

# Digital Technologies

The guiding force in NOC transformation



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The dramatic drop in oil prices sent a shockwave through the industry that is still being felt almost four years later. The repercussions were particularly severe for National Oil Companies (NOCs) and the hydrocarbon-driven economies that rely on them. These state-owned oil and gas producers serve as the cash-generation engines that provide substantial funding for everything from government budgets and economic development initiatives to social welfare programs and subsidy support.

And although the sector has not yet fully stabilized, oil and gas companies are coming to grips with a new business paradigm characterized by single-digit demand growth. This slower growth is largely driven by changing global consumption patterns – specifically, the increased use of alternative forms of energy – and improvements in energy efficiency. Oil and gas will remain a major part of the global energy mix for the foreseeable future but, if NOCs are to keep providing the much-needed financial support to their home countries, they will have to change fundamentally how they operate.

## From volume to value

Prior to 2015, volumes and budgets were the main metrics that NOCs focused on – how much oil and gas they were producing and how they could maximize that production. In today's environment of constrained capital and changing demand patterns, the focus must shift to value – conducting operations with an eye toward driving efficiency and maximizing returns on their invested capital. This means that NOCs can no longer be evaluated solely on production volume but, rather, on efficient production volume. This will require NOCs to allocate capital to projects that promise the highest returns and to assets that operate at the highest efficiency.

The transition will also require NOCs to adopt more transparent and commercially focused operating models – the same type of models that publicly traded IOCs have honed for decades. Many NOCs are moving in this direction already, to varying degrees. Saudi Aramco's recent decision to IPO represents a major shift, and other large NOCs like Brazil's Petrobras, Mexico's PEMEX and China's CNPC are making substantial steps in this direction as well.

To navigate the transition successfully, NOCs will have to change their financial structure and expand their business relationships to include not only their governments but also investors on an international stage. Although they might have operated purely as cost centers in the past, NOCs now must function as profit centers and, as such, they have to justify their business decisions to investors and other shareholders. They have to take a more robust and disciplined approach to allocating capital to the highest-return projects, and they need to operate these projects so that margins and capital efficiency are both maximized, which will help position them for long-term growth.



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## Leveraging digital technologies for a smooth transition

For many NOCs, successfully navigating the shift to a commercial mindset and maximizing returns on investment means embracing the right enabling technologies – digital technologies, in particular.

If leveraged correctly, digital technology is the great equalizer that puts companies on a level playing field. NOCs already have an advantage over many IOCs in terms of the vast reserves they hold. But, by leveraging digital technologies like the internet of things (IoT), AI and the cloud, NOCs can use these reserves to greater effect. They can improve recovery, reduce the cost of extraction through automation, accelerate strategic decision making, and control and manage assets from anywhere in the world – all of which will help place NOCs on an equal commercial footing with the IOCs. In fact, some NOCs are already successfully implementing digital technologies in various ways to achieve this.

But, it is not a question of deploying technology for technology's sake. Transitioning to a new operating state requires NOCs to assess the current state of their digital technology systems and, then, where these systems need to be improved to reach desired business goals.

This requires companies to start by defining the set of outcomes that the company will track to ensure that they are hitting their business targets. The outcomes, which include common metrics like return on assets, earnings per share and operating margins, provide clarity on the type of data needed. Collecting these data sets requires the right combination of enabling technologies – digital systems that ensure that the right data is captured, the right data is analyzed to measure performance, and the right data is used to deliver the outcomes that the business wants to achieve.

If you were the CEO of an NOC leading your organization through this transition, how could you best leverage digital technologies to ensure a smooth transition from volume to value? Fundamentally, you would use digital to sharpen your view of the business through two different lenses – the physical and the financial.

The physical lens focuses on the real-time flow of your physical asset – hydrocarbons – through various parts of your business: from the reservoir to the wellhead, from the refinery to the retail gas station. But, currently, the

view is hindered, if not outright obstructed, by the real or virtual silos and barriers put up between business units and through out the supply chain. These barriers segment both the flow of hydrocarbons, and the various datasets recorded on this flow, many times. They also create a significant amount of data error that makes accurate business forecasting near impossible – or approximate at best.

Digital-enabled data transfer breaks down these silos to provide a seamless view of hydrocarbon flow, open and transparent knowledge sharing, and a clear picture of which units are running efficiently or falling behind. This physical representation of the value chain is represented by operating technology.

The second lens – financial – provides an accurate view of costs, market prices, and other valuation information. By overlaying financial metrics on top of the physical view, one can track earnings, costs, and value gained or lost at each step of the asset value chain. This financial overlay on the physical value chain is represented by information technology.

The true power of digital technology lies in that “sweet spot” where the operating technology and information technology meet. Getting these technology classes to work seamlessly together requires the right infrastructure – one that tracks both physical volumes and the financial value of those volumes at each step of the process. It should be structured to mimic the real-world operating technology environment and with robust cyber-security measures in place to ensure reliable and secure operation.

With the two overlays of the business fully developed, focus shifts to deciding which type of analytics makes sense at any given point in the value chain. The digital technology platform must support analytics that answer some fundamental questions:

- ▶ What kind of analytics will have to be performed to better understand and optimize various parts of the business? For example, machine learning to optimize operations.
- ▶ What kind of performance will be required from the operating environment to deliver the desired financial and performance objectives?
- ▶ Which processes should be changed or optimized to drive greater returns?



A properly implemented digital technology infrastructure can give NOCs a significant performance edge across the asset chain and help set them up for long-term growth. Several examples of how digital can improve NOC asset performance are presented below.

## Improving capital project performance

The industry as a whole has a spotty track record when it comes to capital discipline and megaproject delivery. An EY study of the performance of 365 oil and gas megaprojects (projects with a proposed capital investment of US\$1 billion) around the world found that 64% faced cost overruns and 73% reported schedule delays. These overruns typically end up costing the operator many millions of dollars over the original budgeted estimate.

Digital technologies can bring greater discipline to the planning and budgeting process, allowing NOCs to maximize their returns on invested capital and develop a project portfolio that is continuously geared to yield the highest returns.

Allocating capital for projects is often complicated by the unforeseen challenges and setbacks that arise during construction, start-up and routine operations. These complications often must be addressed on the fly, which adds cost and time to the project and may lead to budget overruns.

Companies are beginning to consider new ways to plan for these challenges and complications, by using digital technologies to improve capital project performance. Several specific areas where digital can increase commercial acumen are described below.

**Engineering visualization technology.** To facilitate greater efficiency and less rework in design, digital solutions can be used to build virtual prototypes of the capital project. A digital prototype of a plant or refinery can help the owner improve estimating, to reduce capital spend and arrive at an optimal design, well before the first shovel goes in the ground.

**Machine learning technology.** To enhance accuracy during planning and speed of execution, sophisticated software platforms can also be designed to manage and track project performance. Such technology can also help reduce siloed working and wasted effort, thus helping oil and gas companies bridge the productivity gap that exists versus other asset-intensive industries.

**Digitizing the workforce.** Companies can leverage advances in robotics and AI to increase productivity and enhance capability. A significant volume of back office work in accounting, finance, supply chain and HR could be done by software systems to lower invoicing and payroll processing costs, minimize data-entry errors, improve security by reducing personnel access to sensitive data, and retain process knowledge that traditionally resided in the brains of a select few individuals.

Although these ideas are still largely in development, EY can safely predict that companies will soon be able to develop workflows that run any number of operating scenarios in the virtual plant, including performing stress tests and optimization studies. Such studies will provide a more accurate picture of the project's actual costs and help identify construction or operational problems that can be designed out or worked around. The upshot: owners spend less time and money to develop a project that functions as intended, the first time.

## Automating R&D

Digital technologies will also help NOCs streamline their research and development (R&D) functions by providing virtual assistance to engineers and scientists who are stretched too thin or lack resources. Most importantly, digital initiatives can help researchers more accurately simulate the effect that a new process or technology solution will have on the value chain, and where it stands to drive the greatest monetization opportunities.

EY investigated the feasibility of creating a virtual R&D department for the chief scientist of a major chemical company. Our research showed that by leveraging artificial intelligence and learning models like those used by IBM's Watson, the company could automate large parts of its R&D process, making research functions faster, smarter, more efficient and mobile.

A scientist working out of a centralized research facility could use such a system to direct virtual R&D projects for any business unit in any operating region or time zone, right from his or her own desktop computer.

## Improving logistics and trading capabilities

Transportation is a critical part of any oil company's business, particularly when one realizes that, by some industry estimates, roughly 60% of all hydrocarbons are consumed in a country other than where they originated.

A wealth of data exists on logistics-related parameters – everything from weather reports and shipping information to routing paths and freight rates. Using neural networks and predictive models, NOCs can collect and analyze all these data sets to more precisely understand the ETAs of ships and predict how long a particular port takes to turn around a ship. This information can be used to drive efficiencies that shorten the cycle time and get ships in and out of ports much more quickly.

Predictive analytics can also improve the trading process by providing greater connection between manufacturing and the commercial or retail side of the business. Such analytics provides a greater understanding of the forward curve, the difference between crude prices, and how the company should hedge. Although not many NOCs are fully implementing digital in their trading, they should seriously consider adding this functionality.

## Supply and demand forecasting

Major oil exporting countries produce different crude slates and announce monthly prices for their crude exports. In response to these variable prices, demand from spot buyers from an exporting country can vary significantly. In addition, even small adjustments to prices can have a significant impact on overall revenues. For example, earning 50 cents more per barrel on 1 million barrels of exports per day can increase an NOC's profitability by US\$200 million per annum. Furthermore, by altering the crude oil production slate based on forecasted demand, the NOC remains more competitive.

With ever-lowering computing costs and increased access to data, a robust demand and supply model can be built with a minimal investment that can be recouped quickly. Such a model can also help the NOC develop its own blend of crude (by mixing crude oil from other countries) that will suit the specifications of refineries while also allowing the NOC to command higher prices for its products.

Many NOCs also have large downstream operations that produce various refined products. Estimating demand for different types of fuel, both in domestic and exports markets, can help the NOC optimize the product mix generated by its refineries, and, thereby, maximize refining margins.

## Reducing losses from oil theft

Many oil companies lose significant revenue to theft, with operators in Nigeria reporting some of the highest losses. However, the phenomenon is widely prevalent, with reports of theft in Mexico, China and, more recently, Singapore. Digitalization can play a significant role in reducing theft. Installation of a sensor network across major pipelines can be both complex and expensive, but the use of sensors in refineries, fuel depots and retail stations helps ensure that companies can quickly identify sources of loss in inventory and take corrective action.

## Finding new value in a changing retail space

As NOCs migrate more toward specialization and building true upstream or downstream companies, they must also consider the additional profit to be made by providing value directly to the customer. As growth for fuels and fuel products slows down, the ability to grow depends requires the ability to attract and retain long term customers with differentiated products, solutions and services.

It is due to these underlying fundamentals of slower economic growth, combined with the obvious digital disruption that has captivated retail, that many Energy companies are re-looking at their customer and consumer strategies to find new and innovative pathways to growth. In many cases, this includes not just the retail offer. Innovation leaders in the Energy space are looking to other industries, including consumer products, petrochemicals and even agriculture – to understand how a “customer back” supply chain can create new opportunities for growth.

The retail space has undergone some dramatic changes over the past several years, and digital has played a major role in some of the most far-reaching, highest value changes. For example, Amazon recently initiated its Amazon Go retail concept, in which consumers go into the store, pick up what they need and simply walk out – without taking out their wallets and with no lines to wait in. Wireless technology detects when products leave the store, at which point a bank account on file is charged for the transaction.

Some oil and gas companies are adopting parts of this business model to improve the buying experience in their gas stations and convenience stores. As Shell installs more EV-charging stations at its gas stations, for example, it has also begun adding digital-enabled amenities that change the downstream retail shop experience. While their cars are charging up – a process that might take 30 minutes to nearly an hour – customers linger in the shop longer, buy

more goods and, ultimately, enjoy a shopping experience that is productive rather than a waste of time. In the future, such a model will not just be a differentiator, but a must-have for NOCs who want to stay competitive in the retail space.

### **Going commercial is the way to grow**

For any company operating in the oil and gas industry's post-downturn era, growth will be the focus, but it will be

hard to come by. For NOCs to grow, they must become more commercially savvy, and they must do so quickly and effectively.

By implementing digital technologies across their businesses, NOCs will be better positioned for growth on the global stage – the kind of growth that helps them adjust to changing crude margins while continuing to give back to their home economies.



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