New Realities in Oil and Gas: Data Management and Analytics

Complex market dynamics create urgent need for digital transformation

Key insights

- Price declines of more than 50 percent since 2014 have upended the global Oil and Gas (O&G) sector. The impacts and resulting operational cost pressures dominate the agenda of industry executives. While the industry has seen many previous downturns, a confluence of powerful dynamics suggests that this one is different. O&G companies must avoid the temptation to simply cut costs until the price slump passes.

- To maximize operational efficiency, O&G companies must address the "data deluge" – much of it increasingly generated by the Internet of Things (IoT).

- Many view this as a major challenge: A majority of respondents in a Cisco survey named "data" as the area of IoT they need to improve most in order to take advantage of connected technologies. However, O&G leaders clearly understand data's potential – they named "data analytics for faster, better decision making" as the number 1 driver for IoT investment.

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Introduction

With worldwide production outpacing demand, oil prices have fallen precipitously since 2014. Several key factors are involved, including

- Continued flat or weakening demand
- Dramatically increased U.S. production (primarily from hydraulic fracturing and horizontal drilling of oil shale)
- Heightened geopolitical risk
- The prospect of increased supply from Iran
- Diminishing storage space for crude

These market conditions and others suggest that the days of $100-per-barrel oil may not return for years, if at all.

In the past, Oil and Gas (O&G) companies have attempted to address oil-price declines by resorting to traditional cost-cutting measures, including layoffs and capital expense reductions. Many are taking a similar approach this time, a risky proposition in a time of unparalleled uncertainty for the industry and in a period of major technology transitions that are creating a proliferation of data (and the opportunity to leverage analytics for competitive edge). The current scenario could pose serious consequences for O&G firms that are not prepared to change and evolve current operating models.

Forward-looking O&G firms, however, believe today's turbulent market landscape provides an opportunity to gain a competitive advantage by harnessing new technologies, including cloud models and data at the edge. These agile companies are already reaping sizable benefits. For example, in the Eagle Ford region of North America, improved drilling techniques and technologies are now enabling oil rigs to produce 18 times more efficiently than in 2008, and 65 percent more efficiently than in 2013.[1]

In addition, O&G firms now have the opportunity to achieve more and to modernize through digital technologies powered by the Internet of Things (IoT) – the networked connection of people, process, data, and things. The industry is in a unique position to combine these advances in drilling technology with digital, IoT-driven technologies to deliver new levels of business and operational efficiency. By becoming "digital technology companies," O&G firms can, for example, further leverage real-time data to achieve:

- Innovation in exploration
- Increased production and oil recovery rates
- Fewer incidents of all types, including product spillage and emissions
- Increased employee productivity and safety
- Improved Operational Excellence (OE) across upstream, downstream, and diverse enterprise, rig, refinery, and field environments

[1] "Oil Price Crash a Blessing in Disguise for U.S. Shale," Oilprice.com, March 9, 2015.

According to Gartner, "The current low-price scenario is unlike prior cycles because digital technologies are enabling optimization of business performance, which is increasing the ability of firms to compete at lower price levels. In this downturn, the ability of an upstream company to continue making strategic investments that improve its ability to compete may be an essential survival skill."[2]

IoT drives digital transformation – with a focus on data, people, and process

As an industry, O&G has been "digitized" for some time – perhaps longer than any other sector. What is different now? For the first time, O&G firms have the opportunity to make IT services a commodity in the business, creating the potential for dramatic cost reduction and improved efficiencies.
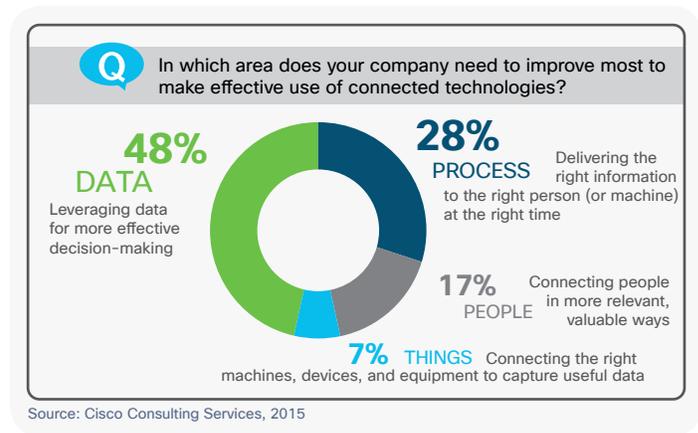
Most O&G firms already have extensive experience with the "things" component of IoT, given the large number of sensors and other devices already deployed throughout operations. Now O&G firms need to focus on the other three areas of IoT – data, people, and process – to maximize business and operational benefits and to position for growth. This digital transformation begins with data.

Data – move from connecting things to capturing insights

Like their counterparts in other industries, O&G companies are deluged with all kinds of data – much of it generated by a multitude of sensors, devices, and machines spread throughout a dispersed and wide-scale value chain. Despite significant investments in operational technology, however, many O&G companies are not fully leveraging real-time operating data to improve functional and business capabilities.

Cisco's survey findings bear this out: 48 percent of respondents named "data" as the area of IoT they need to improve most to make the most effective use of connected technologies. "Process" ranked second (28 percent), followed by "people" (17 percent) and "things" (7 percent).

Q In which area does your company need to improve most to make effective use of connected technologies?

48% DATA — Leveraging data for more effective decision-making

28% PROCESS — Delivering the right information to the right person (or machine) at the right time

17% PEOPLE — Connecting people in more relevant, valuable ways

7% THINGS — Connecting the right machines, devices, and equipment to capture useful data

Source: Cisco Consulting Services, 2015

These findings align with those of a previous Accenture study, which identified "data integration" as the greatest challenge for oil and gas companies related to data quality and the ability to analyze data. In that study, more than half of energy respondents cited the format, completeness, and accessibility of data in their firms as problematic. In addition, only 40 percent felt that their data was relevant to the business.[3]
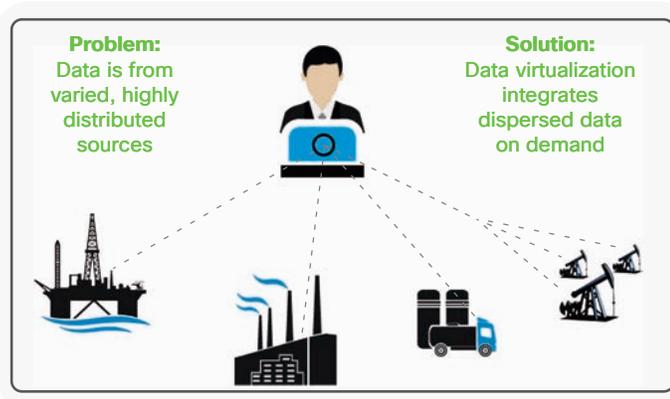
Integrating data

Clearly, integrating data from multiple IoT sources – particularly when those sources are varied in nature and highly distributed – poses significant challenges. Because copying all data to one centralized node for integration is no longer feasible for a variety of reasons – including cost, technical difficulty, and possible regulatory issues – organizations are now starting to rely upon data virtualization to integrate widely dispersed data. Data virtualization makes a heterogeneous set of data sources look like one logical database to users and applications. These data sources do not have to be stored locally – they can be anywhere. This is particularly valuable for an IoT application that relies on data from many distributed sources, such as embedded sensors, video cameras, and third-party data sources.

Data virtualization provides another powerful advantage: Because it is designed and optimized to integrate data live, there is no need to physically store all the integrated data centrally. It is only when users request data from several different sources that it is integrated.

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[2] "How forward-thinking Oil and Gas cios should approach price declines," Gartner, December 3, 2014.

[3] "Analytics-Powered Performance: Opportunities for Oil and Gas companies to improve business outcomes," Accenture, 2013.

In other words, data virtualization supports integration on demand. Data virtualization provides instant access to all the data users want, the way they want it. Users can retrieve and manipulate data without needing to know how the data is formatted or where it is physically located.

Traditionally, the process of gathering and integrating data across different parts of the O&G value chain has involved considerable manual effort. But now, with data virtualization, firms can gain a single view of a well and all of its subcomponents, allowing for quicker identification of targets for improved efficiencies and leading to increased profitability.
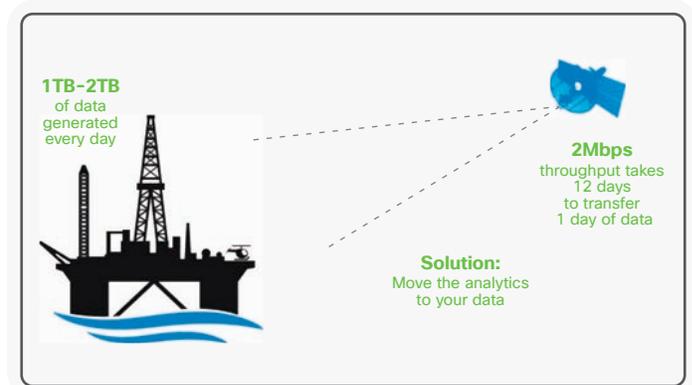

Problem: Data is from varied, highly distributed sources

Solution: Data virtualization integrates dispersed data on demand

Automating data collection — with the ability to process data "at the edge"

After IoT data is captured and integrated, organizations face the challenge of getting the data to the right place at the right time so it can be analyzed. This includes assessing the data to determine whether it needs to be moved to the cloud or data center or analyzed where it is, at the "edge" of the network — in other words, moving the analytics to the data. Organizations therefore require a connected infrastructure that enables insight from the data center to the edge.

"Edge computing" is enabled by the extension of cloud computing and services to the edge of the network — a paradigm sometimes referred to as "fog computing." Fog creates a platform that provides compute, storage, and networking services between end devices and

cloud computing data centers. It also supports emerging IoT applications that demand real-time, predictable latency (such as industrial automation, transportation, networks of sensors, and actuators). Thanks to its wide geographical distribution, the fog paradigm is well positioned for real-time data analytics.

The O&G industry provides a prime example of the need for edge computing. A typical offshore oil platform generates between 1 TB and 2 TB of data per day. Most of this data is time-sensitive, pertaining to platform production and drilling-platform safety. The most common way for offshore oil platforms to transmit data is via a satellite connection, with data speeds ranging from 64 Kbps to 2 Mbps. This means it would take more than 12 days to move 1 day's worth of oil-platform data to a central repository. There are similar examples across several other industries. In fact, 37 percent of respondents in a separate Cisco survey stated that they plan to process most of their IoT data at the edge of the network on smart devices.

1TB–2TB of data generated every day

2Mbps throughput takes 12 days to transfer 1 day of data

Solution: Move the analytics to your data

Analyzing data

Whether it is in the cloud or at the edge, IoT data must be analyzed to identify actionable insights that can be used to create better outcomes. Without this critical step, data remains just "data." Insights then need to be embedded into efforts such as process reengineering and broader business transformations. O&G organizations sometimes lack analytical capabilities due to an absence of both the skill sets (such as those possessed by data scientists) and the tools to deal with the exploding size, speed, variety, and distribution of data.

These firms need to attract or develop employees whose knowledge intersects data science, design, and enterprise architecture. To deliver true value, data insights must link to specific business processes and outcomes.

Respondents to Cisco's oil and gas survey clearly understand the potential of data analytics to drive critical business outcomes: they named "data analytics for faster/better decision making" as their number 1 driver for investment in connected technologies such as IoT. "Improved operational efficiencies" and "increased productivity" ranked second and third.

Leaders of O&G firms have growing expectations regarding data analytics' potential to drive tangible business and operational results:

· IDC forecasted that, with a business case built on predictive analytics and optimization in drilling, production, and asset integrity, 50 percent of oil and gas companies would have advanced analytics capabilities in place by 2016. As a result, IDC reported that O&G CEOs, for example, expected immediate and accurate information about top shale opportunities to be available by the end of 2015, improving asset value by 30 percent.[4]

· According to Gartner, O&G firms' ability to leverage analytics to reduce operating costs and increase production rates "may be an essential survival skill for upstream companies." Gartner mentioned several new analytics methods that are already enhancing the performance of subsurface activities:

  - Digital completion technologies are boosting ultimate recovery rates for unconventional reservoirs from between 3 and 5 percent to between 12 and 16 percent, vastly improving those assets' competitiveness.

  - Advanced sensor technologies such as down-hole fiber generate high-resolution reservoir data for conventional assets, enabling more accurate modeling, simulation, and decision making.

  - Expanded integration of real-time data from field sensors (old and new) with the reservoir model is enabling more robust 4D modeling and, in turn, more dynamic reservoir management.[5]

Q What is the top driver for the industry to invest in connected technologies?

Data analytics for faster, better decision-making — 32%
Improved operational efficiencies — 26%
Increased productivity — 18%

Top three selections are shown here.

Source: Cisco Consulting Services, 2015
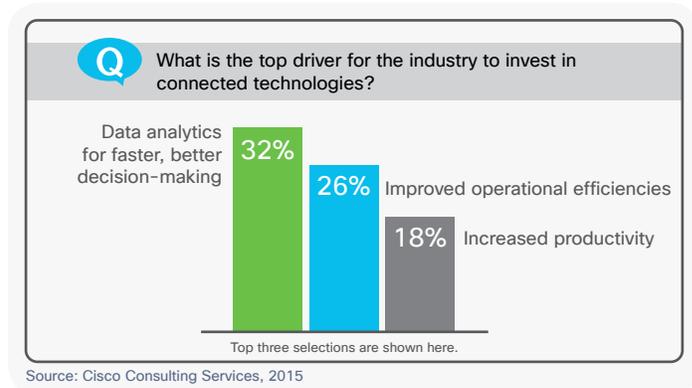
Another example comes from a Canadian oil sands company, which is combining sensors, GPS, and real-time analytics to track the movements of its trucks. Real-time data from the trucks can be viewed on virtually any device, including smartphones and tablets. The solution increases production efficiency while reducing downtime.

Improved data management and analytics capabilities also have the potential to promote more effective allocation of manpower in oil and gas. When data is preprocessed through effective data management and analytics, for example, the workforce spends more time on capturing insights, rather than having to process the data manually.
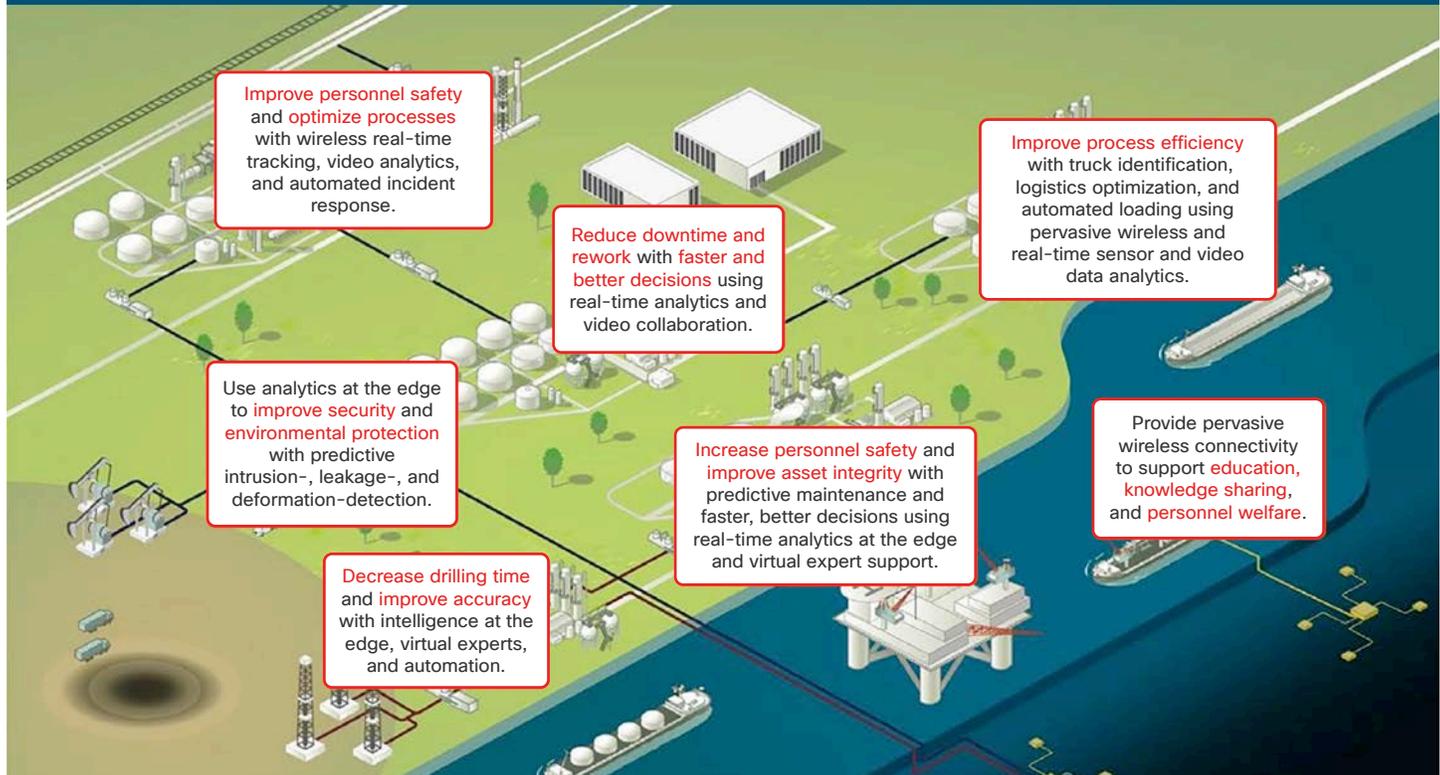
Effective data capabilities also enable a more objective view of operations. Rather than relying on institutional knowledge or "gut reaction," oil and gas firms can make better decisions, improve accuracy, and reduce risk. In addition, a common data platform can help break down language and communication barriers between different parts of the business, including IT and Operations Technology (OT).

Data analytics and data management capabilities are essential components of the IoT usage examples that drive the most value for the oil and gas industry — in the oilfield, pipeline, and refinery. They play a pivotal role in improvements, such as increasing uptime and recovery rates, making better decisions, enhancing refining capacity, reducing lifting costs and cost overruns, and more.

[4] "IDC FutureScape: Worldwide Oil and Gas 2015 predictions," IDC, January 2015.

[5] "How forward-thinking Oil and Gas cios should approach price declines," Gartner, December 3, 2014.

The Oil and Gas industry is primed for digital transformation

Improve personnel safety and optimize processes with wireless real-time tracking, video analytics, and automated incident response.

Reduce downtime and rework with faster and better decisions using real-time analytics and video collaboration.

Improve process efficiency with truck identification, logistics optimization, and automated loading using pervasive wireless and real-time sensor and video data analytics.

Use analytics at the edge to improve security and environmental protection with predictive intrusion-, leakage-, and deformation-detection.

Increase personnel safety and improve asset integrity with predictive maintenance and faster, better decisions using real-time analytics at the edge and virtual expert support.

Provide pervasive wireless connectivity to support education, knowledge sharing, and personnel welfare.

Decrease drilling time and improve accuracy with intelligence at the edge, virtual experts, and automation.

Build on your digital foundation

Digital transformation demands that O&G companies leverage IoT to become more hyper-aware, predictive, and agile. These traits will enable O&G firms to innovate faster and achieve their desired business outcomes. Success requires application of this framework across technology (data), people, and processes.

Data management and analytics should be funded as a business case at the enterprise level. Strive to ensure availability of high-quality, actionable, trusted, and complete data. This includes integrating structured transactional and sensor data with a variety of other data types, including text from content repositories, web clickstreams, customer interaction text from nonsocial networks, mobile devices, geospatial sources, and rich media. Develop advanced analytics tools for predictive statistical analysis or data mining.

Predictive analytics anticipate future behavior or estimate unknown outcomes. By understanding likely outcomes, organizations can choose alternative courses of action (prescriptive analytics) as well as modify investments to maximize return. Predictive maintenance

is one area where predictive analytics can pay large dividends for the O&G industry.

Cognitive computing involves self-learning systems that use data mining, pattern recognition, and natural language processing to mimic the way the human brain works. The goal is to create automated IT systems that are capable of solving problems without human assistance. Cognitive computing will improve knowledge workers' decision-making ability by automating access to information and by highlighting risks and uncertainties. In the future, cognitive computing could impact not just the nature and structure of organizations, but also how they achieve competitive advantage.

With today's pressure on the O&G industry, increased efficiency has become a business imperative that will determine both survival and competitive advantage. The time for oil and gas companies to act is now — through a strategic transformation underpinned by a new approach to people, process, and technology.

Find out more about Cisco oil and gas solutions at https://www.cisco.com/go/oilandgas.