Materials management: A Gold Mine for Upstream Oil and Gas

Materials availability is vital in the O&G industry to prevent delays, even at the risk of higher costs. It is possible to manage materials without incurring delays or extra costs, or compromising availability.
The landscape for upstream oil and gas companies is shifting at an unprecedented pace. The production of conventional sources of oil and gas is relocating to more remote, more difficult, and more expensive parts of the globe, such as ultra-deepwater, and to the Arctic. This inevitably leads to higher project costs and higher risk on capital returns.

Oil price volatility has also reached new highs. Crude oil went from $17 per barrel in 2001 to $105 in February 2012, with downward swings as sharp as five times, from $145 to $30 in 2008.\(^1\) And wholesale gas has had its own ups and downs. In the United Kingdom, for example, day-ahead gas prices were 15 pence per therm in July 2009, 77 pence per therm a year later, below 30 pence per therm a year after that, and trading around 60 pence per therm in the beginning of 2012.\(^2\) On the continent, gas prices started decoupling from oil prices, creating uncertainty and negatively influencing both oil companies and their customers.

To preserve profitability in these challenging times, oil and gas companies must maintain operational efficiencies while minimizing risks. With this in mind, materials management is a hidden gold mine for many upstream companies—a wealth of value waiting to be discovered.

Where is the Mine?

Upstream companies have long pursued the latest strategies to improve profits. They renegotiated contracts with service companies, applied strategic sourcing to reduce equipment costs, and improved maintenance activities to reduce costs and turnaround times. And many firms have brushed up on their “operations specialist” skills in areas such as procurement and lean operations.\(^3\)

While safety stock is required to protect from unforeseen events, excessive stock can lead to missed opportunities.

Few companies, however, have spent time or effort on optimizing materials management. A primary focus has historically been on availability of materials for production or projects rather than costs. This trend was driven by risk aversion, lack of tracking systems, and complicated supply chains, with a variety of parties involved in both the operations of existing assets and the execution of capital projects. Making necessary materials available for production sites and projects is vital, as costs of a missed day of production or delay in the first oil date are significant. But there is also an opportunity to reduce the costs of running the assets or executing capital projects without compromising availability.

We define materials management as activities necessary to ensure that materials flow to exploration, development, and production sites. It is an end-to-end process that includes planning materials requirements, releasing purchase orders, providing transportation to the sites, storing materials and shipping them to operational sites when required, and, when necessary, disposing of unused or obsolete materials.

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\(^1\) U.S. Energy Information Administration, WTI Spot Price FOB

\(^2\) See wholesale gas prices at www.catalyst-commercial.co.uk.

Materials management for an upstream oil and gas company covers materials used in both the day-to-day running of production facilities and the construction of large capital projects. Although production and construction share the goal of ensuring that quality compliant materials are available when needed, each area has unique features and cost drivers (see figure 1).

How Big is the Lode?

There are three main areas in which companies can create value by improving materials management: logistics costs, waste, and capital tied up in stock.

Logistics costs are incurred to guarantee the flow of materials from suppliers to the development or production site along with storage and inspection costs. These costs typically represent up to 15 percent of total operating expenditures, and can be as high as 30 percent, depending on location of exploration, development, or operations. Average production costs for a major global oil and gas company are approximately $10 per barrel of oil equivalent (excluding taxes and royalties). A company producing a million barrels of oil equivalent per day will spend $3.5 billion per year, with logistics costs ranging from $175 million to $525 million. Cutting 10 percent of these costs can lead to as much as $50 million in savings—a significant

Figure 1

Materials management in upstream oil and gas

<table>
<thead>
<tr>
<th>Details</th>
<th>Projects (60% to 70% of spend)</th>
<th>Operations (30% to 40% of spend)</th>
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<tr>
<td></td>
<td>Large capital projects in remote areas with weak infrastructures that take three to four years to complete</td>
<td>Ongoing operations in remote areas that can last 30 to 40 years with supply infrastructure developed during project execution</td>
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<td></td>
<td>Difficult or costly to use excess materials from previous projects</td>
<td>Excess materials saved for future use</td>
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<td>Supply chain activities executed by multiple parties; EPC contractor often responsible for all work</td>
<td>Field operators lead execution</td>
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<th>Primary objective</th>
<th>Ensure that materials are high quality, available when needed, and adhere to safety standards</th>
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<td>Materials management roles</td>
<td>Coordinate the supply chain among many functions and third parties</td>
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<td>Manage surplus materials created by excess contingency and design changes</td>
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<td>Ensure the smooth handover of materials and spare parts to the operations team</td>
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<tr>
<td></td>
<td>Coordinate supplies among multiple assets</td>
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<td>Manage the variability of demand for materials</td>
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<td>Ensure the smooth running of the established supply chain</td>
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<th>Main cost factors</th>
<th>Waste of surplus materials</th>
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<td>Opportunity costs of capital tied up in inventory</td>
<td>Logistics</td>
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Note: EPC is engineering, procurement, and construction.
Source: A.T. Kearney analysis
amount, considering the difficulty in identifying new low-hanging fruit in the energy industry. One reason for higher logistics costs is poor utilization of the logistics network. To ensure availability of materials, logistics networks are designed to carry extra capacity, which often results in unnecessary and costly infrastructure.

Saving money on logistics is only the beginning. Greater savings still can be found in minimizing wasted materials, which on a micro level may seem insignificant, but taken as a whole can create huge savings. Oil and gas majors spend from $15 billion to $30 billion a year on capital projects, about 10 percent of which is contingency.

Excessive contingency provision applied by engineering and procurement as well as changes in design of the asset along the project life cycle result in high levels of surplus materials. Of that 10 percent of contingency materials, up to half ends up as surplus stock, discarded scrap, and spares. Most of the loss is because of obsolescence, poor cross-project cooperation, insufficient system integration, and improper handover from project status to operations. This waste can lead to annual losses of up to $1 billion—enough to fund significant development projects. In other words, this is “easy extra money.”

Finally, while safety stock is required to protect from unforeseen events, excessive stock leads to missed opportunities. Focusing only on availability of materials can lead to excess purchasing, creating buildup and increasing cost of capital. Reducing material storage time in capital projects can free up as much as $2.5 billion. In operations, material stock held by the upstream divisions of oil and gas companies varies from $1 billion to $2 billion, so a 10 percent reduction can release as much as $200 million, significantly reducing cost of capital. Eliminating excess stock also reduces direct charges and ullages.

While most industry players are determined to reduce their maintenance materials, few even consider curbing their project and drilling materials or managing them more efficiently, even though these costs are significantly higher than those of maintenance materials. In these categories, value disappears daily and the effects are palpable; in our visits to development and production sites we find huge warehouses filled with unused materials (see sidebar: Material Inefficiency).

But disappearing value does not have to be the norm. A comprehensive materials management strategy aligned across operations and projects in the company’s portfolio could save companies billions of dollars a year.

Material Inefficiency

The causes of surplus materials are partly historical—the result of an industry wide risk-averse mindset, a lack of tracking costs or key performance indicators, acquisitions without fully integrating systems and processes, and numerous projects with different joint-venture ownership structures. One or more of these often led to the same yard or warehouse having several different project inventories.

There is also an industry philosophy of having excess material available rather than risk delays in projects or the start of production. This philosophy is certainly understandable, as materials and components for oil and gas production usually have long lead times and often need to reach remote areas. Delay or production stoppages can significantly affect the economics of a project or production unit.

Much on-site material is for drilling and completion, particularly tubular products and wellheads. In many cases, especially on production sites, even larger amounts of materials are left over from the project phase. While surplus materials are often necessary to prevent delays, having excess materials can result in costly inefficiencies.
Seven Rules to Mine the Gold

In the upstream oil and gas industry, where some companies have hundreds of locations and tens of thousands of people, getting everyone focused on the same vision and goals can be challenging. Based on our experience in improving industry value chains and managing complexity we have identified seven rules to help companies improve performance and capture value in materials management. Each rule alone is powerful; together, they provide both the direction and momentum needed to deliver sustainable change and extract the value.

Logistics networks are designed to carry extra capacity, which often results in unnecessary infrastructure and higher costs.

Materials management challenges faced on projects can differ from those of production asset operators (see sidebar: Materials Management in Capital Projects). The first four rules, however, work across both worlds to build a solid foundation for management of materials:

Materials Management in Capital Projects

Materials management in capital projects has a number of features that make the process different from that for operations:

- The objective of materials management on a project is to deliver materials necessary to complete a specific scope of work, not the continual stream of materials required to support day-to-day operations. Therefore, materials not used on the project (for example as a result of excessive contingency) cannot be used in future periods and need to be either scrapped or re_allocated to other projects, resulting in a significant loss of value. Also, most of the tools developed for operations—including economic order quantity, and optimum safety stock levels—are not directly applicable to project settings.

- Projects are often executed in remote locations with undeveloped logistical infrastructure, complicated supply routes, multiple cross-border transfers, and a variety of customs regimes such as temporary exports.

- A significant number of parties are involved in execution of materials management on projects, including operators, EPC and EPMS contractors, fabricators, freight forwarding companies, and others. Comprehensive materials management strategy, harmonized standards, and timely and accurate exchange of information are critical to the success of the project.

- Long lead times for materials and equipment combined with a desire to speed project completion often result in orders being placed before the design is complete and exact specifications are known. Balancing potential waste of materials because of engineering changes with the time it takes to deliver materials is a strategic trade-off during projects.

- Handover of materials, equipment, and supporting documentation to operations teams is essential to ensure maximum use of materials and successful running of assets after commissioning.

Best-in-class materials management by an oil and gas company should address specifics of large capital projects. Early involvement of materials management groups in project planning and execution, careful mapping of the supply chain, establishment of communications systems among all parties, excellent execution, and handover of materials to the operations teams ensures that projects can be delivered faster and at lower cost, with improved quality and safety.
1. **Adopt a comprehensive value chain approach.** The best approach to materials management is one that consistently addresses the entire value chain, with coordinated practices across all projects, production assets, and stages of the materials management process. This stands in direct opposition to the fragmented approach taken by most upstream companies. The goal of this step is assessing and improving not only your own value chain but also those of your suppliers. You can achieve this by considering all costs along the entire value chain rather than focusing only on purchasing, transportation, or warehousing. This step also requires a specific contracting strategy. One oil and gas company reduced logistics costs by 5 percent simply by adjusting an agreement with its main supplier of tubular materials.

2. **Reduce complexity in what you buy.** Standardizing and codifying assets can significantly reduce complexity in materials management. Commonality among assets is a prerequisite for cross-site utilization, which is essential to best-practice integrated management and optimization of the value chain. By applying this rule, our client cut roughly $20 billion in expenditures by more than 20 percent. Streamlining purchases—by standardizing equipment, processes, and spare parts—is also a good way to cut costs.

3. **Ensure proper tracking and visibility.** A comprehensive value chain approach to materials management requires consistent, up-to-date information on the status and location of all available materials across all projects and production sites. Proper tracking and visibility requires capable information technology along with the correct systems and equipment for product tagging and picking. Workers must make the most of these systems to allocate materials efficiently, ensuring that surplus material from one project can be used in other projects; one production site might benefit from the materials in another’s warehouse. Even when such synergies are identified, there is often what we call a vortex—a barrier caused by limited transparency and poor tracking of order status, location, and availability across the company (see sidebar: Avoid the Vortex).

Fortunately, all factors that create a vortex can be addressed, and upstream companies are increasingly more focused on these factors to increase competitiveness. Indeed, we recently helped an upstream firm improve its tracking and visibility, which helped eliminate obsolete materials and put the company on track to reduce stock by up to 15 percent.

**Avoid the Vortex**

Wrong processes, siloed organizations, and inadequate systems are inherent challenges for oil and gas companies as responsibilities for materials management activities are often spread among different departments. This usually results in a barrier—or vortex—in which companies are unable to track surplus materials across the supply chain, from procurement to transportation to warehouse inventory.

For example, technical units are generally responsible for planning material requirements, but rarely focus on minimizing inventory. Their job is to make sure they have the latest technology available in quantities that ensure continual production. The procurement organization is responsible for releasing purchase orders and selecting suppliers that meet technical specifications at the lowest cost. And at the end of the process, once materials are delivered to the warehouse, management becomes the responsibility of those in charge of storage and preservation. Warehouse crews may have inventory-level objectives, but they have no control over the earlier stages in the process.

Eventually, the possibility for real optimization in materials management is limited until materials are considered early in the project and built into the management philosophy. Unless this philosophy changes, the vortex remains a dangerous place to be.
4. Establish a performance management system. Generally, what gets measured gets managed in upstream companies, so performance measurement is essential for materials management. Establishing the right key performance indicators (KPIs) linked to overarching goals is integral to decision making. A large oil and gas company introduced performance management into its materials logistics process and reduced logistics costs by 10 percent and inventory by 15 percent.

Handovers are critical, ensuring the smooth transition from the build phase of a project, through hookup and commissioning, to a flawless startup. Rules five through seven are more specific and can apply to projects or operations, or both.

5. Develop a strategy during the early stages of design. Materials management groups must be involved in project planning and execution at a very early stage. Best practice calls for designing a strategy that covers planning of the supply chain, establishing communication requirements for all parties, and developing a policy for managing contingency and handover requirements. Such a strategy will help minimize excess contingency, speed project delivery, and improve quality and safety (see figure 2).

Figure 2
Involve materials management on capital projects from start to finish

- Get involved early in the planning process to develop efficient supply chain strategy
- Develop automated interfaces among all parties involved in supply chain
- Assess demand for materials regularly against what is available in the warehouse and in the supply chain
- Ensure that appropriate actions are taken to minimize the impact of surplus materials
- Transfer materials, spare parts, and documentation efficiently and transparently to operations team

Steps specific to a project
Steps similar to those in operations

Source: A.T. Kearney analysis
6. Ensure smooth handover of materials from project to operations. Handovers are critical because they create a smooth transition from the build phase of a project, through hookup and commissioning, to a flawless startup. They are also crucial in materials management, where too often companies rely on an engineering, procurement, and construction (EPC) contractor to provide spares for both commissioning and the early years of operation. The handover of materials from project to operations must be a key element of operations readiness and assurance activities. If the handover is not managed thoroughly, with clear and seamless communication of requirements, the quantities and documentation required can become chaotic.

7. Develop an operations phase supply chain that addresses specific demand characteristics. When setting up the supply chain for an operating site, always categorize materials according to key demand characteristics and then optimize the supply chain based on the output of that analysis (see figure 3 on page 9). Every item (material) is assessed across defined parameters, such as whether the item is a planned or ad hoc purchase, standard or bespoke; cost; commonality; and how critical it is to operations. After the assessment, materials are categorized by characteristics and then specific supply chain procedures are developed to manage each category efficiently. For example, standard non-critical items used by all projects may be stocked in a central warehouse and delivered to the projects as needed, but bespoke critical items might be manufactured in advance and stored on site to ensure uninterrupted production.

Framework for Improvement

A.T. Kearney has developed a framework to illustrate the different levels of materials management performance (see figure 4 on page 9).

Firefighter. Companies at the firefighter stage are passive in their approach to materials management, usually reacting to “fires” rather than coordinating and controlling requests to reduce costs and risks.

Controller. At the controller stage, companies maintain some active engagement in materials management but primarily focus on ensuring availability of materials. Controllers give little attention to the cost side of materials management.

Innovator. Innovators optimize key elements of the value chain, but they are not yet at the stage in which materials management is coordinated globally.

World class. Companies considered world-class performers have an integrated vision of materials management that encompasses all relevant sites, projects, departments, and countries. At this point, an optimal value chain is a day-to-day reality.

This framework is useful for understanding where your company is today and how to achieve excellence in materials management tomorrow. It also serves as a guide to developing materials management in line with industry best practices.
Figure 3

Categorize materials based on their demand characteristics

Illustrative

Planned — Reactive
Standard — Specialized
Low cost per unit — High cost per unit
Critical — Non-critical
Common across all assets — Unique to an asset

Casing
Replacement part on subsea tree

Source: A.T. Kearney analysis

Figure 4

Four stages in materials management performance

Breakthrough performance

World class

Fireshapeer
Controller
Innovator

Takes a passive approach—simply reacting to requests from production or engineering
Focuses primarily on costs, with little attention to service
Develops key elements of the value chain, but still without global coordination
Creates an integrated vision of materials management, with an optimal, fully developed supply chain

Source: A.T. Kearney analysis
An Emerging Competitive Field

The oil and gas industry is constantly seeking ways to improve efficiency, reduce costs, and minimize risks. While many upstream companies have neglected materials management in the past, the potential for future savings without major investments is becoming difficult to ignore.

By prioritizing materials management, first movers are poised for advantage. A select few have launched structured projects to address the issue. In a few years, this subject will be a top priority in the industry as best-in-class materials management can reduce costs of operations and capital projects, and shorten lead times.

Past failures have stemmed mainly from the cross-functional, cross-boundary nature of the processes, in organizations where people did not share goals, or, even worse, had conflicting goals. Already many other industries, such as automotive, construction, and consumer goods have substantially improved long-term profits by optimizing materials management in both operations and projects. It is time for oil and gas to follow their path. With commitment of company leadership, the hidden “gold” of materials management can finally be discovered.

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