Unconventional Gas Projects

Big Gains from Lean Supply Chains
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EXECUTIVE SUMMARY

Like all energy sectors, natural gas is no stranger to boom-and-bust cycles. During the past five years, prices have fluctuated in the wide range of US$3 to $12 per million Btu (MMBtu). In such a volatile environment, remaining profitable and competitive is a challenge. Indeed, to enhance profitability and respond to changing market conditions, companies must do all they can to position their cost structure at the low end of the natural gas supply curve.

Unconventional gas reserves, which have become an increasingly important component of energy company portfolios, differ from conventional assets in that they tend to be low-margin, resource-intensive exploration efforts. Because profit opportunities are limited, getting the most out of an unconventional program requires close scrutiny of operational efficiency and cost levels. As a result, unconventional reserves are perfect candidates for sustainable cost cutting through the introduction of lean supply chain concepts. Indeed, the factorylike characteristics of unconventional reserves—contiguous land positions (analogous to similar products made in a manufacturing plant), high supply chain activity levels (and capital intensity), and the need for increased execution velocity—facilitate lean supply chain implementation.

A combination of quick hits and long-term benefits is available to players that adopt a lean approach. A lean supply chain transformation, which could include standardizing designs, improving coordinating processes, and enhancing supply chain performance management, can yield sizable reductions in cycle time and costs. Additionally, such a transformation could double the net present value (NPV) of projects and assets and lower by 25 to 50 percent the energy price at which an unconventional project is still profitable.
Over the last decade, demand for natural gas as a versatile and clean energy source has grown worldwide and particularly in North America, where it is primarily used for electricity generation, petrochemicals manufacturing, and residential use. As natural gas gained in importance, new drilling and well stimulation techniques were developed that enabled producers to expand operations in unconventional shale reserves across North America. The potential of these reserves is so attractive that they have already generated some high-stakes M&A activity, including ExxonMobil’s recent $41 billion purchase of XTO Energy Inc., one of the largest independent U.S. energy producers.

As a result of technological advances and increased interest, unconventional reserves could make up as much as 60 percent of U.S. natural gas production by 2030. To achieve this, as many as 300,000 unconventional wells will have to be drilled in North America alone in the next two decades, running up a capital expenditure bill of more than $1 trillion. This suggests that in North America, unconventional drilling activity will more than double from the current levels.

But making money on unconventional projects can be a challenge, particularly when natural gas prices are in the range of $4 to $6 per MMBtu, a low level that many experts believe will continue for some time. In this pricing environment, drilling and extraction costs as high as $6 to $8 per MMBtu—the norm for many unconventional wells owned by energy companies with high cost structures—are simply not sustainable. Consequently, the choice faced by natural gas companies is to either cease drilling by deferring capital investment until prices rise or improve...
operations and reduce costs to be profitable even if low prices persist. A number of players have opted for the latter, making their operations efficient enough that their unconventional projects have moved to the low end of the natural gas supply curve.

Actually, this task is relatively straightforward. For most independent natural gas providers, third-party spending through the supply chain is a major cost element. As much as 80 percent of their total costs are earmarked for materials and services provided by third-party suppliers. Standardizing designs and requirements, improving collaboration with suppliers to reduce cycle times, and managing supply chain performance more diligently can reduce these costs. Indeed, supply chain transformation can minimize costs to a level that makes unconventional projects profitable under virtually any pricing scenario.

While the benefits of a lean supply chain are applicable to both conventional and unconventional assets, three key characteristics of unconventional plays facilitate supply chain transformation and make it especially attractive for these projects:

1. **Repeatability**: Unconventional assets tend to have homogeneous characteristics. Customizing equipment and designs for each well to squeeze incremental gas out of these reserves (as might be done with a conventional resource) is too expensive and almost never profitable. Nonetheless, most companies have yet to tap the potential of standardized well designs in unconventional projects. This lack of standardization increases supply chain complexity, drives well development costs higher, and constrains the efforts to scale up operations to meet high volume requirements of unconventional plays.

2. **Supply chain intensity**: High drilling volumes, water and fracturing requirements, and time-consuming supply chain activities required for an unconventional program magnify the economic impact of various bottlenecks, or choke points, within a producer’s supply chain. Some of these choke points include rig availability and scheduling, long lead time requirements for certain materials (e.g., tubulars), and the ability of vendors to scale up services and crews.

   In order to reduce the impact of these choke points, a supply chain must be well equipped to scale up operations, while minimizing wasteful activities and those that add little value.

3. **Capital requirements**: The high capital outlay for unconventional plays places a greater emphasis on the need for operational efficiencies and low system-wide costs, chiefly to make sure that the investment, substantial as it is, is optimally used. But to achieve the desired results, companies must focus more intently on managing and improving supply chain performance. Unfortunately, most organizations have either too many performance metrics or too few, and in many cases the metrics measure performance in a range of disparate areas, as opposed to evaluating end-to-end supply chain performance.
Effective supply chain management requires business leaders and managers to assume a higher-level recognition of the uniqueness of unconventional plays and the mass-production-like nature of unconventional asset development. With that understanding as a foundation, industry leaders are adopting cross-industry best practices to transform their supply chains based on lean concepts. By taking this approach, natural gas companies can enjoy rapid improvement and value capture in unconventional projects. The transformation also provides potentially sustained profitability in economic and commodity down cycles and competitive advantages in up cycles.

Building an end-to-end lean supply chain for unconventional gas plays involves three key steps:

1. **Standardize specifications and lean out well development processes.**

Among conventional assets in the oil and gas industry, incremental returns can be coaxed out of individual wells by customizing equipment and operational models. However, for unconventional assets, this is not the case. Given the relative homogeneity of geologic formations and the large number of wells involved, standardization is critical in order to capture scale efficiencies and benefit from system-wide best practices. For example, standardization of design enables utilization of equipment at multiple wells—i.e., when equipment is not required at a particular well, it can easily be taken to the next well without much modification.

Coordination between the various internal functions (engineering, technology, operations) and external stakeholders (primarily key suppliers) can enable standardization of operations along with materials and services needs. The focus of the supply chain then becomes centered on risk minimization and mitigation as a means of controlling costs.

Of course, some level of customization of designs is inevitable. But customizing should be permitted only to the extent that it does not create excessive complexity in execution and coordination. The aim is to implement a smart customization philosophy that reduces complexity and total supply chain cost and cycle time but allows slight adjustment to the specific design objectives of individual assets. The payoff can be significant. For example, for an independent unconventional player, reducing the level of customization by 35 percent increased realized NPV by more than 10 percent (*see Exhibit 1*). Eventually, 95 percent of this company’s wells had a standardized design.

### Exhibit 1
**Economic Impacts of Customization**

![Diagram showing the economic impacts of customization between conventional and unconventional wells.](source: Booz & Company client example)
2. Migrate to an extended enterprise structure with suppliers to enable pull-based planning and collaborative replenishment.

An extended enterprise aligned closely with suppliers can produce a number of desirable outcomes for unconventional players: higher efficiency due to front-end coordination; improved availability of equipment and supplies to reduce nonproductive time, lowering costs to support high intensity of drilling for unconventionals; and additional value creation by adopting a continuous improvement philosophy. In all, an extended enterprise enables an unconventional gas producer to execute high volume performance at designed operational velocity.

Several materials and services required to support upstream gas drilling operations have long lead times and supply constraints. The supply chain for such activities should be designed to maximize just-in-time scheduling and delivery. This implies working with suppliers to move the supply chain to an actual demand-based (“pull”) planning and process model in lieu of a forecast-based (“push”) one. In reality, a push–pull boundary should exist; the target should be to move this boundary as far up the supply chain as prudently possible. Materials and services can be supplied to the boundary based on a forecast, but they should be pulled from the boundary to field operations using pull signals. Inventory of critical materials can be stocked at the push–pull boundary to buffer uncertainty of demand and supply.

To attain such efficient objectives, supporting supply chain processes must be redesigned in these areas:

- **Demand planning**: Share long- and medium-term estimates for materials and services with suppliers, enabling them to plan supply to the push–pull boundary.
- **Materials management**: Work with suppliers to allow them to control their inventory and logistics to meet short-term requirements.
- **Services scheduling**: Share short-term services requirements with suppliers and optimize deployment of crews to meet level loads.
- **Pull replenishment**: Order materials and services to well locations based on predetermined triggers and project progress.
- **Continuous improvement**: Measure and improve supply chain and supplier relationships on a continuous basis.

Supporting the collaborative pull-supply chain processes requires a synchronized and integrated operating model that redefines internal processes and augments the external processes and supplier collaboration mechanisms through the extended enterprise (see Exhibit 2). Within the organization, a redefined operating model should integrate and synchronize the internal capital planning and well

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**Exhibit 2**

*Unconventional Exploration and Production (E&P) Operating Model*

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Source: Booz & Company analysis
delivery processes with the external supply chain. Internal processes would focus on development from prognosis to tie-in, and external processes on enabling the execution of well delivery.

By implementing this approach, unconventional producers have realized significant cost reductions—as much as 12 percent in rig downtime (see Exhibit 3) and 4 percent in logistics costs.

3. Institute a robust performance management system.

A well-designed performance management system should focus on aligning processes across the entire supply chain. Key performance indicators (KPIs) should encourage cooperation between functions in the enterprise (functional integration) and across enterprises (partnering in the supply chain).

One of the obstacles to such an in-depth performance management system is that entities in the supply chain often have concerns about sharing confidential information. Setting up appropriate reward and gain-sharing supply agreements to encourage participation and ensure that benefits are shared appropriately with all stakeholders can alleviate this problem.

An important aspect of a lean supply chain for unconventionals is the contract with key suppliers. Supply strategies and agreements forged for conventional well development may require modification to reflect the operational requirements and performance metrics of a lean supply chain for unconventional plays. Using a category management approach to select appropriate supply strategies, suppliers, and supplier management frameworks can achieve a further reduction in total supply chain costs.

In our experience, sizable and relatively immediate benefits can be attained by putting these measures in place and deploying a lean supply chain in unconventional gas projects. For example, at one unconventional gas company, we found that non-value-added activities claimed 64 percent of the engineering team’s time. But with the three-step approach, the producer reduced non-value-added time to less than 20 percent. Project lead times dropped from 24 weeks to 17 weeks, and the company realized savings of $12 million over the lifetime of a field. In addition, through the use of category management to customize contract strategies, the total cost of key materials and services was reduced by 10 to 15 percent.

Exhibit 3
Reduction in Wait Time through Pull Replenishment

Source: Booz & Company analysis
Going Lean

Recently, a large independent oil and gas company expanded its business model to include unconventional plays. This portfolio shift significantly increased the producer’s development spending and consequently the negative economic impact of various choke points. This translated into expensive bottlenecks that slowed down both internal well development and purchasing processes, problems that were not apparent until the client ramped up its unconventional strategy. The client also encountered bottlenecks caused by external supplier constraints. Delays in engineering, construction, and project completion resulted in large budget overruns due to the relative scale and layers of producer/supplier dependence present in an unconventional play. The client’s traditional operating model was too rigid to respond to these challenges.

Consequently, the company chose to redesign its supply chain to make it more appropriate for the unconventional business. The transformed supply chain coordinated internal and external operations with improved synchronization between supplier activity and internal demand, thereby limiting the impact of demand variability and reducing cycle time.

These steps were taken:

- A well delivery process based on the “E&P Factory” concept was formulated, and well designs and equipment were standardized utilizing the smart customization approach.

- An operating model was developed and implemented to integrate internal processes with external suppliers.
  - The new planning process enabled the operator to use services and materials forecasting to help suppliers plan crew capacity and materials deliveries to meet schedule requirements.
  - An effective materials management process was instituted. Classifying materials into various categories depending on spend, lead time, and frequency of use highlighted the need for different stocking strategies. For example, expensive materials with long lead times but infrequent demand were determined to be supplier owned and managed. Costly items with shorter lead times and frequent demand, by contrast, were placed on a direct delivery route from supplier to the required location.
  - Services requirements were level loaded to improve supplier crew utilization and drive lower supply chain costs.
  - A comprehensive supplier collaboration and management framework was designed to streamline the various supply chain interfaces.
• Supply strategies and supplier performance management standards were developed to meet unconventional asset requirements based on total cost of ownership.
  – Supply contracts were based on a fair return pricing approach.
  – A set of KPIs was put in place to evaluate performance and drive continuous improvement across the supply chain.

The redesigned supply chain produced these immediate results:

• Redesigning well development and execution processes enabled a reduction in well exploration costs of as much as 5 percent (including materials cost reductions of 2 to 3 percent).

• Through improvement of supplier collaboration and institution of pull replenishment, rig downtime costs were reduced by 12 percent.

• Level loading of services requirements and reducing contractor downtime through better coordination generated an 8 percent reduction in cost of services and improved supplier crew and fleet utilization.

• By integrating field processes with suppliers, the client achieved a 30 percent project cycle time reduction.

• Standardization levels of 70 percent were achieved by leveraging similar well designs, and inventory levels dropped by 30 to 40 percent.

• New supply contracts reduced costs by as much as 15 percent and reduced exposure to spot market pricing for materials and services.
CONCLUSION

The long-term growth projections for energy consumption are sufficiently robust to support a continued upsurge in unconventional gas production. But to ensure that production is economically feasible, companies must take steps to make their supply chains lean and efficient. Such advantageous supply chain management approaches will allow participating players at the low end of the industry supply curve to succeed by focusing on efficient extraction of resources, a must in this era of volatile energy prices.

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