-intentional-staffing-decisions-to-preserve-core-owner-functions/>.

must prioritize retaining a critical mass of staff in core competencies.

IPA has identified a set of owner core competencies required to effectively execute projects. Our research shows that projects staffed with owners in these functions achieve better definition up front, setting them up to deliver projects for an average of 22 percent lower cost than teams missing owners in any one of those functions. Maintaining staff in these functions helps ensure companies are positioned to effectively execute project work in the short- and long-term.

In addition, other capabilities may be core to your business or provide your company with a comparative advantage. Again, maintenance of staff in these functions should be prioritized because once the competency is eliminated, it will take years to rebuild.

Consider the State of the EPC Industry

As mentioned above, the Industry's typical mentality has been, "If I don't keep it, I can just go to the market and buy it when I need it." However, it is this exact thinking that created capability gaps in the past, and contractors have still not fully recovered. Companies need to really think critically about current contractor capability; where contractors are weak, owners must be strong.

Maintain a Balance of Experience

It can be tempting when reducing capital projects staff to eliminate from either extreme—those that have been with the company the shortest amount of time since they do not have the same tenure as others or to eliminate the most experienced, typically most costly,

staff. However, we would not recommend solely relying on any single strategy. Instead, we believe a balance of experience should be maintained to ensure those with experience and stronger capability can mentor and transfer knowledge to those with less experience.

By considering these issues and equipping organizations with the data necessary to assess the full picture, companies will be better positioned to make informed decisions about reducing capital projects staff and understand how they may affect the project organization's ability to deliver capital effectively in the future.

Contact Sarah Sparks at ssparks@ipaglobal.com to learn more about how IPA helps optimize the staffing, competence, and structure of capital project organizations and teams.

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Elizabeth Sanborn Appointed to ECC Board of Directors



Elizabeth Sanborn
IPA COO

IPA Chief Operating Officer Elizabeth Sanborn has been elected to the Board of Directors of ECC, the Association for the Capital Projects Engineering and Construction Community. Sanborn joins a Board comprising representatives of capital project industry leaders, including many of IPA's most important clients. As stated on its website: "The ECC is an association of leaders in the engineering and construction management world who are interested in fostering a powerful platform for career growth through the free exchange of ideas, the discovery of new perspectives, and the exploration of today's biggest challenges."



How Has COVID-19 and the Economic Crisis Affected 2020 Digitalization Efforts?

By Deb McNeil, Director, IPA Capital Solutions

Should capital projects organizations slow down digitalization programs as a result of the COVID-19 pandemic and economic crisis?

The answer to this question depends on the measurable benefits. Digitalization has been the buzz word in projects for the last couple of years, with many owners taking a serious look at the way they manage and leverage information in the facility design-build-operate lifecycle. The promise of finally leveraging insights from the terabytes of data produced on our projects through streamlined interfaces is simply too good to pass up.

In January of this year, IPA conducted a poll of owners to see what digitalization projects the industry had underway. Over 25 different owners participated, and the results were as varied as the companies we polled. Some projects were focused on engineering efficiency; some focused on project controls; for others, it was operations. The one thing they all had in common was that for most companies these projects were still working to define what value could be created and how digitalization success should be defined.

Despite only being six months removed from the initial survey, we followed up with these companies to see what the COVID-19 pandemic's effect was on their 2020 digitalization projects.

Thirty industry-leading clients took the time to answer our questions on the impact COVID-19 and the economic crisis have had on their 2020 digitalization plans for capital project execution. Most of the companies who responded (97 percent) had planned 2020 improvements already underway in multiple

Number of Improvement Areas by Company

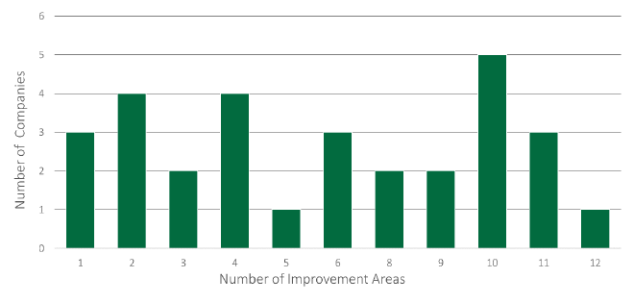


Figure 1

2020 Planned Digitalization Projects

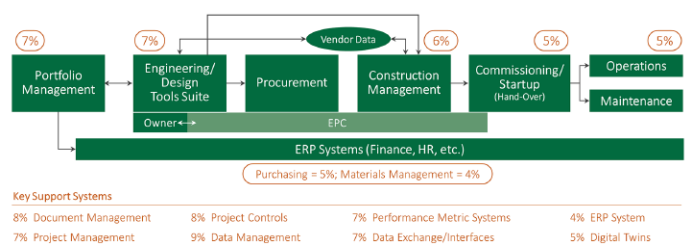


Figure 2

functionality areas. Some companies had as many as 10 to 12 areas of targeted improvements in their digitalization plan (Figure 1).

Within the total 185 improvement efforts reported as being worked on, we see a wide distribution of improvement focus areas. The surveyed companies are basically working across the whole project and facility lifecycle (Figure 2). It is also interesting to note that no single area dominates—work focus is evenly spread.

So—to answer the survey question—what impact has the COVID-19 pandemic and economic crisis had on our digitalization plans? Answer: Some impact has been felt. Eleven companies (37 percent) said that their 2020 plans had changed. Eight companies slowed down some aspects of their plans, although two of these companies also accelerated efforts in some of their improvement areas related to improving connectivity, and one stopped work on their construction management improvement area. Two added new focus areas to their plans—primarily efforts to help deal with COVID restrictions and information access in the field. Many identified a shift in relative priorities and reported that project plans remain fluid at this time.

The primary explanation is that we're failing in the same predictable patterns. We do not complete the front-end as well as we know we should (sometimes we do, but not systematically). As a result, engineering gets out of sequence trying to catch up, and is ultimately delayed. This causes slip in our material delivery. And ultimately, our construction contractors, who are ready and willing to work, are left waiting on materials and designs.

These results should not be a surprise. We do projects the same way we have been doing them since the 1980s. Pandemic or no pandemic, digital opportunities exist today that can help make a lasting change in our projects. A few companies have already measured it, and it is big. So, going back to our question at the beginning, should we be delaying our digital projects? Well, if the project involves creating greater transparency in the maturity of the front-end so that we really know when things are done, then no. If the project involves facilitating the handover between FEED contractors and the engineering contractors, then no. If the project involves creating transparency and seamless transition between engineering, the vendors, and the field and is targeted at improving labor productivity, then no.

Value delivery is obtainable when we make improvements in construction and engineering productivity or accelerate the schedules on our high return projects. The good news is that no companies abandoned their digitalization efforts. As companies continue to look for the improvements needed to improve capital project performance, IPA is here to support those efforts.



Digitalization: Leveraging Data to Improve Project Outcomes

Digitalization and advanced analytics have the potential to usher in a new era for capital projects, one in which critical information can flow automatically among the many systems projects rely on. This free flow of information enables project systems to anticipate and react to challenges, and learn how to improve the project delivery model for future projects.

Through careful study of project management and team behaviors and practices for over 30 years, IPA has identified how to use the right data to accurately predict project performance. No other firm in the world is more equipped to guide organizations through digitalization and define the data and methods required to unlock real knowledge to improve project system performance.

Contact Deb McNeil at dmcneil@ipaglobal.com or Luke Wallace at lwallace@ipaglobal.com to inquire about how IPA can help with your digitalization efforts.

Market Insights for FPSO Projects

By Matthew Ingham, IPA Advanced Associate Project Analyst

This is the first in a series of three case studies by IPA Project Analyst Matthew Ingham explaining how companies can leverage IPA's Upstream Project Evaluation System (PES®)¹ and capital projects database to strengthen floating production storage and offloading (FPSO) project performance. The case study below describes an FPSO market assessment for a client focused on improving the capital efficiency of its FPSO projects.

Visit www.IPAGlobal.com/resource/case-studies to review the other two FPSO case studies in the series and to find out how IPA can help to improve the effectiveness of your capital projects.

The Client's Dilemma

IPA was approached by a client with a large portfolio of upcoming FPSO projects. The client had little experience executing FPSO projects and limited insight into the market outlook for FPSO project costs and schedules. It contacted IPA seeking information and metrics that would help it better understand how market activity and commodity prices influence FPSO project costs and schedules, and how the current and short- to mid-term market outlooks were likely to influence FPSO costs and schedules. The client sought to feed this knowledge back to its planned FPSO projects to support more reliable cost and schedule estimates and better scrutinize contractor-provided cost and schedule estimates. IPA had primarily conducted project benchmarking evaluations for the client, but in this case, the client needed a market assessment to improve its capital efficiency.

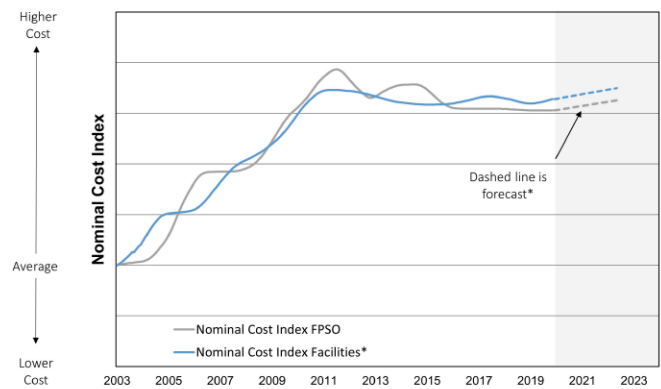
IPA's Market Assessment Approach

IPA's EMEA regional office, working with our Project Research Division, employed its Upstream Project PES methodology to examine FPSOs and large offshore facilities (topside weight >15,000 metric tons [mt]). We included large topside projects because the FPSO market behaves similarly, given that facilities with a topside weight greater than 15,000 mt are built in a limited number of shipyards. The Upstream PES is a set of models (including asset development cost and schedule metrics, individual facility and well metrics, and subsurface evaluation) based on the statistical analysis of historical industry data.

IPA gathered data on current and historical FPSO market activity and on large topside projects and corresponding indicators using a combination of internal and external data sources. IPA then performed statistical analyses to identify historical trends in the correlation between FPSO and large topside market activity and project costs and schedules. These analyses were done to simulate how the current and near-future market is likely to influence FPSO costs and schedules.

The results found that the FPSO market has recovered since the oil price crash in 2014 and cost effectiveness has also improved since then. However, relative to today, as shown below, FPSO costs are expected to increase slightly in the short- to midterm because demand is expected to grow with increased investment in deepwater and ultra-deepwater developments that necessitate FPSO developments. In contrast, FPSO execution schedules are expected to improve slightly. The trends represent IPA's view of the FPSO market and indirectly represent the view of owner companies, vendors, and contractors.²

FPSO Costs Are Expected to Marginally Increase



Includes offshore processing facilities with topside weight greater than 15,000 mt
* Forecast is based on cost estimates from projects in FEL 2 and FEL 3

FPSO Market Activity Insights

The study provided the client with data-based insights into current and historical FPSO market activity in the industry and how the current and near-future market situation is likely to influence FPSO costs and schedules. The client found IPA's external, independent viewpoint to be very beneficial to support cost estimating in their current projects and to validate/scrutinize project cost and schedule estimates.

¹PES is a registered trademark of IPA.

²The analysis in this study was undertaken prior to the COVID-19 pandemic and the drop in oil prices. FPSO market conditions and supply chains have changed.

Early Estimating Metrics for Pharmaceutical Capital Projects

By Geoff Emeigh, IPA Staff Writer

Life sciences companies are spending more capital on the construction and expansion of pharmaceutical facilities to boost their drug manufacturing capacity and strengthen regional supply chains. Given the competitiveness of the pharmaceuticals marketplace, life sciences industry owner companies must deliver cost- and schedule-advantaged capital projects. To deliver capital competitive pharmaceutical projects, owner project teams must access current and reliable early estimating metrics during Front-End Loading (FEL).

IPA's pharmaceuticals and biotechnology sectors capital projects database includes project development and execution data from over 800 projects located in North America, Europe, and Asia. More than 600 projects in the database are completed. IPA was asked by a group of life sciences companies to leverage these data to develop an entire suite of early estimating metrics for the delivery of pharmaceutical facilities projects. Upon completion, the metrics will empower project teams responsible for developing conceptual and feasibility estimates and validating detailed estimates. Another important industry deliverable will be the establishment of a standard Code of

Accounts (CoA), allowing collection of completed project data in the same format and the eventual expansion of the metrics datasets.

What Types of Life Science Facilities Are Included in the Study?

For the first of a planned series of pharmaceutical sector cost studies, IPA is collecting data for four kinds of pharmaceutical facilities:

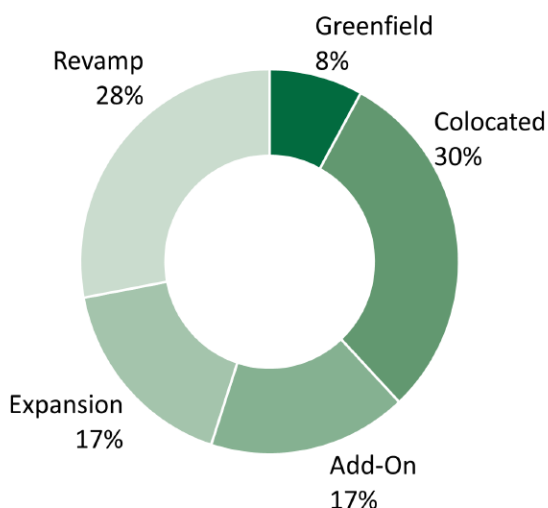
- Bulk biological (large molecule) facilities
 - Will split by single use vs. traditional stainless steel equipment when data allow
- Sterile form/fill facilities
- Laboratories
- Chemical active pharmaceutical ingredient (API) facilities
 - Will split by high-potency API vs non-high potency API facilities based on data availability

To ensure creation of a complete set of early estimating metrics, IPA is requesting data on all project types,

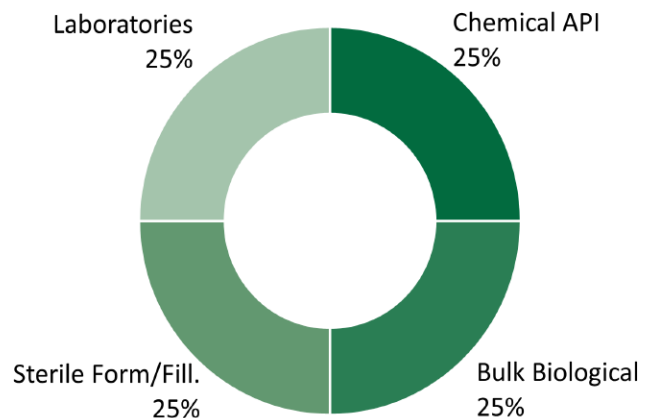
IPA's Pharmaceutical & Biotech Database

Representation of Project and Facility Types

Project Types



Facility Types



including greenfield (process unit costs only), co-located, and brownfield projects (i.e., add-on, expansion, and revamp projects). The projects need to be authorized within the past 5 years. The minimum project size for this data collection effort is US\$10 million. The end product will be a suite of cost and schedule metrics, with summary statistics provided for each metric.

What Cost Metrics Will Be Developed?

Shown below are some examples of the early estimating metrics IPA is producing for participating companies:

- Cost to cost metrics
 - Total Installed Costs (TIC) \$ / Equipment \$
 - Office Costs \$ / TIC \$
 - Process Automation \$ / TIC \$
 - Building Automation \$ / TIC \$
 - Process Installation (Labor & Materials) \$ / Equipment \$
 - Commissioning & Qualification (C&Q) \$ / Equipment \$
- Cost to scope metrics
 - TIC \$ / Square Foot
 - Exterior Enclosure \$ / Square Foot
- Scope to scope metrics
 - Process Area Square Foot / Gross Square Foot
 - Mechanical Area Square Foot / Gross Square Foot
 - Controlled Unclassified Square Foot / Gross Square Foot
 - Process Area + Process Support + Process Related Square Foot / Gross Square Foot
- Schedule metrics
 - Design Duration Through OQ Duration / TIC
 - Phase Duration / Square Foot

IPA invites all owner companies in the life sciences sector to participate in this early estimating metrics initiative. The group is open to including project data from both authorization grade estimates and completed projects.

For more information about these early estimating metrics and CoA for pharmaceutical facilities, please contact IPA Cost Group Deputy Director Aditya Munshi at amunshi@ipaglobal.com or Natalia Zwart, Manager, Life Sciences and Nutrition, at nzwart@ipaglobal.com.



Cost Engineering Bolstering the Industry's Cost Engineering Competencies

IPA helps owner companies improve their cost engineering capabilities at both the individual project level and project system level. Our impact extends beyond our clients, having received awards from prestigious professional trade associations for our contributions to the field of cost engineering. A high-level outline of IPA's cost engineering services is included below.

Estimate Risk Analysis & Schedule Evaluations

- Cost Estimate Risk Analysis
- Capital Project Schedule Evaluations

Cost Engineering Committees

- Cost Engineering Committee (CEC)
- Upstream Cost Engineering Committee (UCEC)

Cost Engineering System Tools & Services

- Work Process Forensic Analysis & Optimization
- Database & Estimating Tools Development

Capital Projects Market Intelligence

- Regional Cost Studies
- Regional Labor Market Intelligence
- EPC Market Forecast Newsletter

Contact Aditya Munshi at

amunshi@ipaglobal.com to discuss your organization's cost engineering needs.

Case Study: Site Staffing Analysis for Rapidly Changing Project Portfolios

By Katya Petrochenkov, IPA Senior Project Analyst

The Problem

A prominent airport, with a clear commitment to continuous project improvement, experienced significant declines in passenger volumes, prompting leadership to reassess the company's business strategy. The capital project portfolio was adjusted accordingly, resulting in a significant decrease in projected capital spend for at least the next 2 years. As part of this client's regular engagement with IPA, the airport had completed a benchmarking and site staffing analysis of capital project resources the previous year. This particular staffing analysis had revealed significant redundancies in staffing for certain functions, driven largely by the organization's complex structure, which limited its ability to use resources across the portfolio efficiently. The airport was in the process of restructuring the project organization to address this issue when confirmation came that capital spending was set to decrease. The client knew this would affect resource levels, but how big was the effect? How could they realign the organization to meet business priorities, without cutting too much? The client needed answers, and it needed them fast.

Analysis

The client approached IPA's Europe, Middle East, and Africa (EMEA) regional office to conduct a site staffing analysis to reflect the downsized capital project portfolio. The objective of the analysis was to determine the optimal number of project resources needed to plan and execute the portfolio, without putting project performance

or continuous improvement initiatives at risk. And the timing was urgent. As the client had completed a similar analysis the previous year, IPA was able to optimize the data collection and assessment process to deliver an update quickly.

Based on planned capital portfolio characteristics for 2020 and 2021 as well as known information about the client's project practices and staffing strategies, IPA completed a quantitative site staffing analysis to examine resource needs for 15 key functions integral to project development:

- Capital projects director
- Project management
- Engineering
- Cost estimating
- Cost control
- Scheduling/planning
- Management
- Business
- Safety
- Environmental/regulatory
- Procurement
- Contracts administration
- Operations
- Maintenance
- Commissioning & startup engineering

Individual statistical models, developed

using staffing data from over 100 project management organizations across a wide variety of industrial sectors, were used for each functional group to determine the optimal levels of owner and third-party resources.

Outcomes

Within a 2-week turnaround time, the assessment was complete and a short, easy-to-digest slide pack summarizing the results was distributed to the client. The results showed that, although the total capital spend of the portfolio had decreased significantly, optimal staffing levels only decreased slightly based on future portfolio characteristics. To shape the new portfolio, the client had gone through a much more rigorous portfolio management process, resulting in a smaller number of higher value projects. The shift from many small projects to fewer larger projects meant resources would not be able to work on as many projects simultaneously as before. In other words, resource demands on a per project basis were actually higher. These findings demonstrate the importance of ensuring resource levels are the right fit for your portfolio and the potential danger of assuming a direct linear relationship between total capital spend and resource needs. While cost-cutting measures will always lead companies to look to resource cuts, cut too much and you run the risk of undermining other organizational goals, like continuous improvement and project excellence.

Contact Allison Aschman at aaschman@ipaglobal.com for more information on IPA's work with clients in the EMEA region.



Manufacturing Facility Relocation: Lessons Learned From Past Projects

By Joshua Carey, IPA Project Analyst

Periodically, companies move pieces of equipment, even entire manufacturing facilities, from one location to another. IPA evaluations of manufacturing facility relocation projects—from consumer goods and pharmaceutical plants to oil and gas refineries—find these projects have a weak track record in terms of their cost and schedule predictability. This cost growth and schedule slip threatens the business case for the relocation effort. What is more, an analysis of information in IPA's capital projects database shows the operability and functionality of relocated facilities at startup often fall short of business expectations.

Despite their relatively poor performance, relocation projects will remain attractive capital investment opportunities for companies in search of lower feedstock costs, confronted with brownfield site constraints, or confronted with government requirements to relocate their industrial operations to a less populated area. Economic uncertainty surrounding the COVID-19 pandemic could, in fact, increase the prevalence of relocation opportunities. Project leaders understanding Best Practices for relocation projects can help secure the business case and increase the likelihood of success after authorization.

Outcomes of Facility Relocation Projects

IPA's capital project database includes many manufacturing facility relocation projects ranging from \$1 million to \$700 million. The relocations include local, cross country, and intercontinental moves. We looked at seven recently completed relocation projects ranging from \$5 million to \$600 million, completed from 2008 to 2019, in the petrochemical and consumer product sectors. A large

project in the sample relocated an entire plant from South America to the U.S. Gulf Coast. While two projects in this sample came in on budget and on time, the remaining five projects experienced an average of 26 percent cost growth and 26 percent schedule slip. The rigor applied to relocation project drivers was much less compared to other new construction projects, perhaps because of the perception of scope and engineering simplicity. We identified several drivers behind these disappointing project outcomes.

One problem is the lack of clear business objectives. Often objectives are a mixed bag and sometimes change mid-way through execution. What starts as a straightforward opportunity to move existing equipment—and current operational capabilities—from one location to the next mushrooms into an opportunity to increase capacity or otherwise grow the business at the new location. Evolving business objectives obscure the project objectives and make it difficult for project teams to make decisions.

Not unlike many other capital projects, the project teams for the relocation projects we reviewed were not fully integrated during project definition. A major gap was the lack of operations and maintenance input from the existing site. The well-executed relocation projects had input from experienced operations and maintenance personnel who were able to either relocate to the new site or spend time training new personnel. Relocation project teams that lacked experienced personnel, particularly those with the most familiarity with the equipment, encountered late changes. Further, health and safety, environmental, and soil requirements at the new location were often not well understood. Project schedules and estimates were underdeveloped and did not consider the full scope of work required.

In addition to cost and schedule erosion, poor project drivers in many instances were responsible for startup and operability issues with the facility. Some problems were

related to insufficient personnel support, but in multiple other cases, the existing equipment's condition was not well understood when it arrived to the new site. In one case, vital equipment was damaged. In another case, the existing equipment's capabilities were overestimated and, once relocated, it was unable to ramp up to the previous operating capacity.

Key Learnings From Relocation Projects

IPA has extracted key learnings from our analysis of recently completed manufacturing facility relocation projects, as described above. These practices should be used on all projects, but omission of any one practice is particularly damaging for relocation projects.

Here are the main takeaways:

- Clarify and document objectives and gain alignment with business on priorities. A Business and Engineering Alignment Meeting (BEAM) workshop is an effective means of gaining alignment between business and project team functions.
- Ensure critical functions, including operators and maintenance personnel from the existing site, are part of the project team.
- Understand site factors and how they differ from the original location to the new location.
- Inspect for defective and unsuitable equipment for the new location—verify the condition of existing equipment before and after transportation so the facility can maintain operating capacity and start up smoothly.

Our review reveals that manufacturing facility relocation projects, on average, have worse cost predictability and similar schedule predictability compared to non-relocation projects. Key gaps in team development and understanding project risks drive poor cost and schedule performance and cause operability and startup issues at the new facility. Ensuring teams use Best Practices specific to relocation projects during project planning and development will give teams the best opportunity to fully meet the required business objectives on schedule and on budget.

Contact **Joshua Carey** at jcarey@ipaglobal.com to learn more about Best Practices for manufacturing facility relocation projects.

On-Demand Webinars

IPA has been delivering free webinars to discuss issues affecting the capital projects industry amidst the COVID-19 pandemic. To access the recordings and slide packs for the webinars below, visit:

www.ipaglobal.com/resources/webinars

Moving Forward With Digitalization in the Time of COVID-19 and Economic Crisis

In this webinar recorded on August 11, 2020, Deb McNeil, IPA Capital Solutions Director, reports on the results of a recent IPA survey on the impact of COVID-19 and the economic crisis on digitalization efforts. (Recorded in August 2020).

How the Capital Projects Industry Is Responding to COVID-19 (July 2020 Update)

As the COVID-19 pandemic is taking a toll on capital projects and project systems, Jason Walker, IPA Deputy Director of Research, and Will Krafcheck, IPA Project Analyst, share new information gathered from IPA's ongoing COVID-19 industry survey on how companies are working to secure supply chains, adapt construction work sites to keep workers safe, and re-balance project portfolios. (Recorded in August 2020).

Making Smart Resource Decisions in the Midst of a Crisis

To deliver projects effectively when capital work resumes, it is imperative that owner companies make smart decisions now with regard to resource cuts. Sarah Sparks, IPA Product Development Leader, Organizations & Teams, hosted this live webinar sharing key project organization staffing data and information needed for smart decision-making from IPA's ongoing COVID-19 industry survey via a live webinar. (Recorded in June 2020).

IPA Institute

Courses Resume Online

IPA Institute courses have officially resumed with Webex Training, a virtual classroom platform, being used to support online courses. Not to be confused with webinars, which mostly consist of one-way delivery, the new IPA Institute online trainings require the participants to think, consider, reflect, and respond to the content presented. The IPA Institute has designed these new online courses to be highly interactive, with some level of interaction every 2 to 5 minutes. Four courses are now available in the new online format:



Front-End Loading (FEL) and the Stage-Gated Process

Project professionals gain an understanding of the elements needed to drive better outcomes in safety, cost, schedule, and operational performance. The course is delivered online in two 2-hour sessions.



Capital Project Execution Excellence and Project Controls

Participants learn the project controls Best Practices that drive Execution Excellence and help deliver competitive and predictable capital projects that meet business objectives. The course is delivered online in two 2-hour sessions.



Leading Complex Projects: How Do You Compare to Successful Project Leaders?

Based on groundbreaking IPA research that statistically links leadership characteristics to success, project leaders find out where they stand in comparison and how to close the gaps. The course is delivered online in two 2-hour sessions.



Project Management Best Practices

Participants emerge from the course with an understanding of how to implement the learnings to improve the way their organizations plan and execute mid-size to large capital projects. Practical tools are also provided for project professionals to use in their daily environment. The course is delivered online in five 4-hour sessions.

All four new online courses were delivered to positive reviews over the summer and will continue to be held over the coming months. View the upcoming schedule listed to the right and visit www.ipaglobal.com/events for more information and to register.

Online Courses

Due to COVID-19, the IPA Institute is focusing on delivering online courses in 2020. View the full online course schedule at www.ipaglobal.com/events.

SEPTEMBER

- 8 & 10 FEL and the Stage-Gated Process
10 a.m. to 12 p.m.
US Eastern Time Zone
- 15 & 17 Capital Project Execution Excellence and Project Controls
10 a.m. to 12 p.m.
US Eastern Time Zone
- 22 & 24 Leading Complex Projects
10 a.m. to 12 p.m.
US Eastern Time Zone

OCTOBER

- 6 & 8 FEL and the Stage-Gated Process
10 a.m. to 12 p.m.
US Eastern Time Zone
- 13 & 15 Capital Project Execution Excellence and Project Controls
10 a.m. to 12 p.m.
US Eastern Time Zone
- 20 & 22 Leading Complex Projects
10 a.m. to 12 p.m.
US Eastern Time Zone

**THE IPA
INSTITUTE**

Advancing Project Knowledge

IPA Events and Presentations

Due to the COVID-19 pandemic, the 2020 meetings of the Cost Engineering Committee (CEC) and Upstream Industry Benchmarking Consortium (UIBC) will take place in a virtual setting, following the successful virtual meetings of the Industry Benchmarking Consortium (IBC) and the Upstream Cost Engineering Committee (UCEC) held earlier this year.

Cost Engineering Committee (CEC)

Begins September 22
Virtual Meeting

The CEC is a working subcommittee under the Industry Benchmarking Consortium (IBC) that assists cost engineers by providing metrics and tools that offer an unbiased snapshot of industry cost and schedule estimates and trends. The CEC focuses on all aspects of cost (or investment) engineering, including cost estimating, scheduling, and project control practices and metrics, with the goal of expanding the owner cost engineer's capabilities. The primary vehicles for accomplishing these objectives are validation metrics, Best Practices research, and practice sharing. Contact Andrew Griffith at agriffith@ipaglobal.com for more information.

Snapshot Demonstration Webinar

September 28
Free Live Webinar

Please join us for a free live demo of IPA's new Snapshot: Subsea Tieback capital project assessment software on Monday, September 28 at 9 a.m. (U.S. Eastern Time Zone). IPA Energy Research Leader, Jon Walker, will discuss why the software was developed and what subsea tieback project teams can expect when using the new software.

8th Congress AACE International (AACEi), Peru Section

October 15-16
Virtual Conference

IPA Founder and President Ed Merrow will deliver remarks during the annual AACEi conference. The theme for this year's virtual conference is effective management of projects during times of crisis. Visit <http://aacei.org.pe/congress/> for more information.

Abu Dhabi International Petroleum Exhibition and Conference (ADIPEC)

November 9-12
Virtual Conference

Rolando Gächter, IPA Director of Middle East Development, will discuss key takeaways from a technical paper on the topic of leading capital projects to repeatable success during the virtual conference hosted by Abu Dhabi National Oil Company (ADNOC). Visit <https://www.adipec.com/virtual/> for more information.

Upstream Industry Benchmarking Consortium (UIBC)

Begins in November
Virtual Meeting

The UIBC is solely dedicated to the exploration and production (E&P) industry. It provides an independent forum for each participating company to view key metrics of its project system performance such as cost and schedule, Front-End Loading (FEL), and many others against the performance of other companies and share pointed and detailed information about their practices. The consortium highlights Best Practices, reinforcing their importance in driving improvements in asset development and capital effectiveness. Contact Andrew Griffith at agriffith@ipaglobal.com for more information.

International Project Management Conference (IPMC)

December 1-2
Virtual Conference

IPA Founder and President Ed Merrow will deliver a keynote address during the inaugural IPMC hosted by Petronas. Per the IPMC website, the virtual conference will cover "a variety of topics relevant to project management such as leadership and human capital, project HSSE and quality, project contract and commercial, project control and monitoring, project stakeholder and risk management, project engineering, and general project management." Visit <http://icep.com.my/> for more information.