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# Capital Project Execution in the Oil and Gas Industry

Increased Challenges, Increased Opportunities

## Executive Summary

As the oil and gas industry's capital expenditures have soared in recent years, capital project execution has become a hot topic in the executive suites of producers and related engineering, procurement, and construction (EPC) contractors.

Recently, Booz Allen Hamilton surveyed leaders from 20 companies—including super-majors, independents, and EPC firms, as well as some heavy industrial companies from the United States, Europe, and Asia—with combined capital spending of more than \$100 billion. Eighty percent of respondents said that they expect their companies to increase capital expenditures during the next five years, with many planning increases of 30 percent in 2006 alone.

Despite this growth, more than half of the executives said they are dissatisfied with their companies' overall project performance, citing the costly budget and schedule overruns that plague 40 percent of their projects.

Owners and contractors are quick to identify the prominent pain points: performance management, risk management, and human resources. Contractors add project planning to this list. Booz Allen believes that making improvements within these areas can significantly boost management's ability to monitor the progress of performance and to anticipate and address deviations from proposed budgets and schedules.

Owners and contractors alike firmly believe that the oil and gas industry's environment has changed so funda-

mentally that many traditional ways of doing business are anachronistic. Increased project complexity in demanding environments and frontier areas, aggressive performance expectations, technological innovations, larger financial bets, competitive national and private indigenous companies, more sophisticated host countries—all coming at a time when the supply of oil and gas is constrained and demand is increasing—mean that management must make quantum shifts to be able to meet the future energy needs of the global economy.

The important shifts include the following:

- Rethinking the project framework so that companies can better leverage their internal scale and scarce internal resources to handle increasingly complex projects
- Standardizing design when possible to reduce project cost and to focus technological innovation where it matters
- Reexamining the relationship between owners and suppliers, which involves rethinking the contractual framework and increasing the level of constructive cooperation so that both parties can jointly address current and future concerns

These shifts apply to upstream activity as well as to other areas of the value chain with looming big-project spending, such as refining and liquid natural gas (LNG).

# Capital Project Execution in the Oil and Gas Industry

## Increased Challenges, Increased Opportunities

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### **A Brief History of a Unique Boom**

Now, at the turn of the 21st century, the oil and gas industry is experiencing a surge in demand. While the United States currently consumes 25 percent of global production, and requirements are expected to continue to rise, developing nations—once barely a blip on consumption charts—are making up for lost time. China and India have more than doubled their consumption since 1990. Indications are that demand from these emerging heavyweights will continue: China's Sinopec Development Research Institute has predicted that China's oil consumption will double during the next 15 years to more than 10 million barrels of oil per day.

At the same time, reserves are not being replaced. World oil production capacity is now high on the public agenda and Congress's "Peak Oil Caucus" has called for a multilateral energy drive.

Infrastructure is also strained. Drilling rigs are in short supply, and refining capacity, traditionally low in the United States, was significantly stress-tested during the aftermaths of Hurricanes Katrina and Rita, sending the price at the pump up 17 percent.

Of course, the oil and gas industry is no stranger to boom-and-bust cycles: Industry veterans remember 1973, when the price of oil peaked sharply in response

to the OPEC embargo, then fell dramatically, only to spike again in 1979 during the Iranian revolution. But they emphasize that the current boom is significantly different because it is demand-driven rather than the result of political maneuvering.

### **An Unprecedented Wave of Capital Spending While Performance Lags**

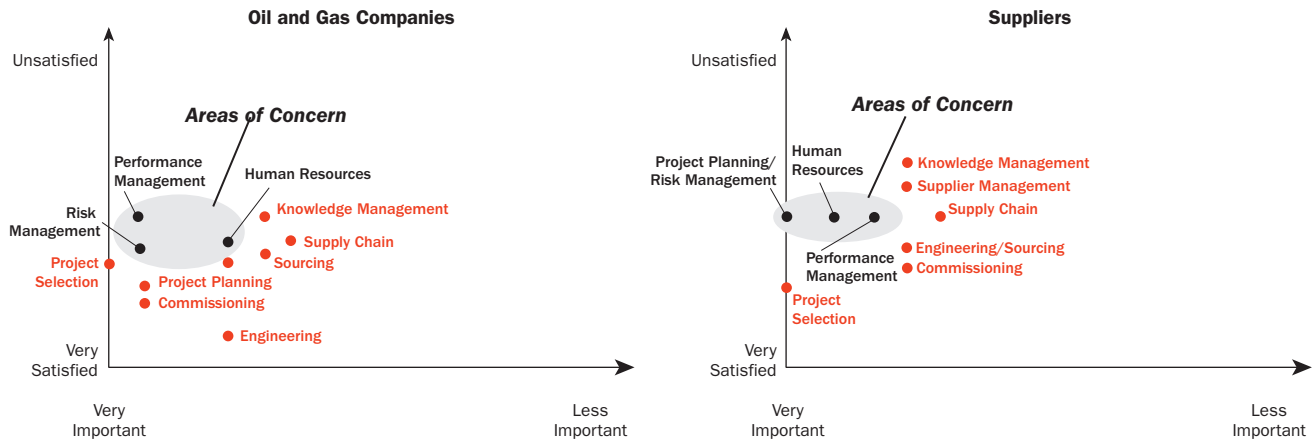
The pressure to increase production has released an unprecedented wave of capital spending by the oil and gas industry. Industry analysts predict that annual capital spending for exploration and production will exceed \$230 billion in 2006, and most of that spending will go toward new megaprojects—many valued at more than \$3 billion. The International Energy Agency estimates that meeting global energy needs will require investing more than \$17 trillion by 2030.<sup>1</sup>

And yet, at this critical juncture, industry headlines are filled with notable examples of multiyear, multibillion-dollar overruns. Leaders of oil and gas companies are less satisfied with overall project performance now than, perhaps, at any time in the industry's history. Specifically, they are dissatisfied with project-management performance, risk management, and human resources management. EPC firms share their clients' concerns—in fact, typically they are less pleased with performance and are further disturbed by the lack of collaborative project planning on the part of owners (see Exhibits 1 and 2 on next page). These problems

<sup>1</sup> Jeroen van der Veer, "A Vision for Meeting Energy Needs Beyond Oil," *The Financial Times*, Jan. 25, 2006.

**Exhibits 1 and 2**

Oil and Gas Companies' Views of Project Performance Versus Suppliers' Views of Project Performance



Source: Booz Allen Hamilton

have been growing for several years and are likely to become even more acute. Booz Allen, along with the majority of the companies interviewed during the survey, believes that they represent significant issues that must be addressed: The megaprojects present unique physical, technical, environmental, and political challenges. If the challenges are not met, they could impede the industry's ability to manage this significant wave of capital investment and to secure the world's energy future.

### As Projects Become More Complex, So Does Risk Management

In this era of megaprojects, bets are bigger, rewards are larger—and risks are greater. Even major corporations cannot afford to miscalculate the risks. And yet, they do not seem to have a good grasp of how to manage the risks associated with capital projects.

While risk management is not a new concept for oil and gas companies, complex commercial arrangements, increased technical challenges, evolving local conditions (both economic and regulatory), and a portfolio that's shifting geographically toward frontier regions are all increasing the risk of schedule and cost overruns.

The shift is dramatic: Investment in traditional production regions in the United States and the North Sea

stagnated (or, in the case of Europe, fell) between 2000 and 2004, while activity accelerated in frontier areas. For example, investments in Africa and the Asia-Pacific region grew at rates ranging from 25 to 40 percent per year.

Operating in these frontier regions presents challenges in terms of companies' political and diplomatic capabilities. The decision-making mechanisms of host governments are often unclear and can lead to significant schedule delays. For example, in new democracies such as Indonesia, the old autocratic way of doing business under the Soeharto regime has given way to a complex, decentralized maze in which the laws are not always transparent and court rulings are often inconsistent, leading to a fair amount of uncertainty. Projects in these frontier regions also face increased supply chain risks. For example, host governments frequently require that international partners use local suppliers with whom oil and gas companies do not have an established track record for material and services.

Most megaprojects involve complex commercial arrangements across numerous companies. In these situations, reaching quick decisions can be challenging and project schedules can be delayed by slow responses from joint venture partners. Project managers, then, who have a limited ability to pressure partners into

making speedy decisions, are left feeling powerless. While the involvement of joint venture partners helps operators mitigate market risks, such partnerships clearly complicate execution.

Risk management is also an issue in terms of technological advances, which continue to be key competitive drivers. Producing wells now go to depths beyond 7,500 feet, while exploration has plunged to 10,000 feet. However, the introduction of new technology adds to project complexity and can be problematic if each project team must, on its own, adopt new techniques that have yet to be fully proven.

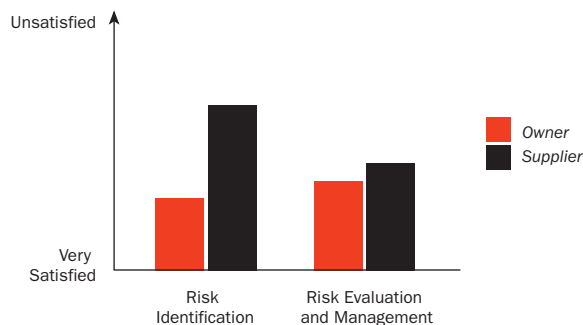
Local economic and regulatory conditions represent another significant source of risk. A very tight labor market has led to significant project delays and cost overruns in Alberta, where companies have been struggling to secure qualified labor and supply-base capacity to meet an aggressive wave of capital investment.

None of these risks are new. However, oil and gas company executives believe that these risks are now more complex to manage because they involve more stakeholders and more sophisticated host countries.

Suppliers share these concerns, but with a heightened sense of urgency. They believe that oil and gas companies do not fully recognize, evaluate, and manage the risks, and consequently are not addressing them effectively (see Exhibit 3).

### Exhibit 3

#### Assessment of Risk Management Practices



Source: Booz Allen Hamilton

### Project-Performance Management: Back to Basics

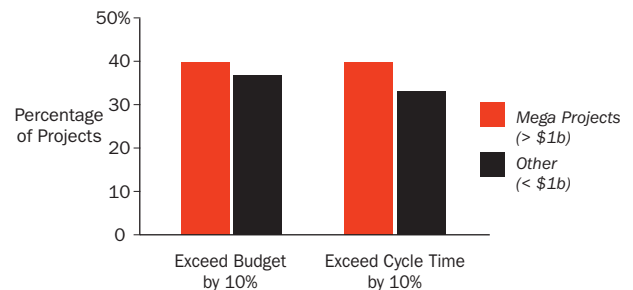
As project risk profiles change, performance volatility becomes a real issue, especially in megaprojects. Our study suggests that there are no significant differences in the ways companies evaluate projects, regardless of size: Most use a combination of criteria, including internal rate of return, net present value, and payback period. Nonetheless, owners and contractors both are struggling to set budgets that are at once competitive and realistic. Even traditional benchmarks, such as Independent Project Assessment (IPA), are becoming less applicable in setting targets or conducting post-project analyses because the number of representative projects is not extensive enough to be used as a solid reference.

Historically, performance management has been outsourced to suppliers via turnkey contracts, depriving oil and gas companies of the basic capacity to monitor, anticipate, and proactively address deviations. Furthermore, post-project performance appraisals have not been conducted uniformly, limiting the ability of companies to learn from their mistakes.

The result is that oil and gas projects frequently exceed budget and time projections by more than 10 percent (see Exhibit 4). These issues seem to be more prevalent in megaprojects, in which there is greater complexity and there are more opportunities for things to go wrong.

### Exhibit 4

#### Percentage of Projects Exceeding Budget and Cycle Time by More Than 10 Percent



Source: Booz Allen Hamilton

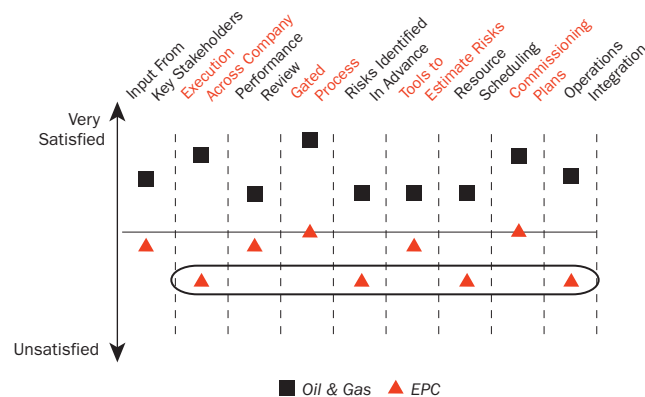
Poor project performance is not acceptable when capital markets are looking for predictability and strong returns. Failures to deliver big projects on budget and on schedule are highly publicized and can negatively impact the perception of a company's ability to meet its commitments.

### Project Planning: An Owner/Contractor Disconnect

In our conversations with owners and contractors, it became apparent that there is a major disconnect in the ways the two groups view success (or failure) in activities planning. While oil and gas owners perceive no major shortfall, contractors underscore the need for a major overhaul of the function (see Exhibit 5).

#### Exhibit 5

Owner/Supplier Views of Success are Skewed, Just When Contractors Are Seeking a More Collaborative Approach



Source: Booz Allen Hamilton

Contractors cite four areas as being particularly unsatisfactory:

1) *Execution across the company.* Contractors believe that planning across a portfolio of projects, rather than on a case-by-case basis, would drive improvement in the supply chain and reduce inefficiencies between project phases.

2) *Resource scheduling.* A more integrated approach to project planning would also help contractors optimize resources across a number of projects—an important consideration in a resource-constrained environment.

3) *Risk identification.* Owners continue to offer lump-sum contracts, while contractors manage most of the supply chain risk alone. This can be problematic, since megaprojects put particular strain on labor availability, supplier capacity, and delivery of long-lead-time items.

4) *Operations integration.* Project teams sometimes fail to integrate operational considerations, leading to suboptimal asset performance and potential tensions with the contractor.

### In Short Supply: Technical Talent

The graying of the baby boomers has a very real impact on the oil and gas industry: More than 50 percent of workers for oil companies and for contractors will retire in the next five to 10 years (the average age of operator technicians is over 45, while the average for contractor technicians is over 50.) This ongoing attrition leads to a loss of the skills required for the continued success of megaprojects.

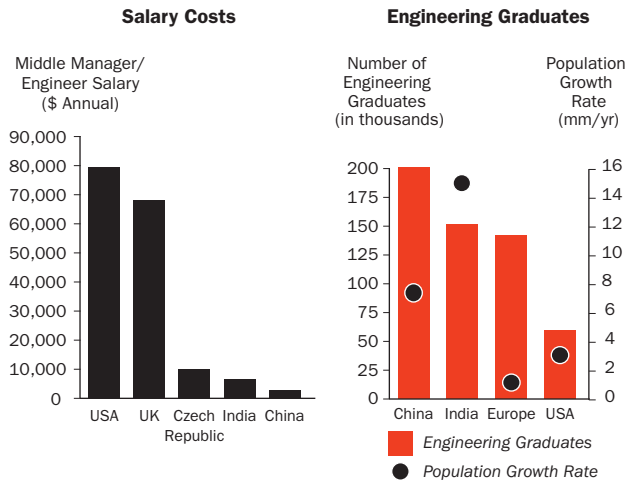
And the talent pool is not being replenished. New candidates in the United States and in countries that are part of the Organization for Economic Cooperation and Development (OECD) no longer find technical careers in the oil and gas industry attractive. The number of petroleum engineering diplomas awarded in the United States in 2002 was one-quarter the number awarded annually in the 1980s. In fact, the impact of the engineer shortage in the United States cuts across all industries. China, India, and even Europe currently outpace the United States in actual numbers of engineering graduates—although the number of engineers per thousand people is still higher in the United States (see Exhibit 6 on next page).

There are clear-cut reasons for the industry's failure to attract, develop, and retain young talent:

- The “single project” mentality leads to job insecurity, as companies hire and lay off employees depending on the level of project activity. This is particularly true for EPC firms, which maintain staff at the whim of oil and gas companies.
- There is a sense among young graduates that oil and gas extraction is a “sunset industry.” The Department

**Exhibit 6**

The United States Leads in Wages for Engineers, But Is Producing Fewer Engineers



Source: Booz Allen Hamilton

of Labor states that, in the United States, employment in the industry is expected to decline by 6 percent through the year 2014.

- Traditionally, oil and gas companies have failed to establish formal career paths to develop their project staff. A focus on short-term performance means that there is no premium put on training. Too often, staff have to rely on on-the-job training to grow professionally, and consequently they depend greatly on the luck of the draw to acquire the experience needed to progress.
- Lifestyle is clearly becoming an issue, as most activity is taking place in remote locales and insufficient financial compensation for the hardship on families has prompted many potential candidates to look elsewhere.

The challenge for oil and gas companies is compounded by the growing competition from national oil companies (NOCs) and small- to mid-sized producers. In fact, NOCs hold more than 75 percent of the proven reserves; as serious contenders, they are now competing for the same pool of talent.

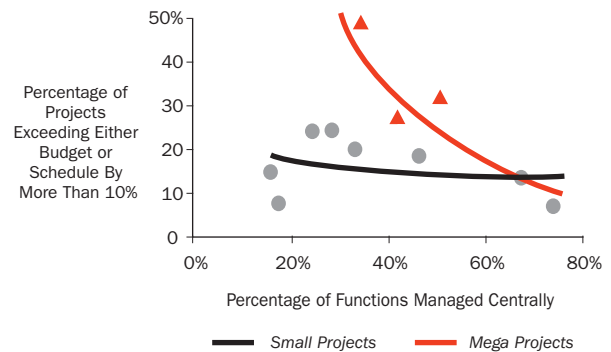
**Going Forward: Three Important Steps**

With the business environment in the oil and gas industry in flux, virtually every aspect of project delivery is impacted. Booz Allen has identified three major themes that both owners and contractors view as imperative to the future well-being of the industry: adopting a global project-management framework; standardizing design and targeting technological innovations; and revamping the relationship between owners and suppliers. These themes reflect a general trend as companies leverage their scale and scope to establish standard practices; to better utilize scarce resources, both internally and across the supply chain; to leverage commonalities across projects, thus reducing technical complexity; and to approach their supply base more holistically.

*Step One: Adopt a more global project-management framework to increase performance.* A number of companies have adopted central management of key functions, and it appears that these companies have enjoyed significantly improved performance, particularly with megaprojects (see Exhibit 7).

**Exhibit 7**

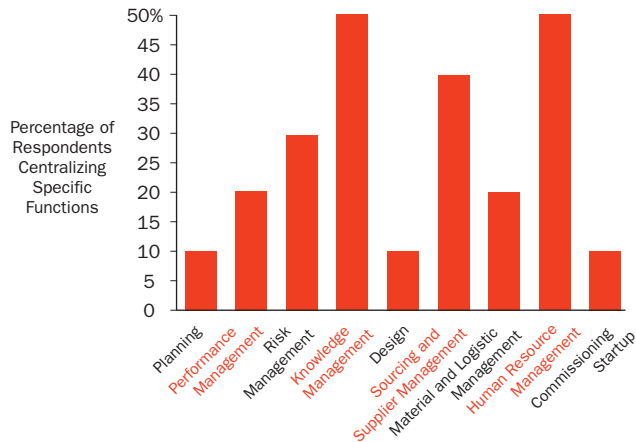
Centralization Drives Significant Increases in Project Performance



Source: Booz Allen Hamilton

There seems to be a broad consensus that knowledge management, supply chain management, human resources management, and risk management can

**Exhibit 8**  
Functions Managed Centrally



Source: Booz Allen Hamilton

greatly benefit if projects are approached as a portfolio, rather than as individual events (see Exhibit 8).

- **Knowledge management.** With a single repository of best practices and learning, a centralized knowledge-management system helps companies accelerate their efforts to backfill their technical capability gaps, recognize and anticipate problems, and avoid reinventing the wheel across multiple projects. But many companies implement the technology for a knowledge-management system and overlook the necessity of emphasizing sharing within the corporate culture. Knowledge management should be holistic: It should include on-the-job mentoring, structured training, and the establishment of institutional mechanisms to capture and disseminate information relevant to project teams.
- **Supply chain management.** Oil and gas companies miss opportunities to leverage the scale and scope of their business with the supplier base by leaving the work to individual project teams. Leaders in the industry now forecast their needs across several projects, looking for opportunities to aggregate and possibly standardize the demand for specific components (such as pumps) or raw materials (such as steel) and share this information with the supply

base. In turn, this helps contractors better manage their resources, anticipate needs, and plan their production and procurement activities. Our experience shows that costs can be reduced by as much as 15 percent by centralizing operations and by purchasing in bulk throughout the supply chain.

- **Human resources management.** This structural problem throughout the industry requires immediate attention. The central management of resources is viewed as a way to optimize the deployment of talent, thus avoiding the peaks and valleys characteristic of project-by-project hiring. Industry leaders have established formal career paths, giving the opportunity to junior staff to assume new, challenging roles. While these measures can alleviate some of the near-term challenges, companies need to reexamine the industry's image and financial rewards, and work with universities and other academic organizations to encourage students to enter the field. Increasingly, American oil and gas companies are turning to specific low-cost countries in search of talent. EPC firms have already moved ahead in this area and established engineering centers in India, Indonesia, and elsewhere. Oil companies should follow their lead and train local talent. It's important to note that host governments are deeply concerned about employment; the training and hiring of local talent not only benefits a company's bottom line, but also increases goodwill with the host government and population.
- **Risk management.** As discussed earlier, project risks are numerous and traditional ways of pushing accountability for risk management onto the project team and the suppliers might not work anymore. Leading companies are recognizing that syndicating certain risks—such as political interfaces, adoption of new technology, and supply chain management for common hardware—across the project portfolio makes good sense. In particular, some leading companies are starting to emulate models used in the diplomatic world to build the institutional knowledge and skill sets necessary to effectively manage political risk and to deal with varying decision-making mod-

els. However, project teams and suppliers still need to be held accountable for the overall project success and therefore need to remain on point to manage schedule- and budget-related risks.

*Step Two: Standardize design and target technological innovation.* By leveraging design similarities across projects, oil and gas companies can reduce capital costs and cycle times while they improve operations and engineering productivity. For many years, leading automotive companies have used the concepts of “platform” and “subassembly” for new model introduction. For example, Toyota drives the design and production of its entire fleet using no more than 13 common platforms—and manages to produce some 40,000 different finished products. Some leaders in the oil and gas industry are moving aggressively in this direction. Recently, the CEO of ExxonMobil promoted the concept of “design one, build many,” emphasizing how this allows ExxonMobil to execute mega-capital projects very effectively.

Supply-base companies have already adopted this mode of operation for producing complex engineering equipment. A senior manager at a Houston-based EPC firm says, “Accelerating cycle time for long-lead-time equipment like compressors is feasible and can lead to up to 30 percent delivery-schedule reduction. The main obstacle is the design and buying habits of our customers, as we have short-term visibility on the demand.” In fact, leading suppliers have already incorporated a modular approach to the design and manufacture of complex engineered equipment: In response to the lack of cooperative planning with their customers, they actually launch fabrication before a firm order is placed. A leading gas compression engine manufacturer currently initiates assembly of its product before the design is finalized. This flexible production system allows the supplier to quickly meet last-minute orders from its clients.

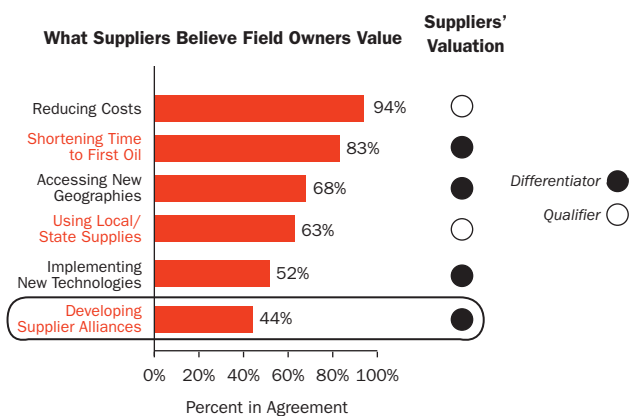
What is good for the suppliers is good for the oil and gas companies. Our direct experience with a large operator in the North Sea indicates that the vast

majority of topside equipment for an offshore platform can be built using pre-designed modular systems that can be assembled quickly to meet the specific needs of a project. Besides offering the obvious supply chain benefits (such as enabling longer-term planning with suppliers, optimizing production asset and inventory levels throughout the supply chain, achieving tighter alignment with suppliers around contract terms, and shared project systems), such an approach also frees internal design talent by focusing engineering resources on downhole design issues.

*Step Three: Revisit the nature of the relationship between owner and supplier, so that they can jointly manage the surge in activity while meeting project-performance targets.* As previously discussed, there are many areas of disconnect between owners and contractors. Much of this stems from what suppliers see as owners’ overwhelming tendency to focus on end results rather than the execution of the projects (see Exhibit 9).

### Exhibit 9

Owners and Managers Have Misaligned Views of What Matters for Effective Project Management



Source: Booz Allen Hamilton

Suppliers are looking for more integrated, long-term relationships that foster advance planning, effective use of resources, and more equitable sharing of risks and incentives—for example, they favor moving toward time and material charges rather than lump-

sum contracts for high-risk projects. They believe that owners are still too transactional in the way they approach projects.

On the other hand, owners point out that they are operating under a series of constraints. Sometimes those constraints are internal, as when a bidding process is imposed as a general policy; at other times they are external, such as when host governments and joint venture partners do not accept an owner's established alliances. In addition, during the past decade, a number of attempts to establish long-term relations have failed, leaving both owners and suppliers a bit skittish and the traditional command-and-control owner/supplier relationship intact.

Improving collaboration with contractors offers perhaps the greatest challenge to oil and gas companies and, we would argue, the greatest potential for improvement.

Historically, contractors have been key to the success of a project. Today, the supply base is consolidating

at a fast pace—a situation that is likely to have far-reaching implications regarding the nature of contractor/field owner relationships. Already, contractors are being selective about whom they work with. A senior manager at a large EPC firm in Houston states that, far from chasing work as was done in years past, his firm will pick and choose projects in the future.

This is a sobering situation for the oil and gas industry. One senior executive who oversees project management for a large oil and gas company estimates that the current contractor base has enough capacity to manage only about 70 percent of the projects currently in the pipeline. Unless demand decreases, the industry is entering a problematic period in which the traditional command-and-control owner/contractor relationship might not be viable any longer. It is imperative that industry players work to bridge the divide and start a dialogue, so that the two sides can align their interests and work collaboratively.

## What Booz Allen Brings

Booz Allen Hamilton has been at the forefront of management consulting for businesses and governments for more than 90 years. Integrating the full range of consulting capabilities, Booz Allen is the one firm that helps clients solve their toughest problems, working by their side to help them achieve their missions. Booz Allen is committed to delivering results that endure.

With 17,000 employees on six continents, the firm generates annual sales that exceed \$3.5 billion. Booz Allen has been recognized as a consultant and an

employer of choice. In 2005 and in 2006, *Fortune* magazine named Booz Allen one of “The 100 Best Companies to Work For,” and for the past seven years, *Working Mother* has ranked the firm among its “100 Best Companies for Working Mothers.”

To learn more about the firm, visit the Booz Allen Web site at [www.boozallen.com](http://www.boozallen.com). To learn more about the best ideas in business, visit [www.strategy-business.com](http://www.strategy-business.com), the Web site for *strategy+business*, a quarterly journal sponsored by Booz Allen.

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