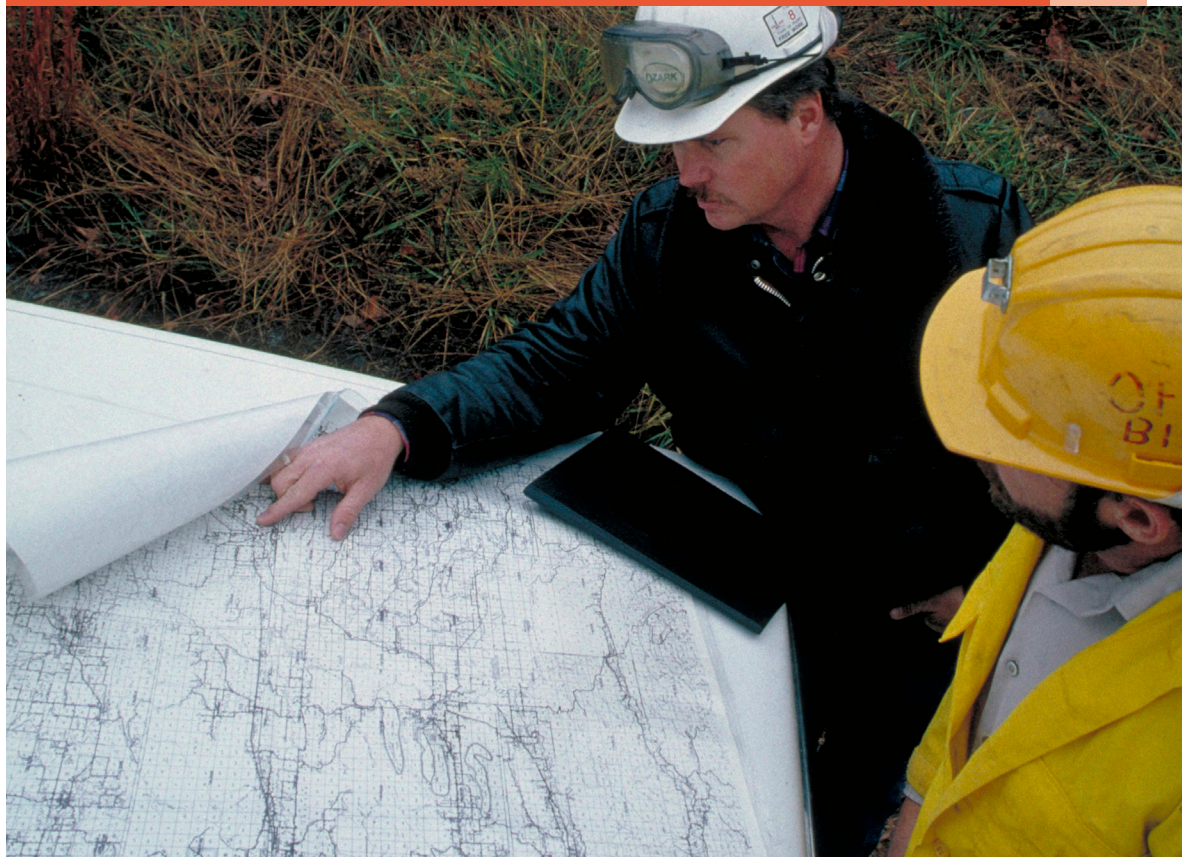


Shale Gas

New conventions for unconventional development for the engineering and construction industry

*Reducing the drag:
achieving speed and
efficiency in shale well
development planning
and execution*



Analyzing the shale gas value chain

Horizontal drilling and hydraulic fracturing have dramatically changed the North American energy landscape over the last decade by enabling the extraction of shale gas. Shale gas now makes up more than 25% of domestic gas production, at 553,000 barrels per day in 2011.¹ This growth rate is expected to continue unabated and to reach 50% of domestic production by the next decade.²

In the push to service demand, oil and gas companies are developing tens of thousands of new well sites, presenting a challenge to current business models and traditional project management. Oil and gas companies, aided by their engineering and construction (E&C) partners, are beginning to take on the challenge by stepping back and analyzing what is and is not working across the shale gas value chain.

This paper is the first of a three-part series on the critical role E&C firms can play in helping their oil and gas clients work through the three developmental steps needed to successfully bring shale oil and gas to the marketplace.

Oil and gas companies, and their E&C partners, are examining the thousands of repetitive activities and handoffs between functions that look as much like manufacturing operations as they do traditional oil drilling and production. In this changed environment, information technology and enterprise systems are emerging as enablers that significantly improve decision making and drive productivity.

Forward-looking E&C firms are working in concert with their oil and gas clients to drive improvement by focusing on these three sequential steps: reducing the “drag,” optimizing the “play,” and gaining speed and flexibility. Each step in the process builds on the foundation established in the previous step.

E&C firms can assist their clients with these steps, working as an integrated project team. The first task is to develop a project management model focused on reducing the organizational and administrative drag on all of the activities required to efficiently produce shale oil and gas and get the products to market. Then, with an integrated operating/project management model in place, a company can shift to optimizing operating expense, capital investment, and resources across the full portfolio of development and production. Finally, with optimized resources and greater insight into the full portfolio, a company can apply sophisticated analytics to enable better decision making and increase the speed and flexibility in the field and in the market.

Reducing the drag: achieving speed and efficiency in shale well development, planning, and execution.

Optimizing the play: delivering optimal returns by aligning operating expenses, capital investment, and resources across the full portfolio of development and production.

The crux of reducing the drag

Given the high stakes, cost pressures, and intense competition in the shale industry, oil and gas companies are learning to apply a holistic lens to all aspects of shale development and managing them end to end. Instead of many loosely related development projects in a field, they are focusing on the development of the entire field with an integrated plan and comprehensive execution. This creates an opportunity for E&C firms, requiring an adjustment to their traditional project management model and a faster response to the changing environment.

E&C firms should consider supporting this new approach by managing the hand-offs among functions. In North America, for example, many unconventional wells are in geographies where the necessary infrastructure does not exist. As a result, E&C firms should evaluate structuring

their project management approach so that the planning, engineering, procurement, and construction of the enabling infrastructure is tightly integrated with well development and production processes. These activities span functions and groups that do not regularly work closely together at oil and gas companies. However, E&C firms can help bridge the gaps by creating an integrated project plan that cuts across organizational boundaries. Without such a plan, production targets may be missed and lead to increased capital and operating expenses due to stand-by time for crews and equipment.

Tightening the functional hand-offs and improving the line of sight between demand in the field and organizational capacity is critical. Doing so can result in cycle time reductions of 30%–40% and annual cost reductions of 15%–25%.

E&C firms should consider establishing a standard approach for activity planning and resource scheduling that integrates their clients' functional planning. This includes mapping all the activities and resources required to develop the whole shale field, providing E&C companies with clear insight into the current status and forecast of all activities. With that visibility, E&C project management should be able to acquire and deploy the right resources (labor, tools, materials, and equipment) to the right place at the right time. As market conditions shift, the integrated plan should provide the information needed to adapt the project plan quickly to meet new requirements.

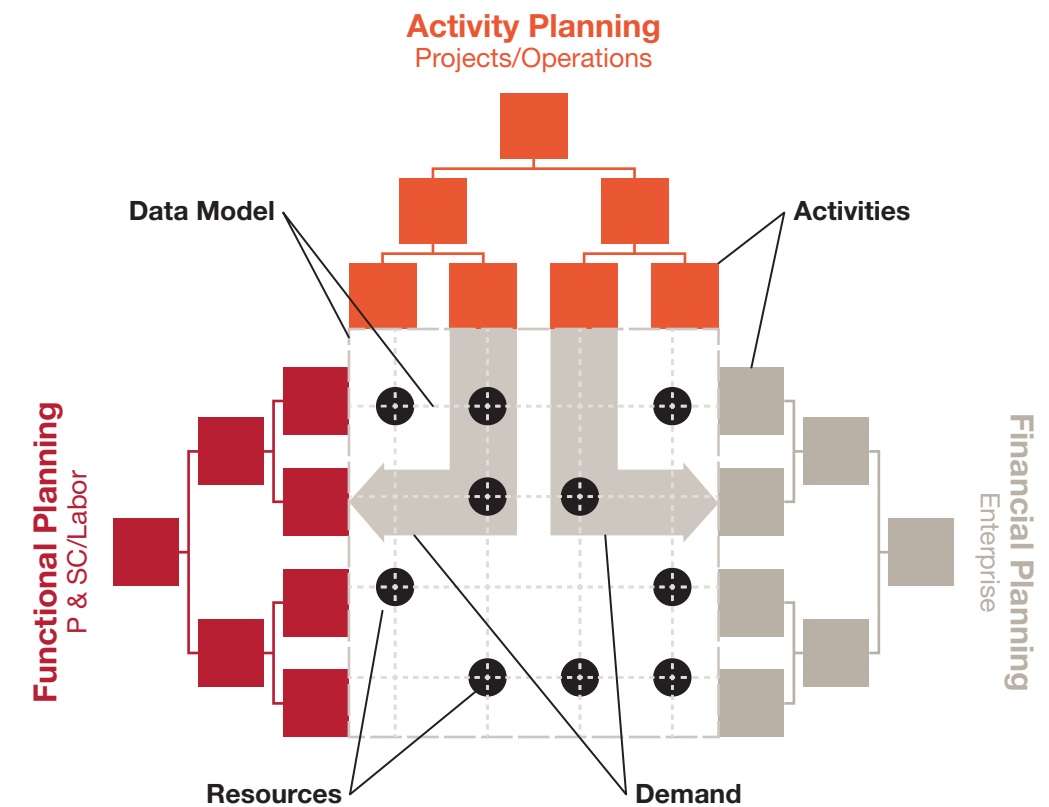
In addition, E&C companies have to ensure a seamless, automated flow of data and information between them and their clients, as well as across a client's enterprise. This data flow will enable the alignment of product design, operations, human resources, environmental health and safety (EH&S), engineering, finance, and supply chain construction into a cohesive structure for effective enterprise portfolio management.

Reducing the drag in planning and execution

Although the biggest challenge is in the many thousands of activity-level details, the essence of managing a portfolio of shale development and production activity is fairly straightforward: detailed process and data mapping that connects field activity planning with corporate functions supplying funding, resources, equipment, business support, and expertise required by the field.

As *Figure 1* illustrates, process and data mapping provides input into functional and financial planning. Because the entire portfolio of work is connected and clearly visible, there is less waste and more overall efficiency as a result of integrated hand-offs between functions.

Figure 1: Process and data mapping



Managing the “play” as a portfolio

The integrated planning approach to shale development underpins the ability of E&C firms to help their clients manage the full portfolio of projects and integrate strategy, objectives, scope of work, required resources, timing, and funding. If one factor changes, such as moving the production schedule ahead two weeks to meet a sales agreement, an E&C firm can immediately assess the impact on a project’s resources and cost and determine whether the goal is achievable.

Portfolio planning and field execution should be a tightly integrated process. Activity planning can help to identify process inefficiencies and eliminate non-value-added work. It also establishes a baseline for the E&C firm in managing performance, controlling change, and delivering results. It increases the accuracy of cost, schedule, and resource forecasts and reduces the corporate “burden” placed on the work done in the field. In short, by managing the full portfolio, an E&C firm can assist a client in the successful execution of its strategy.



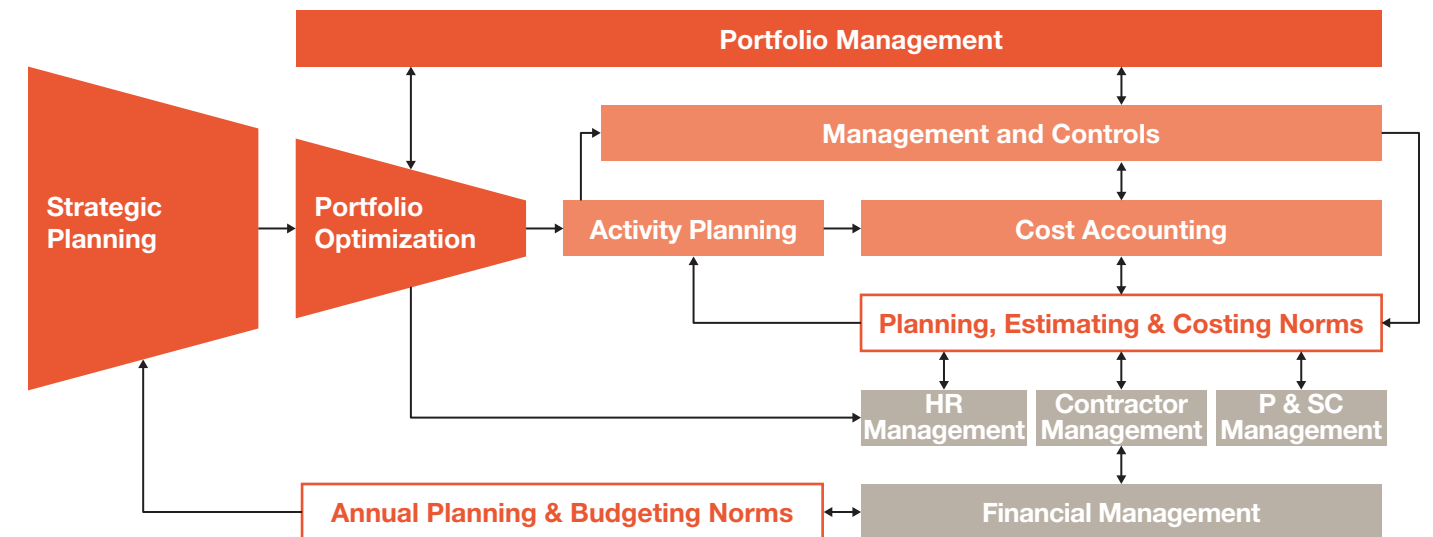
Working the silos

As seen in *Figure 2*, integrated planning and execution by E&C firms and their clients involves many levels and functions. Although the elements are straightforward—alignment around strategic objectives, activities, and activity owners—many oil and gas companies manage them separately and do not focus on their interrelationships and dependencies. Consequently, the companies have difficulty balancing the demands from the field with the priorities of other functions.

People responsible for the drilling function, for example, might determine that padded wells (multiple pads per well) are better than a single well. For an E&C firm and its client’s enterprise to act on that decision effectively, it is essential to develop an effective communications plan that addresses all the relevant parties. The E&C firm should know when the drilling is scheduled so it can build

roads to accommodate the arrival of drilling rigs. The drilling and completion unit at the oil and gas company needs to ensure that construction teams are aware of the padded well approach. The unit also needs to coordinate its work with the supply chain to ensure the timely delivery of materials and minimize downtime and storage costs. It should also coordinate plans with operations to ensure smooth hand-offs.

Figure 2: Functional assessment: integrated planning and execution



Integrating business systems

When the movement of data is automated, it helps ensure that required information is provided to the right function at the right time. For example, an E&C project team may be forecasting that the costs for a certain activity are going to exceed budget. If the finance and project management organizations are alerted in a timely manner, they can take the appropriate

action. In many organizations, such communication does occur, but it is usually informal, particularly when discrete projects are geographically dispersed. An integrated business and systems capability creates a more efficient workflow, linking elements from different processes and systems across all functions, and also between an E&C firm and its client.

The technology dimension

Spreadsheets alone can't coordinate the thousands of shale development activities involved with multiple projects. Enterprise technology provides the tools that allow E&C firms and their clients to manage their portfolios at the detailed level needed to produce extraordinary results. To leverage this technology, companies should focus on two dimensions: integrated data models and combining structured and unstructured data.

Integrated data models: In many oil and gas companies, data is often

structured and defined through the perspective of a single function. The finance organization, for example, may have a cost accounting system with a data model driven by financial and corporate reporting requirements. However, that system relies on the chart of accounts, which is not a framework that project managers can use. By the same token, project management systems don't capture information in a way that can be used by finance. An integrated data model would take information requirements from both functions and

create a connected view that could be used, maintained, and updated by both departments—and the entire organization.

Structured and unstructured data: Both structured and unstructured data are needed to manage complex shale portfolios. The structured data generally resides in databases and accounting tables; the unstructured data can be found in contracts, drawings, specifications, spreadsheets, and emails.

Making it happen

E&C firms and oil and gas companies may successfully reduce the drag by following these principles:

1. Listen to the “silent” business:

Clients have a base of activities apart from new well development and capital projects, everything from inspections and maintenance to training and meetings. Often, new projects become the focus and can drown out the needs of the rest of the business, making them silent. With integrated planning, development activities are meshed with the ongoing work of the business.

2. Factor in context: Everything from local climate and geology to regulatory requirements can significantly differ by well location. If a company were developing a well in Wyoming, for example, the E&C firm would have to account for cold weather in such considerations as pipeline insulation.

3. Lead and model the change: E&C firms need to ensure that all stakeholders buy into the geographically distributed, but integrated, planning approach. They should work with clients to make this approach part of the operating culture by modeling and reinforcing the behaviors they expect from stakeholders. The approach and project priorities should also be clearly articulated to stakeholders so that they understand when a trade-off should be made for the benefit of the full portfolio.

Reducing the drag through integrated project planning has emerged as a leading trend in shale development. It delivers first oil faster and at a lower cost than the prevailing independent and localized project execution approaches. By assessing, planning, and executing all activities across the development and production system, E&C firms should be able to help their clients in reducing working capital through higher utilization of assets and resources, and improving returns on capital by improving efficiency and reducing costs. Integrated planning makes the end-to-end process more consistent and predictable, and it establishes a clear line of sight between project strategy and execution. This enables the optimization of the investment in the portfolio, which will be explored in Part II of this series.

Inside cover:

- 1 Shale oil: the next energy revolution, by Adam Lyons, Michael Hurley, John Hawksworth, and William Zimmern, PricewaterhouseCoopers, LLP, February 2013.
- 2 US LNG Exports: Truth and Consequence, by Kenneth B. Medlock III, Ph. D., James A. Baker III Institute for Public Policy, Rice University, August 10, 2012.

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