Achieving Effective Delivery of Capital Projects

Accenture global survey of the chemicals industry
Contents

Executive summary 4
Key survey findings 6
Leading performers’ attributes and advantages 10
Four recommendations for effective project delivery 14
Conclusion 22
After pulling through the most recent economic downturn, chemicals companies are in expansion mode. Projections indicate nearly $19 trillion\(^1\) will be spent globally through 2035 on capital projects.\(^2\)

The growing investments in the chemicals industry, along with the innate complexity of projects, leads to the question: How can capital project delivery be improved?

To answer this question, Accenture interviewed executives about key challenges and methods to improve outcomes in capital project delivery. Survey respondents were asked about organizational priorities in the next three years and three themes emerged:

- Obtaining the right leaders and talent for project delivery.
- Enhancing front-end loading and scheduling.
- Improving alignment to organizational strategy.

Analysis of the chemical survey along with a comparable recent survey of energy companies’ capital projects produced additional insights. After aggregating responses from respondents in the two industries, Accenture segmented a group of “leading performers,” roughly one-third of the sample size.

All of the leading performers view effective capital project delivery as critical for high performance. The leading group also indicates having a well-developed project delivery culture, as compared to 74 percent in the rest of the sample. Additional characteristics can be seen in Figure 1.

Based on survey results, research and industry experience, Accenture offers four recommendations to help improve project delivery to address cost and schedule demands, reduce risks and boost return on investment (ROI):

1. Establish strong project governance, risk management and front-end planning tools.
2. Enhance scarce talent through portfolio management, organizational flexibility and training.
3. Integrate information systems among capital project players.
4. Accelerate operational readiness.

Figure 1. Leading performer attributes and advantages.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-developed culture</td>
<td>Fewer revisions in approved schedule</td>
</tr>
<tr>
<td>Wider usage of analytics</td>
<td>More timely decisions</td>
</tr>
<tr>
<td>Better transition from project to operating asset</td>
<td>Closer to both cost and schedule objectives</td>
</tr>
</tbody>
</table>
About the research

This report is based on primary research conducted by a third-party firm on behalf of Accenture. Nine interviews were conducted with executives between February and May 2012. All respondents were C-level executives, decision makers or influencers regarding decisions related to management of capital projects in their organizations.

Survey interviewers conducted a phone survey with executives in Canada, Germany, the Netherlands, Saudi Arabia, Thailand and the United States. Projects eligible for consideration involved operating assets of at least $1 billion and took more than one year to deliver. (See Figure 2.)

Figure 2. Capital projects include the following areas among survey respondents.

Scope of capital projects

<table>
<thead>
<tr>
<th>Category</th>
<th>Respondents could list more than one category.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymers, synthetic rubber, fibers</td>
<td>4</td>
</tr>
<tr>
<td>Other specialty chemicals</td>
<td>4</td>
</tr>
<tr>
<td>Petrochemicals and intermediaries</td>
<td>3</td>
</tr>
<tr>
<td>Inorganic chemicals</td>
<td>3</td>
</tr>
<tr>
<td>Agricultural chemicals</td>
<td>3</td>
</tr>
<tr>
<td>Consumer chemicals</td>
<td>2</td>
</tr>
<tr>
<td>Paints, adhesives and inks</td>
<td>1</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
</tr>
</tbody>
</table>
Performance and portfolio growth

Effective capital project delivery is critical to high performance...

When asked about the importance of effective capital project delivery to high performance, eight out of nine respondents indicated effective delivery is critical to high performance. The survey question defines critical as meaning it is one of the top three drivers of superior performance.

...but the majority of companies are not delivering consistently against their targets

Survey responses indicate organizations are not consistently meeting their own targets. (See Figure 3.) Only two executives indicated that, for all projects, their company projects consistently delivered expected business value from new assets.

In a related survey question, "How would you rate your company’s overall level of maturity in project management delivery?" seven out of nine respondents indicated average performance.

Projects are increasing in size and complexity

The majority of respondents anticipate the size and complexity of their portfolios will continue to increase in the next five years.

Key survey findings

Figure 3. The majority of respondents are not consistently delivering against their own targets.

Please indicate to what extent you usually meet your targets regarding the delivery of capital projects?

- Deliver the expected business value from new assets
  - Met for the minority of projects: 1, Met for a majority of projects: 6, Met for all projects: 2

- Deliver to approved cost (within 10%)
  - Met for the minority of projects: 1, Met for a majority of projects: 4, Met for all projects: 3

- Deliver to approved schedule (within 10%)
  - Met for the minority of projects: 2, Met for a majority of projects: 5, Met for all projects: 2

- Deliver to approved cost (within 25%)
  - Met for the minority of projects: 1, Met for a majority of projects: 2, Met for all projects: 5

- Deliver to approved schedule (within 25%)
  - Met for the minority of projects: 1, Met for a majority of projects: 4, Met for all projects: 3

- Deliver reliable production capability
  - Met for the minority of projects: 5, Met for a majority of projects: 4

- Deliver to quality requirements
  - Met for the minority of projects: 5, Met for a majority of projects: 4

- Enhance reputation of the company with external stakeholders
  - Met for the minority of projects: 4, Met for a majority of projects: 5

Base: All respondents who monitor the information.
As companies work with new partners, use new technologies and expand in countries with less mature construction environments, the complications increase. (See Figure 4.)

**Top priorities in the next three years**

Respondents were asked about organizational priorities in the next three years. As illustrated in Figure 5, three themes emerged: availability of the right leaders and talent for project delivery, improving front-end loaded planning and scheduling and improving alignment to organizational strategy.

**Top priority: Availability of the right leaders and talent**

Attracting and retaining talent has become a major issue in the chemicals industry, and eight out of nine respondents indicated talent shortages are a major concern.

In developed regions, the workforce is aging, and the chemicals industry has had difficulty competing with the high-tech industry and high-growth sectors for top college graduates. Burnout has created havoc in retention of needed personnel, which undermines project management skills. High rates of turnover also weaken the ability to deliver projects up to expectations.

According to the survey, respondents plan to address shortages through a variety of measures, including turnkey contracts with engineering, procurement, construction (EPC) companies; tactical sourcing; and development of internal resources. Companies also can mitigate some of the shortage by relying on contractors, but that option does not solve the problem as EPC performance issues, for example, can erode substantial business value from what is expected to be delivered. Contracting decisions assign challenges to other parties, and EPCs and subcontractors also are experiencing talent shortages.

**Figure 4. Complexity is on the rise, as can be seen in ethylene projects.**

**Ethylene crackers: Percent of build in countries with poor construction permit environment**

New plants are rising in average size and increasingly being built in countries with poor construction environments.

![Graph showing capacity built in high-risk areas from 1976–1986 to 2006–2016](image)

*Circle = Ten-year average cracker expansions sizes (ktm py)*

*ktm py = thousand metric tons per year

*Share of new capacity in countries at bottom 20 percent of business environment ranking


**Figure 5. Respondents rank their top priorities in the next three years.**

What are the top three priorities for your company to optimize capital project management in the next three years?

<table>
<thead>
<tr>
<th>Top three mentions</th>
<th>Mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensuring availability of the right leaders and talent for project delivery</td>
<td>7</td>
</tr>
<tr>
<td>Improved front-end loaded planning and scheduling</td>
<td>6</td>
</tr>
<tr>
<td>Improved alignment to organization strategy</td>
<td>5</td>
</tr>
<tr>
<td>More effective change management</td>
<td>3</td>
</tr>
<tr>
<td>Ensuring effective stakeholder engagement</td>
<td>2</td>
</tr>
<tr>
<td>Safety management</td>
<td>2</td>
</tr>
<tr>
<td>Improved contracting strategies</td>
<td>1</td>
</tr>
<tr>
<td>Implementing the correct organizational design</td>
<td>1</td>
</tr>
</tbody>
</table>

Base: All respondents (n=9).
Second priority: Front-end planning and scheduling

Improving project planning and scheduling is the second-highest priority for respondents. Three steps typically are considered part of front-end loading (FEL), also known as front-end loaded planning. The three components that Accenture considers part of FEL are scoping, pre-feasibility and feasibility studies. (See Figure 12 on page 17.)

Inadequate up-front planning can result in budget overruns and slippage in other areas. Respondents cite insufficient detail in the planning stage and subsequent design changes driven by new requirements as two of the top causes for changes to the project schedule. (See Figure 6.)

Third priority: Alignment to organizational strategy

Chemicals companies are strategizing on the best ways to deploy their large stores of cash and liquid investments that, in 2011, were well above average. Many are focusing capital on the most promising projects and acquisition opportunities.

The third priority cited by survey respondents is improving alignment of projects to organizational strategy. Figure 7 shows ways in which respondents align projects to high-level business strategy.

Chemicals companies are likely to engage in joint ventures that set up huge facilities to achieve ever-greater economies of scale. As a result, alignment to organizational strategy becomes increasingly complex as multiple stakeholders enter the mix. In 2000, approximately 60 percent of world ethylene capacity was owned by more than one entity (e.g., joint venture). By 2010, this figure had risen to 70 percent and the percentage is projected to increase further by 2020. (See sidebar on low natural-gas prices.)

Only two survey participants said their company’s decision making is excellent. The timeliness of decision making, however, needs to be balanced with positive aspects of bureaucracy (e.g., multimillion-dollar decisions call for substantial reviews). Sometimes economically attractive decisions are held up for good reasons, such as prioritization or optimal alignment of resources.

Perceptions of contractors and IT

Nearly all respondents are less than enthusiastic about the value-add from contractors. However, this finding needs context since many contractors focus intently on delivering to contractual terms (e.g., turnkey contracts) and, therefore, are less motivated to deliver additional value.

Cost and schedule problems can arise from EPCs due to poor project management or subcontractor performance or control issues. Problems also can be due to weak or slow decision-making processes by clients, as well as changes in project scope.

Figure 6. Key causes of plan revisions.

What drives/typically causes the changes to the project schedule?

<table>
<thead>
<tr>
<th>Top four mentions</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient detail during the planning stage</td>
<td></td>
</tr>
<tr>
<td>Changes in asset scoping/specifications—design changes driven by new requirements</td>
<td></td>
</tr>
<tr>
<td>Availability of resources/talent</td>
<td></td>
</tr>
<tr>
<td>Unforeseen contractor and supplier constraints</td>
<td></td>
</tr>
</tbody>
</table>

| Poor controlling/management                           | 3 |
| Original assumptions prove to be incorrect or incomplete |   |
| New or unconsidered regulatory requirements            | 2 |
| Poor productivity                                      | 2 |
| Changes in asset scoping/specifications driven by new technology | 1 |

Base: All respondents (n=9).

Figure 7. How companies align projects with organizational/business strategy.

How is alignment between the project and organizational/business strategy maintained and reported on throughout the project life cycle?

<table>
<thead>
<tr>
<th>Multi-response</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodic reviews with senior management to assess degree of ongoing alignment</td>
<td></td>
</tr>
<tr>
<td>Business case reviewed periodically against key internal and external assumptions</td>
<td></td>
</tr>
<tr>
<td>Dedicated capital portfolio/program management team tasked with ensuring ongoing alignment</td>
<td>8</td>
</tr>
<tr>
<td>Integrated stakeholder management plans are used to ensure ongoing alignment between the project, business strategy and stakeholders</td>
<td>7</td>
</tr>
</tbody>
</table>

Base: All respondents (n=9).
After the Middle East, North America is now the world’s second lowest-cost olefins production region. By using technology to tap previously unattractive hydrocarbon deposits, such as shale gas, the natural gas supply has increased, pushing gas prices down and decoupling them from oil prices. (See Figure 8.)

The industry uses natural gas for fuel and as a feedstock. Several chemicals can be manufactured from its components, such as ethylene (by far the dominant petrochemical), methanol and ammonia. While ethylene can be manufactured from liquids, such as refined products (based on oil), flexible chemical plants can switch to light feedstocks, such as ethane, which is obtained from natural gas.

Many ethylene “crackers” are under study or in development by companies, including Chevron Phillips Chemical, Shell Chemicals, Formosa Plastics, Dow Chemical, ExxonMobil, Sasol, LyondellBasell, SABIC, Braskem, Occidental and Aither Chemicals.

While all plans will not reach fruition, Accenture Research estimates more than 15 million metric tons per year of new petrochemical capacity may be built in North America—the equivalent of between $30 billion and $50 billion in capital projects in the next 10 years.

Figure 8. Low prices for natural gas are a boon for chemicals companies with North American operations.

Energy price outlook

Leading performers' attributes and advantages

Accenture analysis of the survey data shows multiple attributes and capabilities set leading performers apart from other organizations. A group of leading companies outperforms the rest in meeting their own project targets on cost, schedule, quality and delivery of reliable production capacity.
Attributes

Culture. Leading companies are more confident of their culture of project delivery excellence. One hundred percent of leading companies indicate having a well-developed project delivery culture, as compared to 74 percent in the rest of the sample.

A well-developed culture does not rely on having a large owner’s team, but rather an effective and experienced team of project collaborators. A well-developed culture needs to be infused with capabilities in risk management, superior project management, stage-gating and peer-review processes.

More effective use of analytics. Leading performers use key performance indicators (KPIs) more systematically than other respondents. (See Figure 9.)

Advantages

Having fewer schedule changes. The leaders note fewer changes in the approved schedule. The leading companies outpace the rest of the sample by 37 percentage points (See Figure 11.), which highlights their ability to deliver predictable results.

More timely decisions. In the area of efficient and timely decision making, there is also a wide spread in performance with 42 percentage points between leaders (75 percent) and the rest of the sample (33 percent).

Closer to meeting both cost and schedule demands. All leading companies that met their schedules for all projects (within 10 percent and 25 percent) also did so for cost. This finding shows the leaders are not necessarily exceeding budgets to meet their timelines.

Figure 9. Leaders use analytics more frequently to track performance.

Please indicate the types of key performance indicators (KPIs) used to monitor the delivery of capital projects.

<table>
<thead>
<tr>
<th>Safety KPIs</th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100%</td>
<td>4% 11% 89%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delivery output KPIs</th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100%</td>
<td>4% 22% 74%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Portfolio KPIs</th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>8% 8%</td>
<td>83%</td>
<td>11% 37% 52%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contractor and employee KPIs that are aligned with business KPIs</th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>8% 17%</td>
<td>75%</td>
<td>4% 11% 48% 37%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process KPIs</th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>8% 25%</td>
<td>67%</td>
<td>19% 48% 33%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External stakeholder KPIs</th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>8% 33% 8%</td>
<td>50%</td>
<td>15% 44% 22% 19%</td>
</tr>
</tbody>
</table>

Never used | Used for a minority of projects | Used for the majority of projects | Used for all projects

Base: All respondents.
(Leading companies = 12, Rest of the sample = 27)
Figure 10. Making the transition to operating asset.

Percent of organizations with effective transition from projects delivery to operation assets (rate 8–10)

<table>
<thead>
<tr>
<th></th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>58%</td>
<td>41%</td>
</tr>
</tbody>
</table>

Base: All respondents. (Leading companies = 12, Rest of the sample = 27)

Figure 11. Fewer schedule revisions needed among leading performers.

Percent of organizations where project schedule is delivered as originally specified

<table>
<thead>
<tr>
<th></th>
<th>Leading companies</th>
<th>Rest of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>67%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Base: All respondents. (Leading companies = 12, Rest of the sample = 27)

Methodology for identifying leading performers

Criteria used to identify leading performers included 1) having abilities to deliver to cost and schedule (both within 25 percent), and 2) having reliable production capabilities, as well as quality requirements.

Accenture methodology for this section gave three points to companies meeting the above targets for all projects. One point was given for not meeting targets on all projects but for the majority of projects. Companies received no points if failing to meet any targets or not monitoring the information.

The sample size for this analysis section (n=39) is larger than that for the rest of the survey. This portion includes responses from energy (n=30) and chemicals companies (n=9). Accenture asked similar questions of energy executives (November 2011–February 2012), thereby enabling combined analysis of responses.

Analysis of the data reveals a group of companies outperforming the rest in meeting project targets of cost, schedule, quality and delivery of reliable production capacity. Accenture identified 12 companies as leading in capital project delivery.
Four recommendations for effective project delivery

With each megaproject, hundreds of millions of dollars are at stake. Accenture has identified four areas to help chemicals companies improve capital projects delivery:

1. Establish strong project governance, risk management and front-end planning tools.
2. Optimize scarce talent through portfolio management, organizational flexibility and training.
3. Integrate information systems among capital projects players.
4. Accelerate operational readiness.
1. Establish strong project governance, risk management and front-end planning tools

Multiyear capital projects have many variables and long time spans. Coming up with the perfect plan from the start is, of course, unfeasible. Strong governance is needed, along with the ability to manage risks. Project management must unify a diverse team capable of responding effectively to changes that arise.

Follow a field-tested planning tool for the validation of front-end loading activities

Front-end loading should occur through a well-established, stage-gate phasing. (See Figure 12.) Team members need to meet guidelines for each stage, identify gaps and address them in a peer-review process before moving to the next phase. A highly disciplined approach clarifies engineering needs, and leads to more accurate cost and schedule estimates.

Multiple methodologies for validation of the quality of the stage-gate process exist, including the Project Definition Rating Index (PDRI) for industrial projects. The choice of tool is not as important as solid commitment and discipline to follow a tested methodology.

Project teams should seek an objective review of project delivery that uncovers areas where innovation could result in a better, more informed plan. These reviews should be independent from the project team, and, as project scale and delivery complexity increases, the objective findings and recommendations become increasingly important.

The ability to greatly influence project cost occurs early on when larger amounts of uncertainty exist and contingencies are higher. Through improved front-end planning, both project delivery, and operations and maintenance performance can be optimized in alignment with organizational strategy.

Follow a comprehensive approach to risk management

Assembling a cross-functional group helps to identify a wide range of risks, and the ways in which risks interact and magnify the adverse consequences. Furthermore, a diagnostic can help assess if an organization’s capabilities are adequate to meet the level of complexity of the project.

Proactively managing risks helps reduce the number of realized problems, claims and scope changes. Collaborating regularly with contractors and suppliers also can help project owners manage a wide range of risks. (See Figure 13.)

Align teams from the start

One important topic for discussion is seeking representation from operations and maintenance leaders early on. In addition, systems need to be designed that capture information at the start, and enable sharing of data easily among teams across the project life cycle, including those who will operate the asset.

Agreeing on data needs and relevant performance indicators lays a solid foundation for capital projects analytics. Analytics provide dashboards for integrated project planning, progress measurement, schedule control, risk management and reporting. Agreeing on data needs also can avert the time-consuming challenge of data migration from project to operations.
Figure 12. Typical capital project phases, with the first three parts of front-end loading (FEL).

<table>
<thead>
<tr>
<th>Areas</th>
<th>1. Identify</th>
<th>2. Evaluate</th>
<th>3. Define</th>
<th>4. Execute</th>
<th>5. Operate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical scope/phase</td>
<td>FEL 1</td>
<td>FEL 2</td>
<td>FEL 3</td>
<td>EPC/EPCM or PMC</td>
<td>Plant operations/ sustainability projects/ portfolio management</td>
</tr>
<tr>
<td>FEL 1 (Scoping Study)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEL 2 (Pre-Feasibility Study)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEL 3 (Feasibility Study)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Percent engineering complete| 5%          | 10%         | 20-30%    | 100%       | N/A        |
| Percent capital (CAPEX) estimate accuracy| (+/- 40-50%) | (+/- 30-40%) | (+/- 15-20%) | (+/- 5-10%) | N/A        |

Figure 13. Risk management checklist for capital projects.

Accenture identified the following as key areas for chemicals companies to focus attention on in managing capital project risks.

**Cost estimating and project scheduling**
- Poorly defined scope
- Lack of effective front-end loading
- Limited resources for project controls

**Project economic forecast**
- Misalignment in expectations between technical and commercial functions
- Infrastructure access issues not considered in forecasts

**Procurement, contracting and project material logistics**
- Delays in long lead-time procurement activities impact project schedule
- Ineffective contracts
- Supplier inability to deliver equipment in line with project schedule and quality requirements
- Disruption in supply source

**Financial and commercial management**
- Currency and hedging volatility not considered
- Input costs for major material cost increases (e.g., piping, steel) not considered

**Access to strategic infrastructure**
- Poor planning to move products to market via infrastructure
- Lack of planning for tie-ins to existing and future infrastructure

**Scope growth and claims management**
- Poor definition of scope changes
- Changes not well coordinated
- Weak models to mitigate contract changes

**Human capital**
- Shortage of engineering, management, construction and operations people
- Aging workforce
- Poor planning for start-up and operations

**Management of contractors**
- Limited resources for effective oversight of EPC firms and contractors, who also are experiencing human capital shortages
- Difficulty of managing non-chemical plant components, such as administrative building infrastructure in remote areas

**Production ramp-up**
- Failure to consider production issues to bring products to market at early stages of the project design
- Risk mitigation of major production problems not done early enough
- Delay in setting up the IT infrastructure and applications

**Global program delivery performance**
- Processes not in place to oversee and manage complex projects
- Treating projects separately rather than managing them across a region or portfolio
- Lack of accounting for possible claims

**Legal and regulatory compliance**
- Unclear responsibility for obtaining licenses and permits
- Lack of attention to corruption and anti-bribery laws
- Poor follow-up on immigration and work-permit requirements
- Problematic immigration regulations to bring in skilled labor

**Health, safety, environment and community (HSEC) management**
- Lack of proactive engagement with stakeholders
- Too little marketing of project benefits and programs for environmental mitigation
- Lack of training, which limits the potential of creating a positive legacy for communities
- Poorly understood interface between the business enterprise and project/operational teams
- Projects not aligned with business objectives and properly controlled
- Lack of planning for extreme weather
- Inadequate measures to protect environment

Sources: IPA and Accenture experience.
Companies tended to have experienced project managers 10 to 15 years ago. After the economy declined in 2008, however, managers were laid off, leaving organizations short of experience. Retirements further diminished the ranks of experienced project directors and managers.

Since talent in a wide range of areas will be in high demand for many years, optimal management of existing resources is vital.

Deploy resources in the most strategic way

As the number of capital projects grows, companies are challenged to allocate scarce resources across complex portfolios. With an abundance of high-return opportunities, it is essential that companies do not have too many projects running at the same time, thus increasing the risk of overextending resources. Portfolio planning and optimization approaches help to evaluate and prioritize resourcing decisions given competing priorities.

Similarly, at the project level, automated planning and scheduling solutions enable project managers to know when and where scarce or specialized talent needs to be positioned during each project phase. Project directors can extend the benefit by collaborating regularly with contractors to find the appropriate ways to leverage strategic contractor resources across projects.

Companies can further optimize resource planning by integrating scheduling information with three-dimensional (3D) design models to visualize the schedule and improve project planning, along with reducing constructability and safety risks.

Train the next generation of leaders

Experienced managers in the industry need to invest time in training younger candidates. Accenture recommends developing a strategic plan to identify and develop talent for capital projects delivery.

The long-term process needs to be well monitored. Along with KPIs for retention (e.g., average time at company, employee turnover and reasons for attrition), companies can track KPIs for attracting talent (e.g., time to fill internal positions, number of candidates with skills to match) and metrics related to engaging talent (e.g., scores from employee surveys, uptake of internal training courses).

Reduce costs through flexible organizational design

One method to better leverage scarce, higher-cost experienced resources is to eliminate, or at least shift, tedious, transactional work to other resources. Capital project owners can more efficiently use their critical resources and also reduce costs by outsourcing low value-added activities that are not central to engineering and construction. Flexible organizational design promotes the outsourcing of back-office functions, such as procurement, document management, IT and project coordination support.

Improve productivity and safety through effective training

Training is a critical enabler for project safety, productivity and initial operability. Health and safety training needs to be produced in ways that are easily consumed, communicate desired behaviors and accelerate adoption.

The future lies in training simulations that familiarize staff with how to perform tasks successfully prior to actually doing the work (e.g., installing new equipment, operating new plant systems at turnover, removal of equipment during refurbishment or decommissioning). Simulation-based training, as part of the project execution phase, helps to accelerate operational readiness.

Systems that track training and certification records, and integrate the information into planning and scheduling activities, further support decision making on how to best deploy scarce talent.
Inadequate information management undermines quality, increases costs and delays commissioning of new assets. Virtually everyone in the project life cycle needs access to reliable and updated data.

**Establish electronic data standards early**

Progress cannot be monitored effectively if proper standards are not established early in project planning. Rules of credit, for example, need to be established to measure engineering, procurement and construction progress, which then leads to more accurate reporting. Improved accounting and management of equipment and materials results after chemicals companies consolidate functions that are fragmented among project owners, EPCs and construction contractors. Solid standards also establish the foundation for greater accuracy of transferring materials quantities and specifications.

Project owners need to lead the transition from document management to data management. Ideally, electronic data standards and systems established early promote integration and improve productivity throughout the project life cycle.

Monitoring systems and KPIs give project managers better information about the cost of projects from region to region, and among product groupings. This data can lead to more effective practices and supplier rationalization.

**Benefit from recent advances in visualization**

In terms of engineering capabilities, IT systems today enable much better up-front design and 3D visualization. Companies benefit from reduced rework and improved decision making through the use of the latest tools for visual 3D, laser scans and videogrammetry.

**Ease access to relevant information**

Trying to find the right information on demand is frequently frustrating and time consuming. A number of automated tools can help employees find information, thereby boosting productivity. Virtual tools, including next-generation portals, bring project teams closer together, promoting collaboration, learning and knowledge management.

Tools and information sources need to be structured and configured for specific roles. Many employees in the field, for example, could work with easy-to-use tablet computers, but engineers need more powerful notebooks. Similar to hardware choices, software and data sources need to be configured to simplify information access.

Also, as many are nearing retirement age, formal processes need to be implemented and documented to improve knowledge management and access.

**Enhance decision making**

With thorough information integration, organizations can benefit from improved decision support and stronger leadership. Consider the example of taking a 3D model and applying schedule data to make it, in essence, a 4D model. This model illustrates the progress of the physical build according to the project schedule.

Similarly, organizations can extend this type of functionality to cover other dimensions, such as sustainability and total life cycle cost. As the information is visualized, executives are able to make better sense of complexity.

Information integration also prevents delays. “Most companies don’t know what things are actually necessary to get speed. Cutting corners is a fool’s way to get speed. ... Integration achieves speed,” notes Edward Merrow, founder and chief executive officer of Independent Project Analysis, Inc.

---

3. Integrate information systems among capital projects players
Projects need to be executed with the end result of on-time production remaining top of mind throughout the project life cycle. As an example of the cost of delays, Figure 15 presents a view of how profits have been reduced due to poor start-up timing of ethylene plants.

Ill-timed start-ups equated to approximately $700,000 of lost cash flow per day for a new North American ethylene cracker in 2011, according to Accenture Research. Based on the past few years of industry performance, the consequences ranged from $0.3 to $1.3 million dollars per day of lost cash flow.

Thus, streamlining the effectiveness of the transition from project to working assets makes good business sense.

Work more closely with operations

The earlier that a chemical company’s operations department is involved, the better chance there is of building assets that can be operated as planned and completed close to schedule. Operations executives need to be involved in determining which assets and what types of skills will be needed. In addition, operations will need the latest information on the asset under construction, rather than the original plan, which might be outdated.

Ideally, operator training is conducted in parallel with the final stages of construction. Simulations use advanced technology to give operators a realistic look at what they will be doing on day one.

IT capabilities used in planning also should support commissioning. When employees from operations are brought in to give input to design and delivery during planning, they take greater ownership in new assets under development.

Reduce manual processes whenever feasible

Checking equipment for the purposes of commissioning provides an example of how manual procedures can slow down the process. In many cases, technicians manually enter data onto sheets while in the field. This data is then manually re-entered into a system at the site office, and then manually checked against drawings. By segregating technical from transactional activities, project teams can implement remote services to make better use of scarce talent at the project site.

Project directors need to remain keenly aware of better ways to conduct handovers. Data transitions to operations and maintenance departments should be done automatically rather than manually. Too often operations employees are preoccupied with routine activities, such as loading systems, rather than making the systems operationally ready, and becoming more familiar with the plant. In other words, chemicals companies should make the best use of their talent to accelerate commissioning and start-up.

Figure 14. Profit suboptimal due to delayed start-ups of ethylene plants.

Ethylene investment timing (ethane-based) net present value at start-up vs. margin cycle

Profitability, $US, inflation adjusted

[Graph showing profit suboptimal due to delayed start-ups of ethylene plants]

Note: Since 2008, US ethane cracking became advantageous. So, the net present value (which is forward looking) is less representative of the world ethylene market after 2004. Sources: Accenture Research and, for start-up data, ICIS Consulting.
Conclusion

Throughout the project life cycle, keep the end objective in mind

Sophisticated skills and experience are needed to manage the increasing scale and complexity of today’s capital projects. The focus extends well beyond the scope of engineering and procurement.

Today’s projects call for increased attention to good governance and risk management, along with integrating information systems. Given the talent squeeze, finding the appropriate resources to execute capital projects is critical. Coordinating effectively with all partners to get the best returns from multibillion-dollar projects is equally critical.

It helps to look at the project with the end goal clearly in sight, and to methodically break projects into manageable pieces and manage risks at each stage before moving on. At a high level, some of the ways to do this include improving front-end loading, addressing project gaps and monitoring the project through objective peer reviews at each stage.

A strong project management organization is invaluable for megaprojects with multiyear horizons. Due to the high stakes involved, capital projects call for targeted objectives, clear delivery strategies and diligent monitoring to track progress. Ideally, capital projects should not be run as isolated and independent projects, but instead with a broader perspective, driving synergy across the portfolio for high performance.
Reference

1 Figures in $US unless otherwise noted.


3 Due to the modest size of the base of chemicals industry respondents (n=9), results are reported in absolute numbers rather than in percentages.


About the authors

Andy Webster is a managing director for Accenture Capital Projects Services (ACPS) supporting the chemicals, energy and utilities industry sectors. ACPS focuses on supporting clients through each phase of a capital project life cycle. Based in Houston, Andy works with clients globally providing consulting and project services to support business planning, building new organizational capabilities, improving project predictability and control and enabling engineering and project information management. His experience spans business transformation, business architecture, program management and information management.

andrew.s.webster@accenture.com

Paul Bjacek, a senior manager in Accenture Research, leads global chemicals and natural resources research. He has more than 25 years of experience in chemicals strategy development and research, from base chemicals to specialty chemicals and polymers. Paul also frequent speaks and writes about issues affecting the global materials industry. He is based in Houston. His blog can be found at: www.accenture.com/us-en/blogs/cnr

paul.bjacek@accenture.com

Special thanks to other contributors

James Arnott
John Poisson
Charlotte Raut
José J. Suarez
Carmen Uys

About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with approximately 259,000 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$27.9 billion for the fiscal year ended Aug. 31, 2012. Its home page is www.accenture.com.