Digitalization: The Answer to Low Oil Prices?

The companies that will invest in digitalization in the coming months will be more likely to reap the benefits when oil prices will rise again.

by Daniel Atzori, PhD
Introduction

The upstream industry is at a critical juncture. Downward pressures on oil prices are leading to investment cuts and growing concerns. But the current environment can provide a perfect breeding ground for innovation.

The digital oilfield (DOF) has a clear potential to revolutionize the oil industry. By automating processes, new technologies can increase operational efficiency and reduce environmental, health and safety risks.

When low oil prices are eroding margins, the digital oilfield promises substantial savings.

Analytics has already been successfully implemented in exploration, for example in seismic analysis and drilling.

Hence, the most interesting new opportunities are likely to arise in production optimization and maintenance, especially in the prevention of unplanned downtime.

The present study provides the outcomes of a series of in-depth interviews conducted with leading personalities of the industry, with the goal of exploring the potential of digitalization.

West Texas Intermediate (WTI) Crude Oil Price

A science-focused industry

Since the 19th century, the joint contributions of engineering, chemistry, geology and geophysics have resulted in enormous developments in the oil and gas industries.

Nowhere more so has this been the case than in the shale oil sector, which has been revolutionized by horizontal drilling, hydraulic fracturing and oilfield automation.

There is, however, a perception that the industry is lagging behind in analytics.
The big data challenge

“Analytics is going to bring a sweeping change in the industry, thanks to its huge potential of increasing efficiency and reliability”, said Philippe Flichy, Senior Digital Oil Field Advisor at the oilfield service company Baker Hughes.

Also for Jeff Baker, Manager of IT Applications at Rosetta Resources, an independent oil and gas company based in Houston, Texas, “one of the biggest innovations is certainly going to be around data and how we use it to empower the business to make strategic level decisions.”

By examining vast data sets, big data analytics promises to open new opportunities for energy companies.

However, the amount of information gathered is increasing exponentially. Sensor, seismic and geolocation data are flooding the energy industry, thanks to developments in instrumentation and process automation.

This overflow of data, without appropriate tools to filter it, could actually be an obstacle for an effective decision-making strategy.

A mind-shift

Increased data from fiber optics and wired drillpipes is not only being used for preventative maintenance, but also for real-time control and optimization, said John Hedengren, Assistant Professor at Brigham Young University.

For example, wired drill pipe (WDP) telemetry allows the transmission of huge quantities of downhole data to detect and evaluate problems to improve drilling operations. In his studies, Hedengren demonstrates how wired drillpipes can be used to quickly detect gas influx and make small changes to avoid uncontrolled well situations.

Applications in the upstream industry

The digital oil field (DOF) is not a new concept, and analytics is already widely applied in the upstream oil and gas industries by Majors such as BP, Shell and Chevron.

Shell applied digital oilfield technologies in Perdido (Gulf of Mexico), the world’s deepest offshore oil drilling and production platform, moored in 2,450 metres (8,000 feet) of water and the first one in the Western hemisphere to integrally apply the “Smart Field” – Shell’s in-house digital oilfield technology.

The adoption of these technologies contributes to a more accurate understanding of reservoirs. According to Shell, it can increase the oil recovered from a field by 10%, while boosting the rate of production.

In Smart Fields, information on temperature, pressure and other conditions are transmitted by sensors with fibre-optic cables to control centres, allowing engineers to constantly oversee production - and identify problems in real-time.
IBM and Repsol

The IBM Watson Foundation - the technology corporation’s big data and analytics platform - aims to optimize extraction and reservoir performance, and to prevent disruptions provoked by equipment failures.

IBM and Repsol are jointly developing two cognitive applications. Their goal is to augment the Spanish oil company’s strategic decision making with regard to optimization of oil reservoir production and new fields acquisition.

In particular, Repsol Technology E&P Scientist Rubén Rodriguez and IBM Researcher Jeff Kephart are working together in IBM’s Cognitive Environments Laboratory (CEL) on “cogs”, new cognitive software agents that will be strategic in the oil company’s production optimization.

Apache Hadoop

The open source platform Hadoop is now adopted by several oil and gas companies to store, process and analyse data in real time. Hadoop allows the distributed processing of vast data sets by merging information technology data and operational technology.

Chevron has been using Hadoop since 2012 to reduce the cost of finding oil reservoirs in areas such as the Gulf of Mexico.

Business computer software companies such as Hortonworks, a commercial vendor of Hadoop, started working with the oil and gas industry, in order to allow companies to make the most of the new tools.

Besides oil exploration, Hadoop can be used to optimize production and to detect equipment errors and mechanical failures.

Innovative use of big data

Based in Houston, Chevron’s Machinery Support Center (MSC) examines data generated from thousands of pieces of equipment coming from all the planet in real time.

MSC is part of an ambitious Chevron initiative, the Upstream Workflow Transformation (UWT), which aims to explore and develop the potential of the digital oil field.

Some of the company’s digital oilfields include Carthage in Texas, Kern River in California and Captain Field in the United Kingdom.

Besides, the Chevron Center of Excellence for Research and Academic Training partnered with the University of Southern California to establish the Center for Interactive Smart Oilfield Technologies in 2003.

Planning and forecasting

Organizing data to draw tangible benefits often lies in the collaboration between different industries. An interesting example is India’s Essar Group, a multinational conglomerate operating in oil and gas, but also in steel, power, communications, shipping ports and logistics, construction and minerals.

ESSAR adopted the Cisco UCS (Unified Computing System) to support the implementation of the SAP High Performance Analytic Appliance (HANA) configuration, in order to analyze the huge data sets generated on a daily basis by its activities. This software helps with planning and forecasting, as well as in cost reductions.
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The promise of analytics

“The oil field will start taking off, because there is going to be more ubiquitous connectivity”, said Chris Lenzsch, Intelligent Solutions Manager, Big Data and Analytics at EMC.

According to Peter Smith (GE Oil & Gas), analytics allows operators to focus on their priorities, such as production losses, energy wastages and equipment failures.

“The promise of analytics is to distill into human readable sentences a large mass of data”, said Peter Smith (GE Oil & Gas).

By adopting automated workflows, operators can implement more proactive management strategies to optimize their production.

Within SPE (Society of Petroleum Engineers), groups such as Petroleum Data-Driven Analytics are providing geoscientists and engineers the tools to improve their understanding of available data and models.

But there is a degree of caution in investing in these new and often expensive programs, given low oil prices.

Reducing costs

This is the perfect moment to invest in analytics, experts say, because even marginal enhancements in overall efficiency can lead to substantial savings in production operations.

“Companies will be looking for massive improvements in productivity and efficiencies and this should lead to an uptake of third platform analytics technology, software and solutions focused on improving these areas.”

Chris Lenzsch (EMC)

Based on mobile, social, cloud, and big data technologies, third platform analytics has the potential to radically transform the whole industry.

In particular, cost reductions can be substantial across the whole value chain. Companies that are heavily investing into data analytics expect to see tangible results in terms of their optimization efforts.

Chevron executives maintain that their digital oil field initiatives already translated into hundreds of millions in cost savings and improved output since 2002.

Halliburton estimated that its first development of a digital oilfield in a deepwater environment led the operator to achieve 95% uptime during the first month of production - and to avoid more than $64 million in lost production during the first 18 months.

Apache executives said that by improving pump performance of 1%, oil production will rise by half a million barrels a day, with a gain of $19 billion a year.

According to Peter Smith, Region Leader – Asia Pacific (Automation & Optimization) of GE Oil & Gas, the implementation of data analytics can translate into remarkable production increases, both by avoiding the cost of deferred production and actual production increase.
Data analytics can also bring down both maintenance and energy expenses, saving hundreds of thousands of dollars, Smith (GE Oil & Gas) added.

For Helenio Gilabert, Director of Telemetry Systems at Schneider Electric, the largest potential lies both in the reduction of operating costs and in actual production increases.

**Different solutions to tackle low oil prices**

Oil companies are reacting in very different ways to the sharp fall in oil prices. Companies that have not yet invested in digital oilfield programs are more likely to postpone them.

"Analytics is not mature yet, it is very much a research and development effort. At present, I do not see a lot of companies putting a lot of money into that. It still requires a lot of effort to transform the technology into a mature product. And this is going to cost money before it can reduce costs."

Philippe Flichy (Baker Hughes)

The implementations of analytics appear very promising. But not all the firms are keen on investing in new programs now.

According to Gilabert (Schneider Electric), a few pioneering companies in the industry will set the example for others, showing the value of analytics. Then, in the next three to five years, there is expected to be a higher rate of automation.

A pioneering example of implementation of digital oilfield technologies is represented by BP’s Field of the Future, which aims to optimize operations by improving operating efficiency and decreasing downtime.

Through its Production Management and Optimization Production Management Advisor, BP aims to manage different aspects of production to enhance its decision making.

Low oil prices can actually be “a catalyst for change”, added Gilabert (Schneider Electric).

That’s because the need to devise new solutions to mitigate slimmer profit margins may trigger technological innovation - on an unprecedented scale.

**A shortage of data analysts**

The real challenge consists not only in the management of new data, but in establishing workflows that can be successfully integrated into existing engineering procedures.

Thus, to embrace the analytics revolution, the industry needs to hire a growing number of qualified professionals with the right skillsets.

"These days, people with an analytics background are in high demand. And not only in the oil and gas industries. The challenge is to find people who are expert analysts and yet understand the specific challenges of the oil and gas industries - or are able to talk with the right experts."

Philippe Flichy (Baker Hughes)
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**Production optimization**

Automation processes can boost productivity and trim operational expenditure. This is particularly true for new fields, where digital technologies can be installed right from the onset.

This has been the case for Shell’s Champion West, situated in the South China Sea, 90km (56 miles) off the coast of Brunei. With oil reserves situated between 2,000 and 4,000 meters (6,500 - 13,000 feet) under the seabed, for decades this field was deemed too costly to develop. But Smart Field technologies were applied here from the beginning. They transformed Champion West in one of the first - and most successful - examples of digital oil field.

Another interesting example is the Kuwait Intelligent Digital Field (KwIDF), where Schlumberger helped Kuwait Oil Company (KOC) in implementing solutions to boost production and recovery rates from a greenfield development. The project proved successful in terms of increased productivity, improved workflows and safety benefits.

Large sets of operational and performance data can enhance drilling parameters and completion techniques, as analytics can help identify the factors that enhance or inhibit the performance of the well.

In particular, monitoring the output of each well is essential to identify under-performing wells.

“Gathering information quicker can have an exponential impact. The faster we obtain information in order to make a decision, the better. No savings is too small at this point. In such a sensitive market, everything you save is going to be helpful.”

Jeff Baker (Rosetta Resources)

For small oil companies operating a few thousand wells, the cost saving of a few thousand dollars per well is vital. It can make the difference between surviving and going out of business.

“The promise of analytics is artificial intelligence, which will allow to optimize fields based on instructions from a software package,” said Smith (GE Oil & Gas).

**Predictive analytics and preventive maintenance**

Predicting the performance of an oil field can have huge financial benefits as investment from under-performing wells can be diverted, optimizing extraction from the more efficient ones.

“Leveraging data for forecasting purposes allows us to make adjustments earlier than we’ve been able to do previously, which can lead to significant cost savings and an improved ability to optimize returns.”

Jeff Baker (Rosetta Resources)

Predictive analytics is creating a paradigm shift, from a reactive to a proactive approach. In that sense, problems can be detected earlier and solved more effectively, which decreases the cost of maintenance.
According to Gilabert (Schneider), preventive maintenance can lead to millions of dollars in potential savings.

“The better your equipment is maintained, the less downtime you have. This increases your overall production and also reduces your costs,” Gilabert added.

Avoiding unplanned downtime

Unplanned disruptions are costing the industry $100 billion dollars per year, according to the technology company Osprey Data.

Analytics promises to reduce the cost of unplanned downtime by pinpointing what is causing failure in a certain well. For example, it will identify whether wells are operated with excessive voltage fluctuations.

“What makes operational expenditure (OPEX) so costly during downtime is that it is typically unexpected. If you are able to plan outages and effectively design your response, you should see a decrease in your OPEX.”

Jeff Baker (Rosetta Resources)

The most interesting advancement on the production side is the ability to predict equipment failure, according to Smith (GE Oil & Gas).

Production optimization already shifted from a well-centric model, where optimization was implemented well by well, to a field-centric model, where the process involves the entire field.

Real-time monitoring and alarming technologies can also reduce the number of workers needed to manage a certain amount of wells, according to Gilabert (Schneider).

Smarter cuts and faster decisions

The digital oilfield can reduce operating costs and increase efficiency - along the whole value chain.

“Smarter companies will use new technologies and capabilities to make smarter cuts,” said Jim Crompton, Managing Director at Reflections Data Consulting.

“Data is more important than ever and will continue to become one of the organization’s most valuable resources. We do not want to lose ground or simply sit around and wait. We need to do something.”

Jeff Baker (Rosetta Resources)

There is huge potential for analytics to influence acquisitions and divestiture (A&D) activity, according to Baker.

For example, a company that traditionally requires several months of due diligence to assess an acquisition of a particular position, or even another company, could utilize these new technologies and reduce their decision time significantly. Shortening this time window could be the difference between closing a deal or missing out on an opportunity all together.

Besides, analytics can have a huge impact on safety, especially when disaster prevention is concerned, according to Flichy (Baker Hughes).
Conclusion

Computing can drive forward the productivity of oil and gas companies - and low oil prices will not stop the digitalization of the oil industry, experts say.

Rather, the proliferation of data, combined with the downward pressures on oil prices, is likely to pave the way for the digital revolution.

The success in field applications is making them more palatable for oil companies, said David Brower, president and founder of Astro Technology, a leading provider of instrumentation and monitoring solutions in the Gulf of Mexico.

But there are still many challenges ahead. Barriers to the oilfield will remain, because of the costs of technology infrastructure and lack of qualified analysts.

“It is not only about automation - it has to be intelligent automation,” said Gilabert (Schneider Electric).

“There are large companies and mid-sized companies that are very proactive in the implementation of analytics. Others are waiting for service companies to come and propose solutions”, said Flichy (Baker Hughes).

The most likely result is that the gap will further widen between companies. Some will turn to innovative solutions to increase productivity, others will cut down on research and development, according to Baker (Rosetta).

The companies that will invest in digitalization in the coming months will be more likely to reap the benefits when oil prices will rise again.

However, companies that are struggling to balance their return may be reluctant to invest their money in something they cannot yet see or touch.

“But this is the time to go forward and seize the opportunity”, said Smith (GE Oil & Gas).
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