

White Paper

Transformational Technologies Are Transforming Oil and Gas

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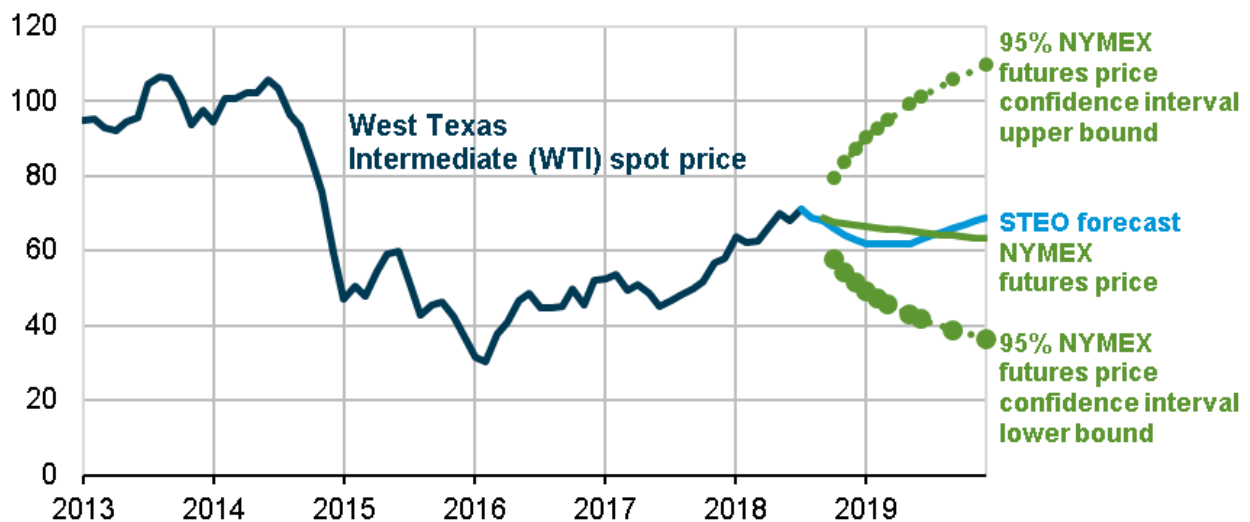
IN THIS WHITE PAPER

The global oil and gas industry has been, and continues to be, subjected to significant market fluctuations in the past four years. As shown in Figure 1, the fluctuations in petroleum commodities have been extreme and painful.

FIGURE 1

Well Life Cycle, 2013-2019

West Texas Intermediate (WTI) crude oil price and NYMEX confidence intervals
dollars per barrel



Notes:

Confidence interval is derived from portions of market information for the five trading days ending August 2, 2018.

Intervals are not calculated for months with sparse trading in near-the-money options contracts.

Source: Short-Term Energy Outlook, August 2018, and CME Group

This instability in the market has driven volatility in operational and IT spending in parallel. But we are entering a new period where oil and gas executives have realized they can't operate their technology infrastructure based on the whipsaw budgets driven by highly variable commodity markets. To separate fluctuations in profits from fluctuations in commodity pricing, oil and gas executives will have to adopt transformational approaches to their businesses. That means transformational technologies are at the core of avoiding instability in performance.

Definitions of Terms Used in This White Paper

- **Upstream:** The exploration, extraction, and production portion of the oil and gas industry
- **Midstream:** The logistics and transport portion of the oil and gas industry that moves petroleum products from the well to storage, refining, and retail distribution (It includes pipelines, trucks, trains, and maritime assets.)
- **Downstream:** The refining, marketing, and retail distribution part of the oil and gas industry, including retail fueling stations
- **Oilfield services:** The companies that provide rig assets, engineering services, data services, and other support services to oil and gas companies
- **Technical debt:** The cost associated with outdated, obsolete, and overly complex systems and technology that a company must maintain and use to operate its businesses. (Typically, these are systems deemed too expensive to replace, but expensive to maintain and change.)
- **Operating model:** The model that an oil and gas company uses to operate its business to satisfy internal and external customers

IDC Energy Insights conducted a survey of oil and gas executives to get a more detailed understanding of how companies are reacting to the new norm. We collected data across all streams and using that this white paper examines how industry business and IT executives are transforming their technology strategies to break the investment cycle of the past.

SITUATION OVERVIEW

A Broken Model That Will Only Break More

Historically, oil and gas companies have flexed up and down with the market by ramping up infrastructure spending and technical resources only to have to build rigid technology architectures with heavy amounts of technical debt (for definition, see the Definitions of Terms Used in This White Paper sidebar). That rigid architecture leads to the inability to scale the architecture down on downturns in the market.

The other effect of large market swings is on IT and technical staffing. In the latest downturn, IDC Energy Insights estimates the large oil and gas companies (supermajors, majors, and independents) shed almost 100,000 technical jobs. The reorganization costs and disruption from those job displacements are felt for years after any recovery.

"Two-thirds of oil and gas companies have seen little to no change in their operations due to technology."

The difference in this market cycle from others in the past is the technology landscape. There are now technologies that should have an impact on how oil and gas companies recover from a downturn:

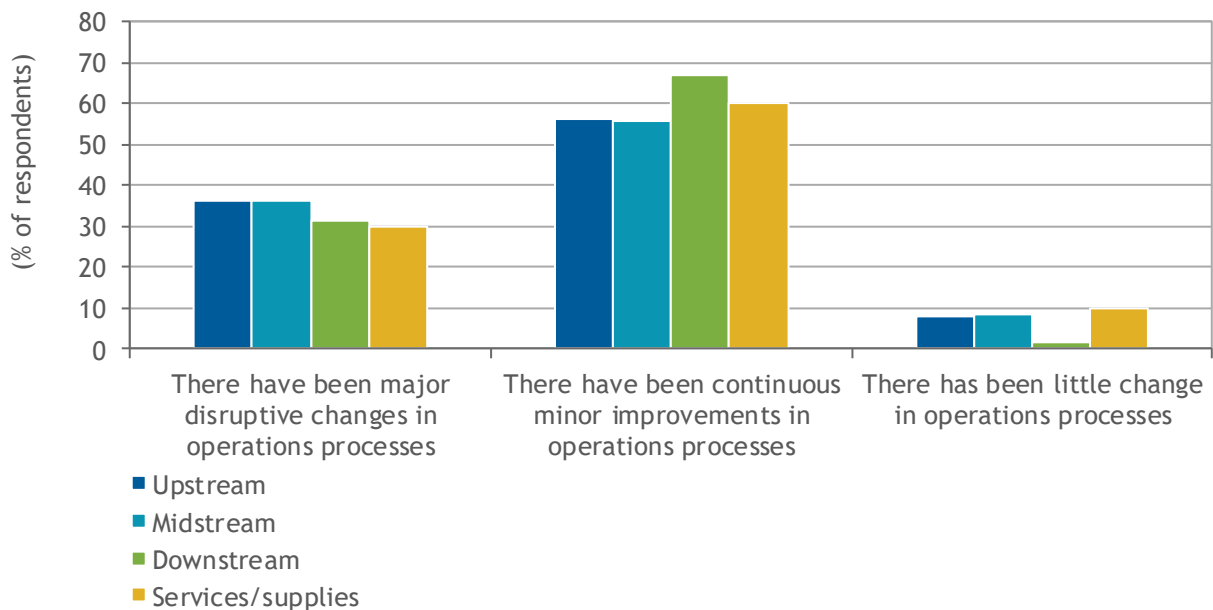
- Cloud, including software as a service and platform as a service
- Big data
- Advanced analytics
- AI and other cognitive capabilities
- Internet of Things (IoT)

Figure 2 shows that, across all streams, many oil and gas companies have seen only limited or minor improvements in their operations.

FIGURE 2

Impact of Technology on Operations in the Last 12 Months

Q. *Change and disruption in operational processes*



Source: IDC Energy Insights' *Oil and Gas Survey*, 2018

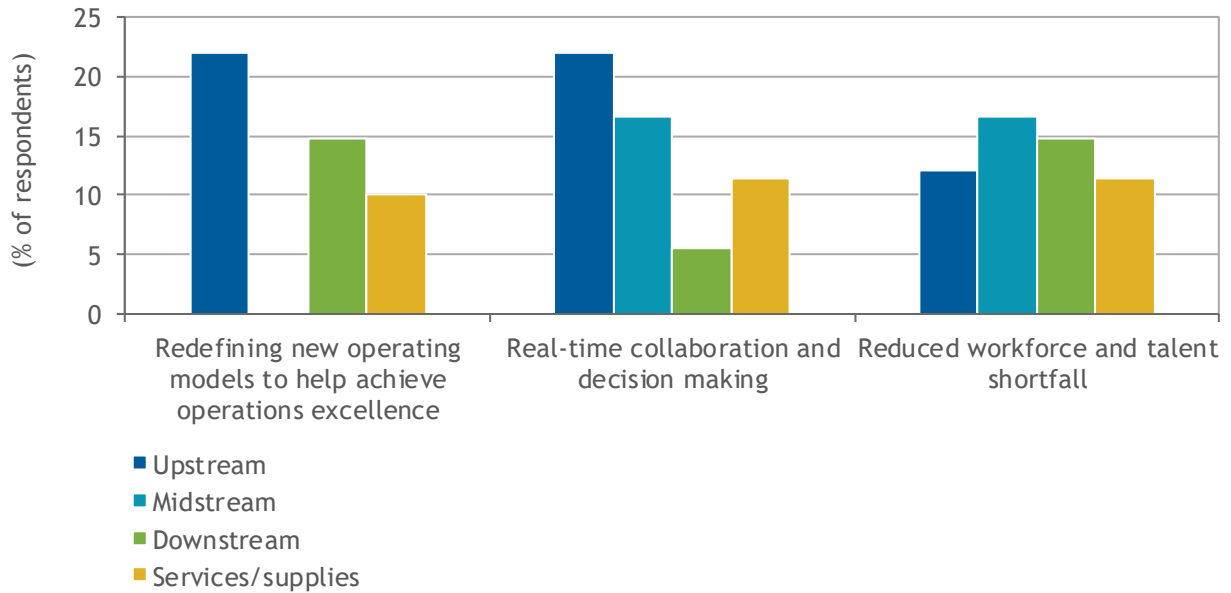
We can see that less than a third of oil and gas companies have seen any significant change in operations from technology. Two-thirds of oil and gas companies have seen little to no change in their operations due to technology. With all the talk of digital transformation in oil and gas, this is an astounding statistic. This has been a consistent issue in oil and gas companies. New technology comes along that solves a very specific issue. The technology is implemented but never extended beyond a localized business problem. The change becomes transformational and positively disruptive when these local solutions are extended to all parts of the business.

So let's look at some of the other challenges that oil and gas companies are facing that are holding back their ability to drive transformative impact from technology. Figure 3 shows the main culprits.

FIGURE 3

Top Challenges to Transformation in Your Organization

Q. *What are the key challenges that you perceive in wider adoption of technology/IT in your area of operation?*



Note: Select Top 3 out of 10 answers.

Source: IDC Energy Insights' *Oil and Gas Survey*, 2018

This is where we start to see some differences across the various streams:

- **Upstream** – Challenges across all three, but operating models and siloed decision making are at the top of the list
- **Midstream** – Major impediments siloed decision making and talent
- **Downstream** – Struggling with changing operating models and talent
- **Services/supplies** – Challenges in all and spread equally among the three

Note that talent is a critical challenge across all three. This is known in the industry as "The Big Crew Change." It's the aging of the oil and gas employed technical workforce. As the demographics have begun to skew, several things are becoming important to note:

- A large bubble of oil and gas workers will potentially be retiring in the next 10 years.
- Market conditions have kept oil and gas companies from hiring younger technical staff due to budget constraints.
- A large amount of technical knowledge and skill will be leaving the building over the next 10 years.

Oil and gas companies are recognizing these issues. For the next four to five years, most executives believe the demographic issue will be the biggest issue facing oil and gas companies.

The market volatility, The Big Crew Change, siloed organizations, and slow decision making are across the board issues for limiting agility and margins in downturns. They are also restricting maximizing profits in upswings. Oil and gas companies across all streams must unhook themselves from their technology debt, capture knowledge before its gone, and develop agile technology and architectures before it's too late and another commodity cycle starts.

Transforming the Technology from Yesterday to Today

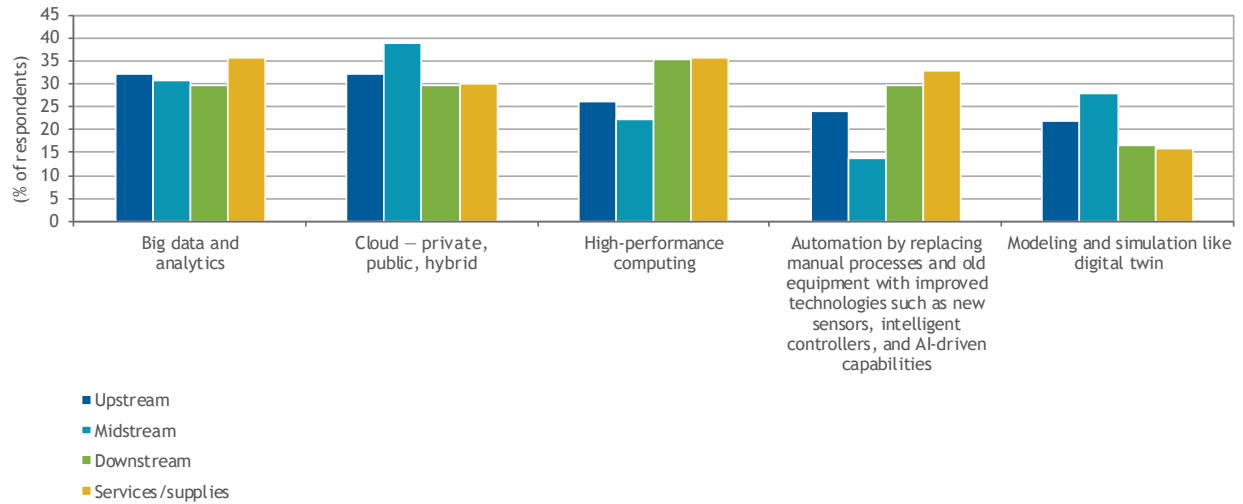
Now that we know why oil and gas companies are struggling with scaling their technology capabilities, let's look at what they are doing and what they should do. If we go back and look at the list of technologies with the potential to have significant impact on oil and gas operations, we can compare it with what oil and gas executives are investing in (see Figure 4).

A large amount of technical knowledge and skill will be leaving the building over the next 10 years.

FIGURE 4

Top Technology Investments from the Past Two Years

Q. *In the past two years, what new technologies saw the greatest investments in supporting operations?*



Note: Select Top 3 out of 15 answers.

Source: IDC Energy Insights' *Oil and Gas Survey*, 2018

Figure 4 shows that from an individual technology segment, oil and gas companies know that they need to invest in transformational technologies. IDC Energy Insights' research shows that line-of-business (LOB) executives are driving the call for investment in the aforementioned technologies. IT executives are, in general, reacting to the pull from the LOB side of the business.

An area where we see a lot of activity is business process automation. As shown in Figure 4, it is one of the top investment areas for oil and gas companies in downstream and in oilfield services. Business process automation entails using AI and data management to automate traditional manual processes. A great example is contract ingestion in land management systems for upstream and midstream companies. Today, lawyers and legal staff spend hours on each contract putting terms into structured formats for eventual division dispensation. An AI-based system would automatically ingest the contract terms into the system, based on factors set by the legal team. We are seeing several supermajors already putting these systems in place.

Another area that is seeing immense activity is around big data and analytics. There is a lot of activity around building out analytics platforms and data strategies. But oil and gas companies are being somewhat wary about creating new silos of data. This ties back to Figure 2 and the concerns about seeing only minor improvements in operations. Leading oil and gas companies are recognizing that having an overall data governance strategy is essential. Part of that is a consistent platform for the businesses to use to ingest, access, and analyze data. That includes a platform that can support a

secure development environment for businesses to develop local apps that automate business processes.

IT is scrambling to invest in the infrastructure that can support transformational technologies and business models. The infrastructure must be agile and able to cope with large market swings without tying innovation down with the overhead of large technical debt. It also has to be agile and flexible enough to support rapid and innovative transformation even in the best of market cycles.

An interesting investment area is around high-performance computing (HPC). The oil and gas industry has always been a big user of HPC for seismic data analysis. But IDC Energy Insights sees HPC penetrating into more day-to-day capabilities to support the flood of data coming from IoT and enhanced exploration technologies like drones. The services side of the oil and gas business is beginning to ramp up HPC capabilities as these oil and gas services firms are driving data analysis as a service for their oil and gas E&P clients.

As an example of the pressure IT executives are under to transform their operations and infrastructure, let's look at what a CFO from a large midstream pipeline and logistics companies says. The CFO stated, "I am tired of monolithic systems that can't be changed or discarded as our markets change. I want applications that if I have to throw them out, I don't want to have to be concerned about a write-off. I need a platform and infrastructure that allows us to develop small disposable apps to solve local business problems."

"I need a platform and infrastructure that allows us to develop small disposable apps to solve local business problems." — CFO of \$5 billion independent oil and gas company

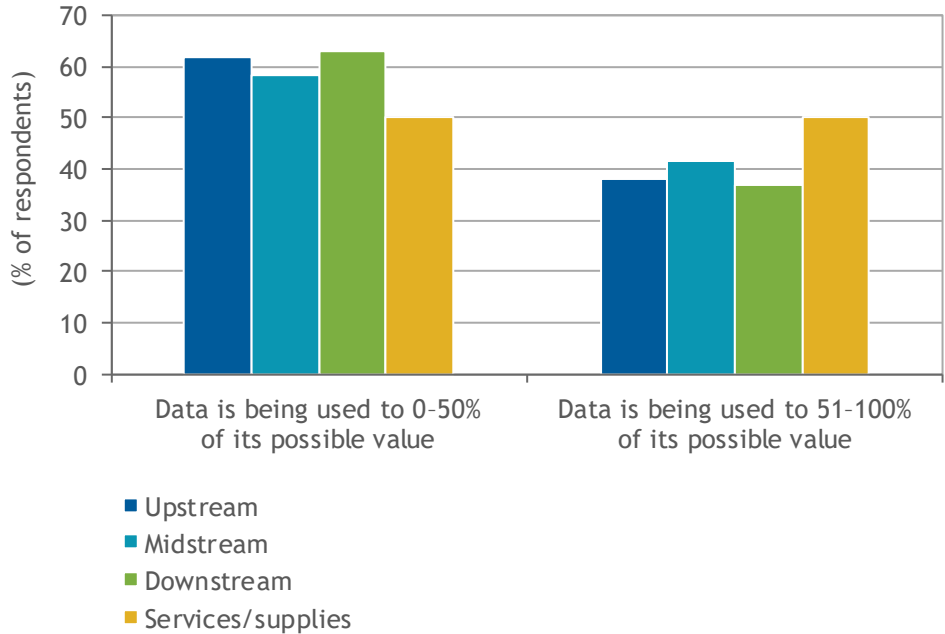
Transforming the Value of Data

One of the key things to look for any organization and its technology infrastructure is how the data is being used to support operations. Figure 5 shows how oil and gas companies estimated the use of their data to support operations.

FIGURE 5

Perceived Value Leveraged from Data

Q. How well is the data currently being collected to support operations being used?



Source: IDC Energy Insights' *Oil and Gas Survey*, 2018

As you can see, from 50% of services companies leveraging data to 63% for downstream companies leverage less than half their collected and available data in operations. That means oil and gas companies are leaving immense amounts of potential value in data on the table. Here are the main reasons:

- Data siloed and inaccessible
- Lack of knowledge about data credibility and reliability
- Lack of skills to analyze and draw insight from the data
- Lack of budget to develop or acquire tools to use the data

There are obviously more reasons than this list, but these are the top reasons IDC Energy Insights hears from oil and gas executives. The data silo is the most common driver for cloud data strategies. But a good data governance strategy will go beyond just a consolidated storage strategy. It will have cross-silo data access, ingestion capabilities, machine learning, and so forth. The point is that it's not a simple storage strategy. Turning all of your data into value is the key to transforming any oil and gas operation.

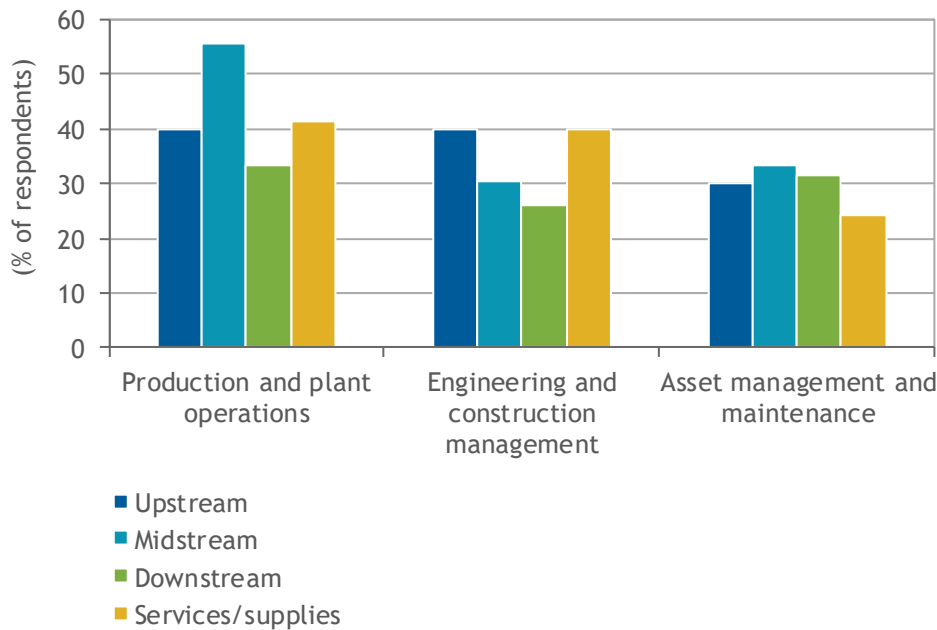
Another aspect to consider is that it's not just what you are investing in but where you are investing. Figure 6 gives an overview of where oil and gas companies plan to invest their technology dollars on the way to transformation.

But maybe the biggest aspect of the transformation of data is the previously mentioned "The Big Crew Change." Decades of hands-on experience will be walking out the door within the next 10 years. Capturing the knowledge through data models, simulations, and AI capabilities is becoming an industrywide imperative. It's not just about automating manual tasks. It's about putting into digital form the detailed knowledge of how business process runs, assets operate, and oil is taken from the ground and delivered to the final customer. Without those transformational technologies, large numbers of business processes will have to be deconstructed and relearned.

FIGURE 6

What Functional Areas Will You Be Investing in Three to Five Years Out?

Q. *Top Functional Investment Areas for Technology*



Source: IDC Energy Insights' *Oil and Gas Survey*, 2018

"Digital transformation can only travel at the speed of HSE transformation."

Figure 6 shows that operational areas production management, asset management, and construction are the top areas for technology investing out a few years.

One key aspect to consider when looking at digital transformation and technology investment is the speed of change in oil and gas and its traditionally conservative approach to change. That aspect is health, safety, and environment (HSE). Every change in an oil and gas operation has to have HSE as a consideration. That means that in oil and gas companies, digital transformation can travel only at the speed of HSE transformation. Every aforementioned functional area has very serious considerations around HSE and HSE compliance. Every form of transformation must have HSE in lockstep and able to be transformed along with the rest of the organization.

FUTURE OUTLOOK

The future of the oil and gas company and its technology capabilities is about agility aligned with the market. This section outlines how an oil and gas company should transform:

- Invest in transformational technology.
- Don't get out ahead of your skis ... move at the pace of safety and watch your operational assets.
- Choose a partner that can flex up and down. (A partner that can react before you do to market conditions without a PO)
- Choose a partner with domain expertise and can innovate with the safety and asset framework.
- Develop an ecosystem of partners that can scale their ability to deliver apps and systems in line with your ability to scale with market demand.

Choose a partner with domain expertise and can innovate within the safety and asset framework.

CHALLENGES/OPPORTUNITIES

Challenges

- Push for new operating models
- Slow decision making
- Organizational inertia
- Demographics and talent management
- Safety and the resulting many "Can't Fail" situations

Opportunities

- Technology platforms driving innovation
- Deriving real value and insights from existing and new data
- New talent, more technology capability
- Partners that bring a combination of domain expertise and detailed understanding of innovation/transformational technology
- Aligning infrastructure to markets and forecasts through transformational technology

CONCLUSION

The variability and instability of the oil and gas commodity markets will never go away. But oil and gas companies do not and should not be at the whip end of the markets. A big part of getting off the roller coaster of market swings is building a digitally transformed business and supporting IT infrastructure that can better predict the swings and better scale with the swings. A key component of building that capability is working with a partner that knows both the business of technology and the business of oil and gas.

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