New conventions for unconventional oil and gas series:
Optimizing the play to improve returns

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Advancing performance
Once a company has applied investment and operations planning, it can focus on improving financial and operational performance. The ultimate goal is to increase return on capital employed. That goal is driven primarily by three factors:

- **Capital cost**
  Labor, equipment and materials

- **Completion schedule**
  The amount of time needed to complete the project and turn it over to operations

- **Asset revenue**
  The product, price, and rate of production
In this issue of the series, *New Conventions for Unconventional Oil and Gas*, PwC is charting rapidly evolving management practices that address the speed and complexity inherent in developing tens of thousands of unconventional wells across the shale basins of the lower 48 states. In the first installment, *Reducing the drag to achieve speed and efficiency*, we detailed an integrated planning approach that aligns functions and resources around a common set of processes across the production life cycle. This integrated planning approach helps companies eliminate the broken hand-offs between functions that drag down drilling and production programs. Reducing the drag also helps companies increase return on capital by improving asset utilization, reducing cycle times, and eliminating waste. Through a clear link between strategy and execution, land, drilling and production operations become more consistent and predictable across the basin.

Once the integrated planning model is in place, companies can focus on optimizing the play: how organizations are tackling operating expense, capital investment, and resources across the entire development and production portfolio. The optimization process has three broad steps:

1. **Balancing supply and demand**
2. **Advancing performance**
3. **Finding the efficient frontier**

### Balancing supply and demand

Given the rapid rates of production decline typical in shale development, effectively and efficiently balancing supply and demand links an organization’s capabilities, capacity and extended supply chain to the requirements of field work execution. Balancing supply and demand also provides significant competitive advantage. In shale development we refer to this balance as manufactured drilling, which is increasingly on the radar of shale basin operators. Specifically, manufactured drilling balances the forecast demand for resources (for example, labor, equipment, rentals, and materials) with the constraints in the organization and its supply chain to ensure that the right resources are in the right place at the right time.

### Drilling down into manufactured drilling

In manufacturing, the process of balancing supply and demand is known as sales and operations planning (S&OP). The goal is to align resources and activities so the company can optimize profits, while effectively managing supply and demand constraints and fluctuations to ensure the right product is delivered to the right location at the right time with the right information and resources. In traditional manufacturing, end producers work collaboratively with their supplier base to align processes and standards to develop what the industry refers to as a “horizontally integrated supply chain.” Through timely and accurate information flows, demand data passes through the horizontally integrated supply chain of
Changes in demand, or delivery, are quickly identified, and revised “signals” move up and down so the system can adjust.

companies and then the right amount of products and services passes back down (Figure 1). Changes in demand, or delivery, are quickly identified, and revised “signals” move up and down so the system can adjust. Enabled by enterprise technology, the process is anchored on standard processes and information.

Figure 1: Illustration of a horizontally integrated supply chain

Although shale basin development and production is certainly not manufacturing, the development of each well shares a key manufacturing characteristic, a general process that repeats tens of thousands of times. That repeatability lies at the heart of applying S&OP concepts and processes to shale. But shale development has four significant, non-manufacturing characteristics that should be addressed in order to realize the benefits of an efficient, horizontally integrated supply chain.

1. **Shale development is not a sales-driven or “pull” process where funding and resources are used to meet sales goals.** It is a “push” process that is driven by capital investment and depends primarily on the availability of land access and capital funding.

2. **Land, drilling and completions, and production operations can vary significantly from well to well.** In addition, the actual work scope of each well entails uncertainty. Changes from plan are inevitable and must be addressed quickly.

3. **Shale development has very different constraints than does manufacturing.** From permitting, lease terms and land boundaries, to geology, geography and infrastructure (for example, power, roads, water, and pipelines), to the availability and quality of mobile resources (for example, people, equipment, tools, and supplies), a wide array of constraints can hamper a company’s ability to balance shale development supply and demand.

4. **At the basin level, operators manage a hybrid model that combines continuous processing (producing wells which still require project attention) and discrete manufacturing (new well drilling).** These continuous and discrete processes rely on a single pool of funding and resources.
Applying the S&OP model has proven to reduce cycle times and costs in shale development. To achieve these benefits, however, companies should transform S&OP into investment and operations planning, or I&OP. Next, we turn to how this transformation occurs.

**Push versus pull**

Instead of sales driving demand, shale development demand signals come from capital funding, land acquisition and access, and production projections. This difference has two implications. First, capital planning, land activity planning, and evaluations must be tightly integrated with drilling plans and updated dynamically on a continuous basis to identify and address changes. Second, activity planning for land, drilling and completions must be made with standard models. In traditional manufacturing, the bill of materials defines the resources. In oil and gas, companies need to define the bill of resources for a well (for example, people, equipment and materials). With a defined bill of resources and activity cycle times, a standardized structure can be used to define supply chain requirements and generate accurate and timely demand signals.

**Variability and uncertainty**

From well to well and project to project, drilling programs and capital projects experience high degrees of variability. To effectively manage the variability, operators should deploy three project management fundamentals. First, the organization should apply risk profiles and robust risk management processes to all investments. Second, businesses should quantify risk and determine levels of cost and schedule contingencies needed to deliver the project within the risk tolerance of the organization. Finally, robust change management helps in quickly identifying plan changes and their impact on cost, schedule and resources. With that knowledge, companies can determine how to manage the variation.

**Managing constraints**

All drilling programs and capital projects activities have dependencies, both internal and external. For example, one activity can not start until another either starts or is completed. If the labor, material and equipment are not available in the right place at the right time, work on an activity grinds to a halt. Integrated planning identifies these constraints and builds them into the plan. Activities should be linked to their resource requirements both within the project and to other functions and stakeholders within and outside the company.

**Hybrid production**

In shale development at the basin level, regional or asset teams should manage a discrete manufacturing business (drilling and completions) and a continuous business process (production operations) in parallel. To do so requires a common business infrastructure platform and pool of resources. Integrated planning extends beyond land, drilling and completions and includes the activities and resources of production operations. Each function has its own cadence and drivers. However, with integrated planning, a basin level view of all activity provides insight into capacity and performance in order to tightly link strategy and execution.
Advancing performance

Once a company has applied I&OP, it can focus on improving financial and operational performance. The ultimate goal is to increase return on capital employed. That goal is driven primarily by three factors:

- **Capital cost**—labor, equipment and materials
- **Completion schedule**—the amount of time needed to complete the project and turn it over to operations
- **Asset revenue**—the product, price, and rate of production

With a clear and forward-looking view into all plans and activities, an organization can reduce its costs by becoming more strategic in its sourcing and more efficient in deploying labor and equipment. As is the case in traditional manufacturing, an accurate and consolidated view of demand can create closer, more cost effective relationships with suppliers. Knowing in advance what will be needed along with demand changes gives suppliers a predictable view that allows them to be more efficient and share the resulting cost savings with their customers.

Better utilization of labor and equipment can contain costs even more. With a clearer view into resource needs, companies should no longer outfit every crew with every piece of equipment or material it might ever need. Equipment and materials can be held in centralized locations and provided to the field just-in-time. The key is being able to do this consistently and accurately so the field trusts the supply chain’s ability to meet their requirements every time whether it is planned work or when a critical breakdown occurs. The impact of eliminating material and equipment duplication can be profound. Historically, we have found that the costs of that duplication can inflate inventory costs 20 percent or more.

Labor utilization can also become much more efficient through consolidated demand planning. Knowing the composition of crews and when they will be needed significantly reduces downtime and improves productivity and cost efficiency. In addition, because processes are standardized across assets, operators can respond quickly to changes, projects require less senior expertise, and crews can attend to a greater range of assets.

In our experience working across industries, demand consolidation and the planning and deployment of resources can reduce costs 20 to 30 percent and cycle times can be reduced by equal amounts. For shale development, reducing time to first oil by 30 percent creates significant competitive advantage.
Finding the efficient frontier

The efficient frontier provides a systematic, bird’s-eye-view of the information needed to optimize the investment portfolio, which projects fit, which don’t and why. Oil and gas companies should make these decisions in the face of uncertainty, project interdependencies, and changing economic environments. In the shale basin, investment decisions center on three key issues: which well to drill; what facility, pipeline or road to construct; and what maintenance activities to perform.

Portfolio optimization requires calculating each investment’s potential value. Valuation models should include quantitative inputs of financial performance such as production expectations, development and operating costs and the net present value of cash flows. But in shale development, two types of risk valuation should also be added to the equation:

**Reserve risks:** With shale, the extent and makeup of ground reserves are uncertain. The rate of decline from one well to the next is also difficult to predict. Probabilistic modeling can account for these risks which can have considerable impact on value and the assumptions used to calculate it.

**Commodity price risk:** As liquids and gas prices swing, the fluctuations can guide decisions about “sweet spots” and where to prioritize investments in light of market forecasts. Unlike reserve risks, which are independent from site to site, commodity price risks affect the entire shale investment portfolio. As a result, they call for additional attention and portfolio stress-testing.

Valuation can also include more than hard financial and performance metrics and assess less tangible factors (for example, safety) that should be considered in making investment decisions. A number of strategic issues that are difficult to quantify come into play and are just as critical. These can include public perception, brand reputation, regulatory compliance, and environmental impact and safety.

Although these are non-standard measures of value, they can be calculated. For example, a project’s safety risk can measure how many workers are exposed, and the potential impact of that exposure in each incident. Including the steps and costs needed to mitigate these risks captures their full impact.

Creating an optimal portfolio should also take operational constraints into consideration, including those related to people, tools, equipment, and infrastructure. The rate of well completions and subsequent production depend on the availability of resources and infrastructure. These dependencies should be factored in. With the I&OP approach, they can be dynamically linked to integrated activity planning and reflect the resource constraints in the valuation.

With a holistic view into the value of any mix of potential investments, management can step back and take a portfolio view of opportunities: of all the projects that can be undertaken, which set drives the best return on the investment and what should the level of investment be to maximize the returns? In addition, a portfolio view allows a company to stress-test its options under different scenarios. For example, if a company must reduce its budget or commodity prices drop, it can decide which projects should be eliminated or downgraded.
As illustrated in the chart below (Figure 2), each portfolio scenario produces an expected value at an expected cost. By picking the right projects, a company can generate the maximum value for a given budget constraint. This approach allows companies to identify both the level of investment and the mix of investments that produce the maximum value. For shale development, each point on the chart below would represent a different mix of capital investments including wells, roads, gathering lines, process and storage facilities, as well as water and power supply.

**Figure 2: Creating an efficient frontier**

![Efficient Frontier Chart]

The portfolio on this line (the “efficient frontier”) creates the maximum possible value for any given budget level (horizontal axis). The goal is to select a portfolio on the efficient frontier.

The current portfolio line is an inefficient allocation of the resources. More value can be generated for the same budget level by selecting different projects (and move up the arrow).

Each point represents a different funding scenario (i.e.; a different portfolio).

**Leveraging technology**

Technology solutions can help align long-term strategies, financial plans and forecasts with proposed and on-going projects through the development of an integrated financial planning model. Creating tight financial linkages through an integrated model provides a centralized planning view with accurate and timely financial forecasts.

Currently, leading companies, such as Oracle, SAP and IBM, provide software solutions as part of their analytics and performance management product suites. These solutions can be integrated relatively easily into ERP and project management systems. They can also support driver-based planning frameworks, workflows and approval processes. In addition, these solutions can help prioritize and approve projects based on pre-defined key performance indicators and financial thresholds. Technology can also help engage stakeholders from different functions by providing a common view emanating from the same systems. Technology solutions can also reveal the impact of project changes on financial statements, which helps companies build multiple scenarios based on one set of clearly defined assumptions:
**Expense Plan:** With industry leading planning and forecasting solutions, companies can perform expense planning at the account level (rentals, shipping, travel, and depreciation) as well as the resource level (labor, equipment, and material). Both can be based on predefined drivers and used to analyze the impact of each category on a project. These solutions also support the allocation of organizational overhead to specific projects based on predefined attributes. Overall expenses can be consolidated at the project level and managers can examine the impact of each expense category over the entire portfolio. To help supplier negotiations, the solutions provide overall forecasts by category. All resource plans can be integrated with other systems used for procurement, workforce management, and capital planning/budgeting to provide insights into the availability and utilization of current resources and new assets coming on line—a key tool in preventing resource hoarding.

**Revenue Plan:** Leveraging technology, companies can create several revenue scenarios based on production expectations, commodity prices and exchange rates.

Once developed, the integrated financial planning model can be used to create income statements, balance sheets and cash flow forecasts. Companies can also create scenarios based on various assumptions about labor rates, commodity prices, exchange rates and interest rates. This ability allows project managers, area managers and other stakeholders to make informed decisions based on a common view of the facts provided by the I&OP approach.

It is important to point out that in a dynamic environment, where supply and demand must be constantly balanced, strong workflow integration is critical. With hybrid production, for example, companies need to integrate information management for both discrete and continuous activities. In terms of portfolio optimization, some major vendors include analytics models. But these may not fit a company’s needs. When they don’t, the business should consider building technology platforms that integrate their own, unique models. Designing a technology platform should account for software vendor’s native capabilities and how to integrate them into workflow, portfolio optimization models and dashboards.

**In summary**

Taking best practices from the manufacturing industry, this publication detailed how companies can balance supply and demand to facilitate getting the right resources in the right place at the right time. When they are aligned, oil and gas businesses can significantly reduce costs by becoming more strategic in their sourcing and more efficient in their deployment of labor and equipment. When operations and financial planning are efficient, oil and gas companies can confidently optimize their portfolio of investments by understanding which set of projects provides the best return on capital employed and what the level of investment should be. Technology lubricates the process by providing a common, centralized view of information and forecasts.

In the third and final installment of our new conventions for unconventional oil and gas series, we will focus on speed and agility—and how analytics drives them.
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