



Large project management in oil and gas

Large, complex projects demand a coherent reference framework and top-notch project management skills.

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Rome wasn't built in a day; it grew through a series of large projects, managed to schedules and budgets. Consider the Colosseum: An army of workers took less than 10 years to complete it in 80 AD, using 100,000 cubic meters of travertine marble. To accomplish this, project leaders relied on tested engineering concepts and organizational innovations.

- The amphitheater was divided into sectors, assigned to different contractors and supervised by teams of civil engineers, who shared best practices and guaranteed results.
- Contractors followed prescribed practices for simple designs, to deliver against cost and time goals. Roman engineers set a very high bar for innovations.
- Engineers managed the organizational and logistical complexities in the design phase. For example, working space on site was maximized and many activities were outsourced to yards where partly assembled blocks were prepared.

Today, large projects in the oil and gas industry face similarly daunting challenges as they become increasingly complex and technologically demanding. Schedules and budgets are tight, safety is crucial and every project faces a network of stakeholders concerned about its impact on the environment and communities. Even so, today's project managers still rely on concepts that the builders of the Colosseum, as well as other large projects of antiquity, such as the Pyramids of Giza and the Great Wall of China, would recognize: work breakdown plans, design-to-cost and make-or-buy decisions.

Our experience working with projects in oil and gas suggests that while best practices and experienced talent are essential, they are not enough. Successful managers of large projects follow a coherent, consistent reference framework that guides their decisions and processes. These frameworks include:

- Formalized project phases and checkpoints
- Clear accountabilities within an integrated project team
- Checks and balances between central functions and project teams

- Continuous review to measure project value and monitor risk

Successful companies also continuously improve their general project management skills, as well as skills specific to oil and gas. A shortage of technical talent in the industry—destined to become more acute over the next seven years as a generation of experienced engineers retires—complicates the problem. Even so, as they approach projects of greater complexity and scope, companies cannot afford to bring second-rate talent to the game.

The challenge of large projects

As activity ramps up and more oil and gas production moves to frontier and unconventional resource areas, projects are becoming larger and more complex. These include an offshore facility in the Arctic, budgeted at more than \$3 billion, and an \$8.4 billion petrochemical complex spread across 45 kilometers in South America. Such projects involve many stakeholders, including shareholders, local authorities and regulators, and environmental and community advocates. Schedules are compressing, too: For one oil company, more than 90% of its field discoveries from 2009 to 2011 are due online in less than eight years.

Of course, no company manages only one project at a time. Firms' portfolios may include hundreds of complex projects, which they prioritize not only on financial goals and risks (including execution, commercial, health-safety-environmental [HSE] and reservoir risks), but also increasingly based on the availability of scarce resources like engineering talent. Some are building up their internal engineering staffs by as much as 80% to effectively manage the many contractors and suppliers on each project.

Scoping projects accurately is an important skill. For small companies, delivery of a smaller, technically complex project may be as demanding as larger projects are for large companies. However, projects that look very big (for example, upstream shale production projects) may in fact be a collection of smaller projects. Companies that approach their unconventional strategy in the same way they would approach a large, complex project run the risk of over-engineering their upstream production if they treat many small projects like a large one.

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A framework to meet these challenges

Following a robust project reference framework can help avoid cost and schedule overruns. Leading companies gather technical input early, incorporating it into the project’s framework to make sure it aligns with the organization’s larger goals. They also engage stakeholders throughout the life of the project, from architecture and design through execution.

Formal project phases and checkpoints. Decision checkpoints, or stage gates, mark the end of formal project phases (*see figure*). To move from one stage to the next, managers, coordinating with stakeholders, have to decide if they are ready to move on.

To keep these stage gates relevant, leading oil and gas companies and the contractors who work with them continuously revise their stage-gate frameworks to align them with evolving market conditions. They anticipate the needs of key stakeholders as they plan the steps toward completion. For example, it may make sense to define local content requirements well ahead of front-end engineering design.

Leaders also work to control costs in the early architectural and planning phases, when key decisions are made. Typically, 80% to 90% of costs are incurred in later phases.

Well-managed large projects balance simplicity and flexibility with respect for rigor at checkpoints. While it’s important to keep project teams on task and schedule, processes that are not easily changeable can place unnecessary hurdles in a project’s path.

Clear accountability in an integrated project team. Successful projects require effective decision making. Our analysis of projects that run late or over budget finds the top reason is “not making good decisions with the right people and not making them happen.” This may include failing to invite technical input at the concept phase, disregarding stakeholders or misaligning decision makers’ incentives and project goals.

An integrated project team with clear roles and responsibilities, and a shared interest in the project’s objectives, helps ensure accountability. In some organizations where decisions and accountability are not clearly allo-

Figure: Typical phases and stage gates of a major oil and gas infrastructure project

	Project architecture	Detailed planning	Execution	Completion
	Gate 1	Gate 2	Gate 3	Gate 4
	Choose the project	Define the concept	Execution and start-up	Performance test
Objective	<ul style="list-style-type: none"> Define the sources of value Evaluate the alternatives Identify any constraints Choose the best concept based on evaluation of risks Create a strategy 	<ul style="list-style-type: none"> Produce an execution plan Collect bids 	<ul style="list-style-type: none"> Manage the project within cost, time and quality targets Effectively manage variances 	<ul style="list-style-type: none"> Achieve expected results Make a plan to maintain performance and deliver maximum return to stakeholders
Stage-gate question	Is this the best way to maximize the project’s value?	Can we successfully execute the project and create value for stakeholders?	Is the asset ready for production?	Did we achieve the project’s goals? Can operations proceed efficiently? What lessons did we learn?
Key deliverables	<ul style="list-style-type: none"> Understand sources of value Build a system to monitor constraints Agree on a consolidated plan Obtain approval 	<ul style="list-style-type: none"> Project plan: front-end engineering and design (FEED) Assign contracts 	<ul style="list-style-type: none"> Commissioning Start-up 	<ul style="list-style-type: none"> Performance tests Evaluate project Handover to operations

Source: Bain & Company

cated to project teams, functional experts may wind up making key decisions. That can create bottlenecks and delays, as decisions percolate up to functional managers with wide-ranging agendas. A diagnostic survey of decision quality, speed, yield and effort can identify areas that need to be changed.

Checks and balances between central functions and project teams. Corporate functions empower project teams by staffing the best people, defining processes and ensuring control of managerial and technical activities. In turn, project teams must be able to make the decisions for the projects' deliverables. Projects are more likely to succeed when the functional experts have an advisory rather than a decision-making role in assurance, control and steering activities.

Continuous review to measure project value and monitor risk. Successful organizations assess projects continually, not only at formal checkpoints and stage gates, to ensure they are on track to add value. Ideally, senior managers who are not part of the project team give a "cold eye" review of the project, costs and progress. They report to decision makers on the project's state of readiness and suggest ways to improve value or cut costs. Comparing the project with others in the portfolio helps prioritize resources in line with company goals. Sometimes the reviewer's analysis will lead the organization to modify a project or change its delivery date.

Competency development across capabilities

A good framework is essential, but it's not enough to satisfy the demands of major projects in oil and gas. Companies must also continuously improve their general project management skills, balancing trade-offs among costs, schedules, technical demands and stakeholder requirements while also coordinating between the functional center and project teams (see the sidebar, "Managing large capital projects," for a complete list).

In oil and gas, some skills areas are particularly important:

Local content. Local content rules, which require large project owners to source some goods and services from the host country, are critical in oil and gas projects. Project managers must understand the requirements and plan accordingly, taking into account the relevant risks. In some cases, services are not available from local sources, or local providers are not able to deliver

against objectives. Failing to plan for these contingencies can delay a project and send it over budget.

Successful project managers seek to understand the host country's goals. They engage policy makers to create long-term strategies that go far beyond their immediate supplier needs, promoting best practices that help local industries meet global standards. A local network of robust suppliers not only benefits the project, but also the local economy.

Engineering. Over-engineering can contribute to unnecessary complexity in major projects, while simplicity in design can ensure efficient and competitive solutions. This is an ancient principle: Even the engineers supervising the construction of the Colosseum demanded simple, proven construction techniques, setting a high bar of proof for any deviation that strayed from their templates. Today's oil and gas projects can benefit from the same principles. At one project, engineers reviewed 71 complex engineering actions, from rotating machinery to the layout of pipes, to find simplifications that saved between 1% and 2.5% of costs.

International oil companies (IOCs) and oil field service companies are building up their internal engineering capabilities to ensure quality among their contractors. This enables them to better manage projects for national oil companies (NOCs) and other resource holders (see the Bain Brief "National oil companies reshape the playing field" for more on this trend).

Procurement. Many oil companies are rationalizing their procurement relationships, moving from many shallow relationships to fewer but deeper ones. For example, some IOCs are trying to spend half their procurement budget with their top 40 vendors, whereas a few years ago that share might have gone to more than 250 companies. Taken as a whole, these improvements could return 5% on cost efficiencies.

Procurement trends follow cycles, however, and the push for local content requirements could fragment the procurement pool again. If local content efforts are to succeed over the long term, NOCs and other oil and gas companies will have to work with local suppliers to build a strong foundation of support services (see the Bain Brief "How national oil companies can fuel economic development").

Managing large capital projects

Successful project managers rely on a collection of essential skills:

Project management: Manage trade-offs among costs, schedule, technical solutions and stakeholder requirements to ensure the project's value

Local content and other stakeholders: Ensure proper alignment with stakeholders while meeting requirements to use local content and contractors

Costs and schedule: Provide an accurate estimate and control of project results, from concept to completion, monitoring project costs and schedule

HR and support functions: Manage resources, training and compensation to ensure that the necessary skills are available to the project when needed

Production operations: Take into account all aspects of the asset's operability and maintenance, from planning through commissioning, start-up and performance tests

Engineering: Identify technologies that deliver innovation and competitive advantage in terms of quality, costs and schedule while avoiding over-engineering

Procurement: Source goods and services based on best market opportunities

Contracting: Define and manage contracts to meet quality, costs and schedule requirements

Risk and opportunity management: Minimize the probability and consequences of threats while maximizing opportunities in a systematic and constantly updated process

Quality and HSE (health, safety, environment): Guarantee the health and safety of employees, contractors, customers, local communities and the environment throughout the project life cycle

Better tools can also improve procurement. One company redefined its contract work breakdown into related contracting modules, allowing it to reassign some contractor jobs and save 13% on goods and services. Global companies should also strive to manage suppliers at the global level and ensure they're working with the supplier's A team, which adds value (and reduces frustration).

Risk and opportunity. Managing risk and opportunity is a continuous process that requires companies to consider not only the most common risks, but also to have experience mitigating unexpected events. In the oil and gas industry, it's never been more important to manage health, safety and environmental risks, given the rising complexity of operations and the close scrutiny by regulators and stakeholders. Risk identification and evaluation is a continuous process throughout a project's life cycle and across the project portfolio, taking a systemic perspective that considers projects, their phases and relevant risks.

Leading companies work with contractors to determine how risk and opportunity will be shared. This can forge a much closer relationship than simply trying to transfer risk to contractors while reducing cost and risk for the managing organization.

Engineers and builders in the oil and gas industry face daunting and unprecedented challenges as they design and construct the infrastructure to extract and process the resources that will power the global economy over the next few decades. Few large projects in the planning stages will stand the test of time like the Colosseum. But that doesn't diminish their importance or suggest they should be undertaken with any less rigor. As the oil and gas industry embarks on a new generation of major projects, project managers will need to rely on coherent, consistent reference frameworks that guide their decisions and engage the most competent talent they can find in order to keep pace. 

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