Managing Capital Projects for Growth in the North American Petrochemical Industry
Over the next four years (2014–2017), more than $425 billion in new petrochemical plant investments are expected around the globe¹—and a substantial portion of these will occur in North America.

The reason: The abundance of shale gas and shale gas liquids in the region and the resulting stability in long-term natural gas prices, have created a cost advantage for the industry in North America.

According to the American Chemistry Council, 148 US-based projects—totaling about $100 billion in potential chemicals capital investment—were announced in early 2014.² Many global and regional producers have initiated studies or plans to build ethylene, gas-to-liquid and ammonia plants, as well as NGL export terminals, LNG export terminals and other gas-based chemical and derivative manufacturing plants in North America.

Those capital projects are a vital part of North American petrochemical companies’ growth strategies, and they represent tremendous opportunity for the industry. But planning and executing these projects can be difficult—and the cost of delays and disruptions can be high. Indeed, problems with capital projects can have a significant impact on growth plans. Fortunately, experience and research within petrochemicals and across other chemicals industries provide insight into the critical challenges that capital projects typically encounter—and point to some fundamental principles and practices that companies can adopt to help ensure that their capital projects run smoothly.
Capital Projects: Key Challenges

The challenges associated with managing large petrochemical projects vary.

They require skilled professionals and craft workers, and often involve a range of partners. They generate a wealth of data that has to be managed and shared. They require rigorous governance, coupled with flexibility. And through it all, companies need to pay close attention to environmental, health and safety compliance.

At the same time, the scope and complexity of such projects is growing. The average ethylene cracker capacity is well over 1,000 kmpty today, which has nearly tripled since the 1980s when the average ethylene cracker capacity was 370 kmpty. Petrochemical facilities usually take years to build, and have to account for local regulations, changing economics and evolving technologies. The talent needed for these projects is scarce around the world: In a recent global survey of chemical companies, 8 out of 9 respondents said that talent shortages are already a major concern for capital projects delivery. In North America, the large number of projects planned or under way makes that shortage especially acute.

When the planning and execution of large projects do not go smoothly, the impact on the bottom line can be significant. A shortage of key talent, for example, can increase project costs by 20 percent to 40 percent, while delays can mean lost opportunities to take advantage of peaks in business cycles. An assessment of a North American ethylene cracker project estimated that delays can equate to a daily loss of cash flow of $1 million a day or more.

Focusing on the Right Improvement Efforts

While there are a variety of issues companies need to take into account with large capital projects, there are also a wide range of steps available to avoid them. Companies can typically benefit from a strong focus on five key goals:

• Optimize scarce skills and talent
• Manage complexity and integration
• Accelerate operational readiness
• Integrate information systems across capital project teams
• Establish strong project governance, risk management and front-end planning tools
Optimize scarce skills and talent

Today, large capital projects typically face resource/skill shortages in three key areas: engineering, construction and project management.

The shortage of skilled engineering talent is well documented. But with capital projects, that shortage is often aggravated by the need to manage and segment complicated work. Engineering firms are often working with diverse processes, and need to foster communication among specialist engineers, on-site engineers and integration engineers. In addition, much of this engineering work is typically done without the benefit of face-to-face discussions with customers, which makes it difficult to conduct effective iterative engineering efforts.

Meanwhile, construction firms in North America are often smaller private companies—because the industry has not seen the kind of consolidation that other industries have experienced over the last decade and a half. As a result, construction firms are often specialized in their services—and often have workforces that have varying skills and competencies. They tend to have limited resources in the core areas of project management, specialty skills and equipment operators.

However, the shortage of project management skills is a challenge globally. These are specialized skills that take years of experience to develop, and they require proficiency in engineering, management and commercial activities. Personnel with these skills are in high demand and short supply—and that is especially true when it comes to project managers with experience in large capital projects.

To optimize their use of skilled resources, petrochemical companies need to understand the challenges and constraints associated with their business and resource models, and how those will affect the unique nature of the specific project in question. This entails understanding the cost drivers of each service being provided and aligning these services with resource needs across the project’s life cycle. Companies can also use supplier management programs to identify, develop and manage resources before the project, and improve their ability to predict the pipeline of projects and skill requirements.

In some cases, a center-of-excellence approach can be effective in coping with skills shortages. Many engineering firms now have such centers in locations around the world, often drawing on lower-cost specialized engineering support in those locations. This approach allows engineering firms to more effectively leverage scarce engineering talent, and to provide 24-hour-a-day support to help speed up design work.

Manage complexity and integration effectively

Today, capital projects in the petrochemicals industry involve increasingly complex business relationships. For example, joint ventures are often used to develop chemical plants, integrated chemical plants and refineries, and chemical facilities that link different technologies, companies and facilities at a single site. These business relationships can complicate the management of capital projects.

Evolving processes and technology also create project complexity. Facilities may use coal and coal-derived syngas as a chemical feedstock; ship large quantities of natural gas liquids by ocean; and capture and efficiently monetize small natural gas fields through new liquefaction technologies. These types of approaches require complex designs that are flexible enough to keep up with changing markets and customer requirements.

Finally, major chemical companies often have diverse portfolios of capital projects that are in process. This creates another layer of complexity, requiring sophisticated approaches to governance, the tracking of financials, and the ability to manage risk across the portfolio.

To address these challenges, companies need to develop relationship models that enable diverse organizations to work together to govern complex processes. They also need to establish engineering data management systems and processes that enable improved visibility and data-driven analyses of complex problems. And they can use process modeling to develop portfolio management systems and tools that enable them to manage diverse portfolios. The use of analytics can also play an important role in several tactical areas, such as increasing visibility into cash flows and financial constraints, the testing of assumptions, and the ability to manage risk for a portfolio of projects.
Key Capabilities for Capital Projects

To improve their ability to plan and execute large capital projects, petrochemical companies can identify and pursue improvements across the engineering, procurement and construction segments of projects. Accenture’s research has identified five key capabilities that companies need in these efforts.

Integrated project planning and cost control.
Integrated project controls that extend from planning to start-up are vital to the effective delivery of large-scale projects. They can often help reconcile conflicting requirements from various stakeholders. Supporting tools should ensure the effective tracking of progress at any time during the entire project lifecycle.

Integrated engineering data and documents.
This capability enables engineering to collaborate with other functions and parties, and gives the owner and its EPC (engineering, procurement and construction) partners better visibility into project progress. Overall, the integration of data and systems helps increase speed and efficiency in design, project work and the project handover, and supports the effort to capitalize on scarce engineering and technical skills.

Materials quantities, procurement and logistics control.
Companies can develop materials and service strategies that take advantage of cost and schedule opportunities, and rely on standard codification to support accurate tracking of materials. Materials management should span all EPC project phases.

Construction planning, monitoring and management.
The optimization of construction strategies is essential to ensuring that project costs are properly managed and executed. The management of resources/talent is often taken for granted, but it is a key driver of project excellence. Typically, communication and stakeholder management can be enhanced to enable companies to continuously align the project goals and resources.

Human resources management.
Companies should establish clear responsibilities, ensure that the right project management skills are available, and manage people to support execution effectiveness. The control of workload demand versus workforce capacity is key in the EPC industry, where the right talent is often in short supply.
Accelerate operational readiness

Most major petrochemical companies recognize the need to establish operational readiness programs. These programs should be started early on, during front-end engineering and design, and then continue through construction. They should focus on asset development and integrating the right operational principles into the selection, development and execution of capital projects. This helps ensure that capital investments result in the value defined in their original project plans.

Various programs can address specific areas. For example, programs might include:

- **Safe operations**—assessing job safety for future maintenance and operations activities.
- **Outage analysis**—defining areas where outage costs can be reduced through better access and design.
- **Environmental analysis**—reviewing operating constraints related to safety, health and environmental factors.
- **Equipment asset management**—developing maintenance and troubleshooting practices focused on maximizing equipment life and availability.
- **Spare parts**—reviewing planned purchases of parts and drawings to enable the manufacturing of those parts.

An early focus on operational readiness enables the project team to develop assets that are flexible and customizable products. It also lets teams make use of simulation models to optimize performance and design systems that reduce operational and maintenance costs. And it makes it easier to find and resolve problems early on and to collaborate on potential design options.

Integrate information systems across capital project teams

In dealing with complex projects, centralized information and data management systems are critical to enhancing communications, increasing visibility and ensuring that the project data is relevant and usable by operations and maintenance throughout the life of the asset.

An integrated approach to information systems can help companies with capital project portfolios leverage resources, reduce rework, increase the speed with which projects can move from construction to completion and operation, and support effective operations over the long run.

Establish strong project governance, risk management and front-end planning tools

Larger, more complex projects require especially strong oversight. Companies should develop governance models that provide consistent management across projects in the portfolio, and that have an integrated gate process that enforces the disciplined review and verification of each project stage before it is funded.

In terms of risk management, companies should establish processes that constantly identify opportunities and risks associated with project plans and cost estimates. These processes should also define and document the actions that will mitigate risks.

Companies usually have an opportunity to improve front-end planning tools, as well. Effective tools will help them manage limited funding, providing better visibility into the entire list of potential capital projects and enabling them to constantly test input assumptions related to products, costs, schedule and the availability of resources. Effective tools can also help companies align front-end engineering and financial plans with the various partners involved in the project.

Case Study: Assessing the Approach

When a petrochemical company was considering a new facility to produce high-value fuels and lubricants, it began by carefully assessing its approach to estimating and managing costs for capital projects. The assessment looked at project-execution policies and procedures; engineering, procurement and construction (EPC) strategies; and the interfaces between contractors and organizational units involved in the project. It also drew on market intelligence to identify leading practices in these areas and better understand the market drivers of potential risk for the project.

The assessment identified a number of strategic and tactical procurement and contracting improvement opportunities across EPC activities. It identified gaps in capabilities, and prioritized them so that the company could begin addressing high-value, low-effort improvements quickly. At the same time, the assessment identified savings opportunities totaling more than $450 million.
Conclusion

As petrochemical companies launch new operations to take advantage of North America’s shale gas, they need to be aware of the challenges often encountered in capital projects. Those challenges are significant—and in some ways growing, as project size and complexity increases. The approaches that companies use to meet those challenges can have a sizable impact on the project’s ultimate success—and on the company’s long-term profits and competitiveness.

Experience and research have shown where the most common pitfalls lie in pursuing capital projects—and there are clear steps that companies can take to avoid them. Understanding and addressing these key challenges can help companies reduce risk and achieve value with their large projects—and ultimately, grow in the North American market.
About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with approximately 289,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world’s most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US$28.6 billion for the fiscal year ended Aug. 31, 2013.

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Further reading

Capital Projects in a High-risk World:

Developing Strategies for the Effective Delivery of Capital Projects:


Large Capital Expenditures in Emerging Markets:

Managing Capital Projects as a Business:

Next Generation Asset Management:

Capital Project Risk Management Foundations Mastery:

Endnotes

1 Industrial Info Resources

2 “America’s shale gas revolution: U.S. chemical investment reaches $100 billion,” American Chemistry Council, February 2014

3 Achieving Effective Delivery of Capital Projects Accenture global survey of the chemicals industry


5 Accenture Research analysis, 2014.

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