Accelerating the oil and gas industry’s journey to the Industrial Internet
Introduction

For the asset-intensive oil and gas industry, the time is right to actively invest in the promise and potential of leveraging digital technology throughout the value chain. What is the end game? A more operationally efficient, cost-effective and adaptive industry designed to deliver value regardless of market conditions.
The oil and gas industry currently faces a set of challenges requiring it to make significant operational changes if it is to remain economically viable in this low-price environment. Asset utilization is one of the driving forces of revenue generation in the oil and gas industry and a key area for the sector’s transformation. Improving utilization rates offers significant opportunities to lower costs and drive efficiency. Whether the aim is to increase production in the oil field or boost throughput in the refinery, improved asset utilization is a key goal for any technology investment in oil and gas.

Oil and gas is the world’s most asset-intensive industry, with global upstream spending alone topping $3 trillion within the last five years. And yet, the industry has demonstrated a historic disconnect between investment in technology and the pursuit of a positive return on assets (ROA) and increased utilization. Compared to most other asset-intensive industries, oil and gas lags far behind in terms of ROA. A study conducted by EY showed that between 2007 and 2014, the oil and gas sector’s average ROA was just 7.5%. The research also showed that a 4%-5% increase in net income on the same asset base is necessary if the industry as a whole is to reach its top quartile ROA of 16%. Contrast this with industries like industrial machinery and semiconductors, which had average ROAs of between 30% and 60% during the same period (Figure 1).

The industry now finds itself in a time during which the downturn in the price of oil and gas coincides with low prices for hardware and major advances in wireless connectivity and process management software. Faced with a “perfect storm” of increased supply, decreased demand growth and pressure from renewables resulting in sustained low oil prices, the industry is in search of a solutions to keep it competitive and profitable. Digitalization is now available at competitive price points – it is now cheaper to make a piece of equipment “smart” through digital means than it is to maintain the equipment with minimal functionality.

Figure 1: A comparison of average annual return on operational assets shows that compared to its industry peers, oil and gas lags far behind.
The Industrial Internet: informing impactful decisions with real-time information

What types of digital investment make the most sense for oil and gas companies, and where should these investments be focused? Just as asset utilization and uptime are critical drivers of profitability, maintenance and unplanned downtime are serious drains to a company’s bottom line.

Optimizing asset uptime while streamlining maintenance activities requires having access to accurate, detailed and timely information – the kind that comes from the promise of the Industrial Internet. The concept of the Industrial Internet, a term that many attribute to GE, refers to the drawing together of fields such as machine learning, big data, the Industrial Internet of Things (IIoT) and machine-to-machine communication to acquire data from machines, analyze it in real time and use it to adjust operations.2

With the advent of the IIoT, the infrastructure now exists to bring together producers and consumers of common sources of information to drive greater operational efficiencies and lower costs. Companies can use sensor-enabled IIoT to gain more productivity from their fixed assets and people. By adjusting their operations quickly and accurately based on the real-time equipment data coming in and analyzed from the field, operators can switch their maintenance operations from a “just-in-case” to a “just-in-time” model, helping to avoid unplanned downtime and develop faster pathways to complete scheduled maintenance. This switch allows operators to make informed and intelligent decisions on when a piece of equipment should be serviced, prioritize maintenance schedules based on equipment criticality and keep replacement parts well stocked to avoid delays. It also makes optimal use of increasingly mobile and short-staffed maintenance crews, limiting the number of times workers have to travel to maintain field equipment and informing them of exactly which tools and replacement parts they will need to take with them.

Using the IIoT to connect assets, people and processes

While the oil and gas industry connects every continent and time zone around the world, many oil and gas companies still conduct their major operational processes in unconnected islands of activity. A company’s demand-and-supply planning activities often take place with limited forecasting accuracy, limited integration with process improvements and lack of insight into market structure and positioning.

In addition, the supply chains in many of today’s oil and gas companies still comprise large pockets of internally focused and functional silos. Manual order entry and inventory tracking processes are still commonplace, and operational data is not being exploited at an enterprise scale. A lack of integration continues to exist in critical adjacent parts of the core value with operational assets chain, including transportation, logistics and warehousing. And although many activities across the oil and gas supply chain are largely repetitive, operators increasingly rely on a large number of different service providers spread across areas of specialization and time zones to run daily business activities.

EY believes the connectivity gains promised by the IIoT can help streamline and simplify today’s fragmented and globally distributed oil and gas supply chain, just as it has done for other industries who are further along the adoption curve. Process management software, for example, can integrate and standardize functions to allow operations personnel to cooperate and coordinate at a faster pace. And the increased adoption of cloud-based, visual development environments will afford easier and more efficient collaboration among business groups all along the value chain.

Collaborative discussions and decisions will be fueled by field data recorded by sensor-enabled smart machines and gauges, which can be linked to process activities and analytics. For example, master data, inventory data, external demand data (e.g., industry data, competitor and partner activity) and prior purchase history can be combined into a central database for demand and supply integration. Statistical analysis can predict demand spikes or dips by piece of equipment, parts or people, while dashboards communicate key metrics and trends across key stakeholder groups.

The increased adoption of IIoT processes will ultimately create a step change in operational efficiency by further integrating internal and external supply chain partners, leveraging collaboration and/or mobility tools to compress process time and exploit data and analytics to enhance predictive and insightful decisions.

Figure 2: The cloud integration layer can coordinate all these entities through a single business process to optimize the end-to-end value chain to drive a specific financial result.

Figure 3: To achieve the full benefits of digital transformation, companies will have to build their capabilities along a maturity curve that begins with connecting operations, moves to connecting the value chain and finally, builds a fully connected enterprise.

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Moving up the adoption curve

What will the digital oil field of the future look like, and how will today’s oil and gas companies get there? EY believes that technology adoption will follow three major phases or stages, each building on the previous one and patterned after the well-known maturity curve approach.

**Connecting assets and operations.** The initial two phases focus on connecting field assets and equipment to the Industrial Internet through the use of sensors that provide automated monitoring and diagnostics. Through the creation of a cloud and IT environment that can store and analyze incoming data from critical assets, the company begins to build real-time and predictive insights on the operation of individual assets and whole processes comprising multiple pieces of equipment. Such insights will help optimize asset utilization and maintenance planning for individual assets. Maintenance crews can be sent directly to those assets requiring repairs, upgrades or replacements prior to failure, thus minimizing downtime and keeping operational costs low.

Thanks to the ready access of proven remote sensing technology and IT architectures, the industry has already made good progress connecting assets. Significant work remains on fully connecting all of these assets to operations and using the data from these connected assets to boost utilization rates and lower operating costs. This will require a fundamental change to how readily people within the organization embrace the new technology. Companies will need to ensure high adoption rates for the technology and that the technology is used to automate and monitor entire processes, not just separate assets.

**Connecting the value chain.** The next phase of creating a digitally connected oil and gas enterprise centers on connecting operations to both the internal and the extended value chain, which includes transportation, terminals and warehouses. Such interconnectivity must include automated ordering and logistics functions enabled by real-time tracking and predictive analytics of asset performance in the field.

This level of connection between the asset and the whole supply chain ensures inventory levels in the warehouse are automatically informed by how the asset is running. Inventory should be pulled out of the warehouse, or new parts and equipment orders automatically placed, based on an asset’s current run life or expected time to failure. And if a major field upgrade or workover is planned, the system should automatically ensure that the sufficient number and type of tools, parts and maintenance crews are ready when they are needed. The enhanced forecasting and planning capabilities afforded by a fully connected value chain gives the company clearer visibility into the costs associated with inventory, contractions and logistics – and subsequently, higher levels of ROA.

**Connecting across the entire enterprise.** The final phase of digital adoption is achieved when a company connects all of its assets and processes across an integrated value chain. The IIoT and cloud architecture will allow companies to connect their operations on a global rather than local scale, whether it is connecting all subsea wells to optimize production from multiple offshore platforms or connecting all of a company’s refineries located across the US Gulf Coast.

This phase represents the ultimate goal of any digital oilfield initiative. Enterprise-wide connectivity will help optimize asset utilization and maintenance planning for all assets across every oil field, processing facility or refinery, and allow for better coordination and decision-making of supply chain management teams across all operations.

This level of connection will also converge operational information with financial information on the Industrial Internet to enable integrated planning for the entire enterprise. Such convergence allows a company to make the most informed financial decisions possible by helping them to understand how operational decisions impact current financial performance and more accurately forecasting the impact of future operational changes on revenues. For many companies, operational information and financials currently exist in different software systems, with no bridge between them. The Industrial Internet can create that bridge.
How EY can help

We live in an age of innovation and digital transformation. Digital changes what is possible, and its impact is affecting every individual, organization, business and government.

At EY, we believe a better working world means developing better, digitally-enabled approaches for our people, our clients and the communities and wider world we all serve. We also believe that digital should be infused in everything we do. So we don’t start with a digital issue — we start with a business issue, and then build a plan, fit for a digital world. This means being able to look at digital from every angle, to help build, grow and protect organizations, today, tomorrow and far into the future.

Our deep understanding of new technologies and innovation, professional judgment and human insight helps us to build confidence in a digital world.

With our global presence, digital-enhanced methodologies and deep sector insights, EY helps oil and gas companies evolve to make better use of digital capabilities aimed at improving business processes. We are considered an industry leader at helping clients improve their internal operations by embedding digital throughout the organization. Teaming with companies like GE, IBM, Microsoft, SAP and other top IIoT technology providers, we bring a broad digital approach.

Asset performance management

EY can offer our clients operational technology (OT) that sits on top of equipment and connects to the cloud to analyze data thereby improving productivity and reliability. EY combines these approaches with our transformational process capabilities to drive faster and better operational decisions across a connected and highly-integrated energy value chain. This can help to lower operating costs, reduce unplanned downtime, increase production and asset utilization and drive internal efficiency.

In addition to asset performance management, EY can assist with:

**Mobile field operations** – This provides highly-integrated information system analysis and design, process automation and leading-edge analytics combined with industry leading performance improvement approaches. By helping to create transparency in all areas of the supply chain, we can foster better decision making based on real-time data.

We can help deliver fixed and variable cost optimization, process compression and risk reduction – for example, by decreasing the number of people in potentially hazardous environments, increasing financial predictability and reducing information transfer errors.

**Digital labor** – The digital labor teams use robotics process automation (RPA) to change how work gets done by helping organizations automate existing manual and repetitive processes with intelligent software applications. The resulting cost savings and productivity gains can help create dramatic changes to a corporation’s operation. The virtual robotic workforce is transforming how we perform business processes, move data, alleviate regulatory pressures, and improve data security and quality.

**Digital tax** – Recent technological investments in digital automation and analytics are viewed as potentially driving cost savings. They may also increase revenue leading to the evaluation of tax considerations and helping optimize the tax benefits of digital investments.

Through assessing an organization’s digital penetration, evaluating the current and future R&D spend in the digital space and understanding whether or not digital investments have been monetized as revenue streams, our digital tax teams can help our clients effectively optimize their tax planning.
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The oil and gas sector is constantly changing. Increasingly uncertain energy policies, geopolitical complexities, cost management and climate change all present significant challenges. EY’s Global Oil & Gas Sector supports a global network of more than 10,000 oil and gas professionals with extensive experience in providing assurance, tax, transaction and advisory services across the upstream, midstream, downstream and oil field subsectors. The Sector team works to anticipate market trends, execute the mobility of our global resources and articulate points of view on relevant sector issues. With our deep sector focus, we can help your organization drive down costs and compete more effectively.

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