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Adapting to new realities in oil and gas

Information-based value creation with the Internet of Things

IBM Institute for Business Value

Tap new technologies

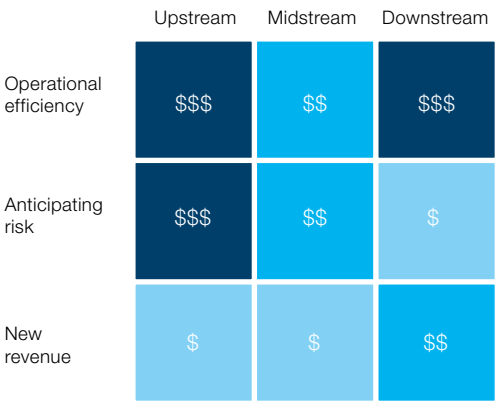
History shows the price of oil can spin into volatility mode with little warning, yet it appears cheaper oil prices are here to stay.[1] Against a backdrop of the current “lower for longer” era, energy companies must prioritize operational efficiency to stay afloat. Despite the huge amount of data the oil and gas industry produces daily, many processes are simply outdated. Digital transformation of facilities and modern, new technologies for environmental and human monitoring, logistics and more can turn data into insights. And if tapped effectively, the Internet of Things (IoT) can provide a competitive edge.

Revolutionizing petroleum

The task of spotting patterns in data gathered from millions of sensors, and then making actionable sense of it, is a daunting one. It is estimated that oilfield sensors generate petabytes of production data, though oil and gas companies typically use as little as 1 percent of the data generated.[2] With the potential to connect everything with everything, the Internet of Things (IoT) makes it possible to monitor and manage objects in the physical world digitally.

IoT integrates sensing, decision-making and execution capabilities. From enabling self-managing machines in a production environment, tracking ships at sea and wearable devices that monitor crew health in challenging environments, sensors combined with advanced analytics offer unparalleled depth of digital insights and fact-based action. In terms of improved operational efficiency, enablement of new revenues and managing risk, IoT has significant benefits (see Figure 1).

Figure 1
Impact of IoT on O&G areas



IoT and the competitive advantage

Key business drivers for IoT are increased operational efficiency, for example reduced asset downtime and improved process performance; anticipating risk, whether human or environmental; and new revenue generation. The value each driver can provide varies over the value stream.

"Oil is like a wild animal. Whoever captures it has it."

J. Paul Getty, American industrialist and founder of the Getty Oil Company

"The difference between oil and data is that the product of oil does not generate more oil, whereas the product of data will generate more data."

Piero Scaruffi, cognitive scientist and author of *A History of Silicon Valley*

IoT can be characterized by five major elements. Together, these components can accelerate digital transformation and reinvention:

Sensors for data generation. For every physical quantity, there's likely a sensor measuring it, from pressure, corrosion or human heart rates, to geophones that convert ground movement into voltage and Global Positioning System (GPS) devices that track location.

Networks for data transmission. Multiple channels are available, including cable, WIFI, xG networks, low-power wide area networks (LPWAN) and satellite. Location and data size often determines which channel or channels are best. Edge computing – data preprocessing and filtering before integration – is increasingly essential to keep network loads manageable.

Platforms for data integration. Typically, networks bring together data from many sensors spread across many locations. Platforms integrate all this data in a common structure and provide the basic capabilities to process it.

Advanced analytics for insight generation. Without an advanced digital boost, petabytes of data are just data. Data mining, machine learning and cognitive computing can generate actionable data insights from structured and unstructured data.

Business integration for aligned operations. Insights integrated in business processes and operations can generate insights that result in fact-based actions.

Crossing the value chain

We have identified 12 leading IoT use cases and mapped them over the high-level value chain (see Figure 2).

Three use cases drive operational efficiency in the upstream area:

- Well drilling optimization predicts drilling failures before they happen.
- Well predictive asset optimization accurately predicts equipment failures.
- Well production optimization determines optimum injection to maximize production.

Two use cases cross the upstream and midstream areas to help anticipate risk:

- Environmental impact monitoring uses sensors and predictive models to determine the impact of production on the environment.
- Real-time personnel safety management monitors crew well-being and identifies dangerous situations.

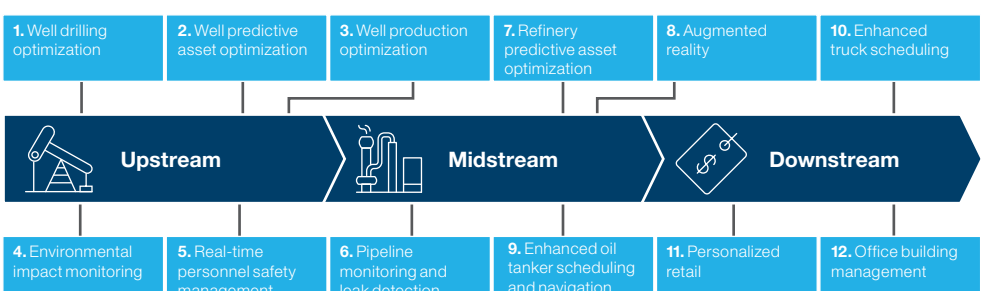
Four use cases drive operational efficiency in the midstream area:

- Pipeline monitoring and leak detection track structural integrity of pipes.
- Enhanced oil tanker scheduling and navigation manage and track oil tankers.
- Refinery predictive asset optimization predicts equipment or containment failures.
- Augmented reality provides real-time, situational information on installation and processing status.

Three downstream use cases increase operational efficiency or enable new revenue models:

- Enhanced truck scheduling optimizes routing, driver effectiveness and safety.
- Personalized retail can tap into new revenue streams for petrol tanking stations via hyper-local and real-time information.
- Office building management effectiveness can increase with predictive maintenance and adaptive utilities.

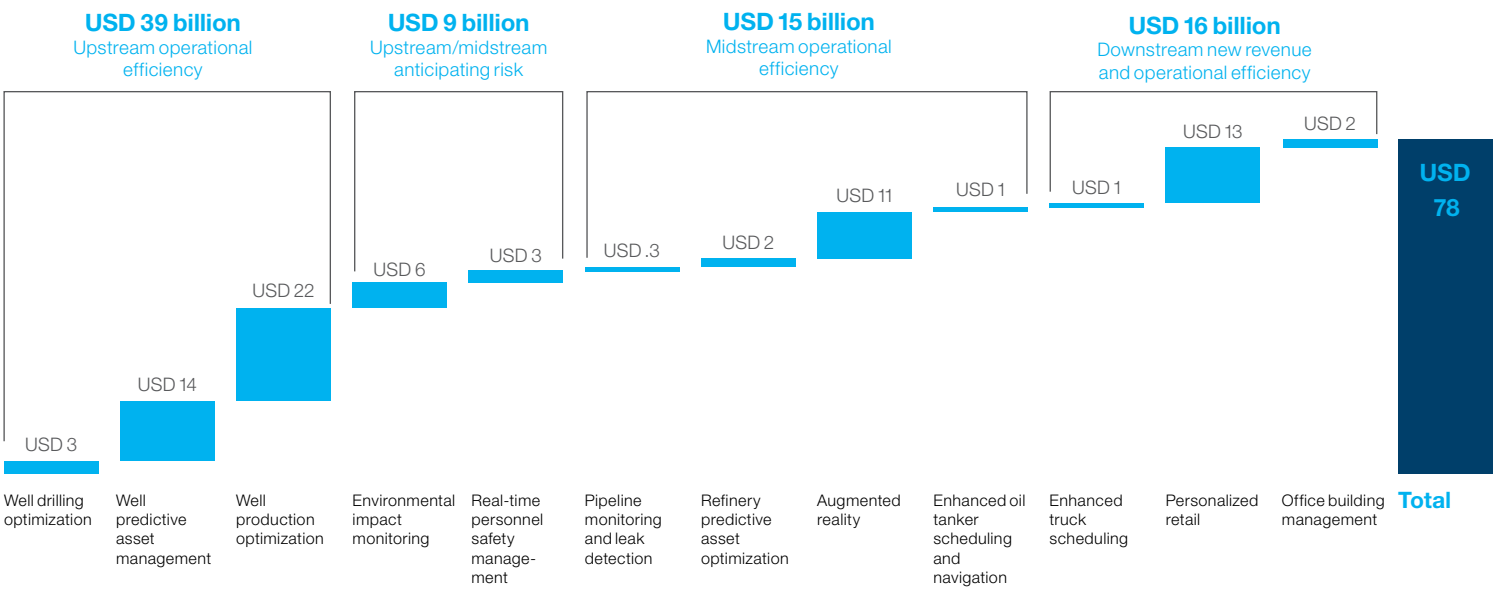
Figure 2
IoT use cases for oil and gas



Billion-dollar insights

We have assessed and positioned our 12 selected use cases in terms of the estimated order-of-magnitude value if successfully rolled out on an industry-wide scale. For the oil and gas industry globally, these use cases represent a potential value realization of USD 78 billion annually (see Figure 3). Actual value and the relative positioning of these use cases will differ for each oil and gas company, depending on relative presence in value chain elements, business priorities and technological prowess.

Figure 3
Value of IoT use cases (USD 78 billion)



The time has come to act on facts

With heavy investment in assets and the hazardous nature of its operations, the oil and gas industry has long invested in operational automation and remote monitoring. But the cost and complexity to implement infrastructure and analyze sensor data has curbed its full potential. New digital technologies like artificial intelligence (AI) or cognitive computing, LPWAN for wireless data communication in relatively remote areas, edge computing and device democracy make it possible to benefit from IoT's full value today. Oil and gas executives can begin the IoT journey by taking two key steps:

Select, deploy and extend. First, prioritize use cases based on value and stakeholders buy-in. Second, implement POVs at favorable locations using rapid prototyping and last when successful, scale consistently to obtain full value.

Implement an enabling foundation. An IoT platform should address three basic technological components. One, interconnectedness to integrate data from various data sources and platforms; two, cognitive analytics to keep pace with the volume, complexity and unpredictability of unstructured information; and three, security since IoT systems have a direct physical impact on their environment.

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Notes and sources

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