Cloud in the Transformation of Upstream Oil and Gas

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The oil and gas industry has gone through unparalleled transformation in the past three to four years. Rapid growth in unconventional extraction methods coupled with sub-$50/bbl for crude has forced an innovative approach to oil and gas operations. The impact of the change is especially felt in exploration and production (E&P), as well as in service companies, due to the limited availability of the capital in a volatile market. There are various approaches and strategies that lead to an acceleration of digital transformation in oil and gas companies. IDC believes that cloud-enabled technologies provide the ability to rapidly develop applications that can access data across the enterprise. This Technology Spotlight will focus on showing how leading oil and gas companies should prioritize transformational technologies.

Introduction

The oil and gas industry continues to undergo a business transformation to meet dynamic market challenges. The new normal of unstable market pricing for crude is forcing these companies to reevaluate every aspect of their operations. To address the challenges, companies are implementing new strategies for applying technology to develop a business transformation road map.

Upstream Exploration and Production as a Focus

While the entire value chain of the oil and gas industry is undergoing transformation, we will take a specific look at upstream E&P for several reasons:

■ It is where the long-term value and differentiation of oil and gas companies is created and seen by the market and shareholders.

■ The conservative nature of E&P operations is ripe for innovation.

■ The massive amounts of data generated by E&P operations is a potential gold mine of innovation.

■ Upstream E&P companies are expected to dramatically increase budgets for onshore U.S. drilling and production of oil, especially in shale plays.

IDC Insights research shows that the main drivers for transforming E&P value chains are efficiency and operational excellence. While companies have always been focused on operational efficiencies, the impact of the transformation is laying the foundation for faster decision making and increased efficiencies. As part of the operational excellence concept, the ability to be agile and adaptable to changing conditions is a prerequisite to optimization.

To improve efficiency, upstream companies are challenged to transform their IT environments and technology infrastructure into tightly integrated platforms for managing all types of data, including structured and unstructured data. Data is generated by numerous applications as well as equipment, devices, and business processes. And the application of data-intensive systems and processes is accelerating in the oil field. To get ahead of this rapidly increasing data flow, oil and gas companies are looking at various initiatives and approaches, including cloud, as the foundational technology for transformation.
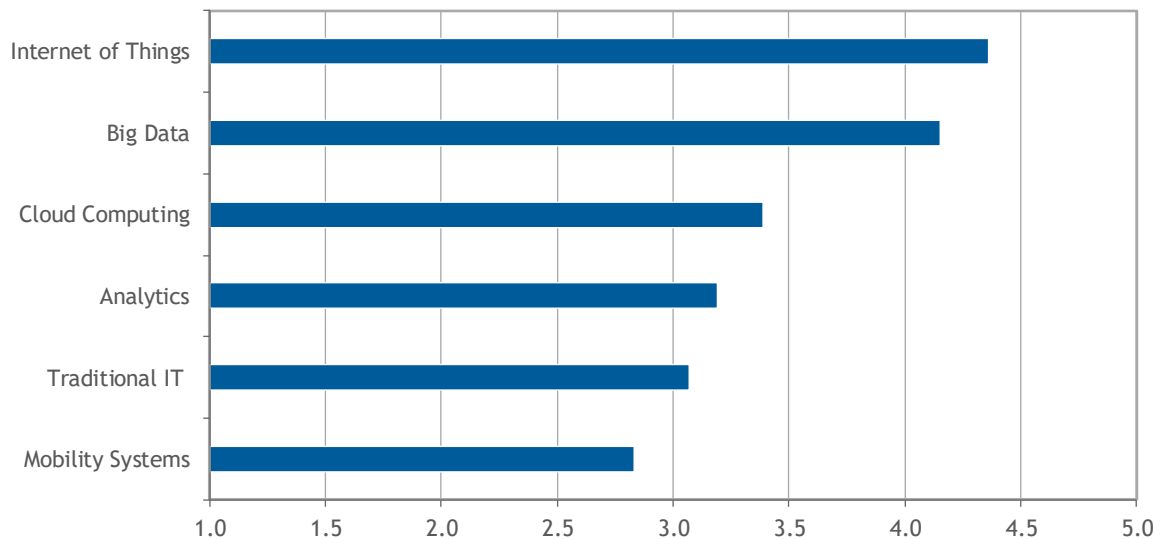
In fact, one of biggest parts of transformation is eliminating the technical debt from investments in legacy systems. Another key aspect of transformation is the use of agile workflows that can quickly adapt to any business demand, including doing things that no one has even thought of yet. Those legacy systems entail horizontal technology, like datacenters and business systems, to name a few. But the debt also encompasses industry-specific technology like the SCADA systems and custom well accounting systems. Any platform-based transformational change must be able to significantly reduce technical debt to the point that the upstream organization has the capability to transform its infrastructure and operations to meet any market volatility in near real time.

Prioritizing Data, Agility, and Collaboration

Oil and gas companies have prioritized investment in six transformational technologies to help enable business innovation, as shown in Figure 1.

FIGURE 1

Priorities for Upstream Oil and Gas Technology Investment

Note: Scale is 1–5 (1 = least important and 5 = most important).

Source: IDC Insights' *Vertical and IT Communications Survey,* 2017

However, IDC Insights research indicates that there are other considerations as well:

- Cloud-enabled technology is a foundational component for all the technologies listed.

- Managing and deriving insights from data is the core competency for transforming the business.

- Efficiencies and innovation through automation of processes are focus areas and goals for many of these technologies.

- The Internet of Things (IoT) is a combination of data, analytics, cloud, mobility, and IT.

Note that IDC defines the IoT as a network of uniquely identifiable endpoints (or things) that communicate bidirectionally without human interaction using IP connectivity. It typically includes cloud capability as the storage and access component to analytics.

These initiatives are dependent on how well data is openly managed and distributed throughout the organization. But leading oil and gas companies know that monolithic applications and infrastructure can't solve their problems. There is a heavy dependency on developing and implementing open platforms with integrated connections to enable moving data across and outside of silos.

The innovation goals of these technologies are the automation of E&P business processes and opening up capabilities not available without cloud and agile development. IDC Insights believes that rapid application development also plays a key role in keeping solutions simple, maintainable and, in some cases, disposable. By disposable, we mean that the capital investment for new apps and partners must be low enough that the decision to replace or modify an app to meet new business demands must not hinge on depreciation. As another factor in the equation for disposability, oil and gas companies, as well as the service companies working in the field, must also consider the value of the information managed by the new system versus the value of the information in the legacy system. Where the capital cost is limited and the value of the information is high, the technical debt is low.

Getting Cloud Working for the Organization

As Figure 1 showed, cloud is one of the core transformational technologies that oil and gas companies prioritize investing in to enable business innovation. Figure 2 shows that there are also key parts of a cloud strategy that must be considered.

The first category in Figure 2 shows the importance of close collaboration between IT staff and business leaders. This collaboration keeps all the organization's cloud needs coordinated to improve costs and to provide visibility across all the silos. The coordination between IT and business leaders also enables the rapid dissemination of best practices and lessons learned.

The second category in the figure, using cloud to drive innovation, is a core part of the innovation process and determined by the agility of the systems and organization. It is defined as the ability to rapidly adjust the organization. However, organizations must also be able to develop and alter apps and workflows to address changes in organization, assets, and markets, among other things.
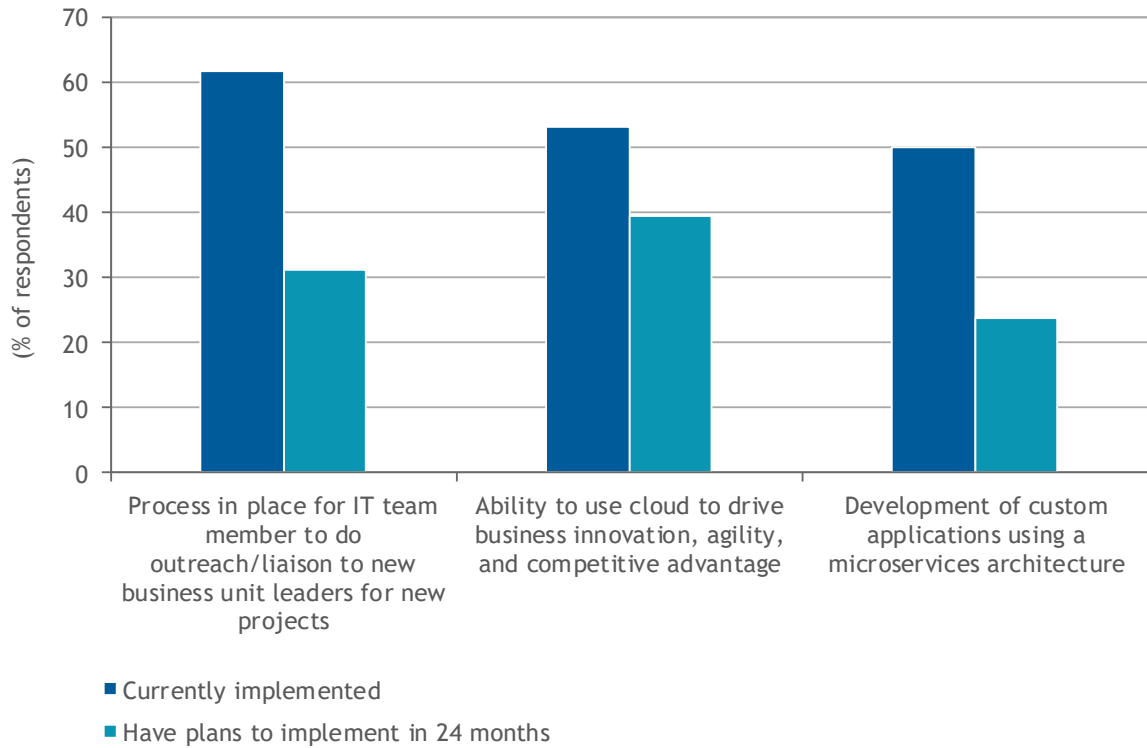
The third and most technically critical capability is enabling the development of apps and workflows without the heavy demands of cost and time associated with a legacy IT staff. This includes both internal app development and an ecosystem of external suppliers and developers. It is all enabled with a software-agnostic microservices platform that defines, enforces, and monitors standards and data flow.

But the most interesting insight from Figure 2 is that oil and gas companies recognize the importance of all three capabilities. Over half of the companies have already started implementing these capabilities, and another third plan on doing it in two years. By that time, over three-fourths of oil and gas companies will have tightly aligned IT and business leaders, will use cloud as the foundational transformation technology, and will have implemented a microservices architecture-based

development platform. That microservices architecture allows a company to use a platform for data management, rapid app development, and the management of an ecosystem of third-party partners to provide an agile and full-featured system of business technology management.

FIGURE 2

Cloud Platform Capabilities in Upstream

Source: IDC's *CloudView Survey,* 2017

Getting Insight from a Swamp of Apps and Data

IDC Insights has seen that oil and gas companies are prone to developing data and application silos that parallel their organizational silos, especially in upstream parts of the business where geoscientists and engineering groups tend to build their own application infrastructure. Cloud platforms have the potential to relieve this situation, but that relief tends to be isolated within the siloed part of the organization.

Analytics is a valuable tool when joined with relevant data, such as when analyzing and predicting the impact of applying a subsurface and surface intervention by comparing production volumes before and after intervention. Being able to have that analytical engine access data from other silos in (near) real time makes for faster and more automated decision making. In this case, metrics and benchmarks can be determined to establish best practices based on performance and to predict and flag health, safety, and environment (HSE) violations.

Each functional area typically has its own data governance and connectivity strategy. Even with a platform strategy, there are many silos, islands of automation, and variables that need to be organized and integrated. Without a good enterprise-level cloud platform strategy, you can easily end

up with silos of platforms in the cloud. A core part of any application and cloud strategy is a foundational data governance model and strategy across the entire organization. With the right cloud platform strategy, this is a key part of the platform itself.

One of the biggest considerations when looking at application development in E&P is that, historically, all the apps and connectors are usually from separate technology vendors or built internally. This difference in tools leads to severe strain on the entire architecture in the form of:

■ Maintaining the software and the related expense of doing so

■ Paying the high costs of staffing to maintain legacy systems

■ Experiencing a lack of agility and flexibility as any change has unpredictable impacts on other apps

■ Possessing limited resources that are knowledgeable enough to make changes

■ Dealing with applications that do not communicate across silos, which restricts needed work and data flow

■ Supporting in-house secure development using proprietary company intellectual property (IP)

For an organization to draw insights from all the data in the architecture requires a workforce with detailed knowledge of legacy applications, workflows, and data structures.

In addition, any insights and reports tend to become stale over a short period of time. IDC Insights has seen oil and gas companies running over 2,500 reports a month — and less than 100 reports were considered reliable and accurate. Turning data into valuable insight lets workers make better decisions. That insight will help optimize processes as new process capabilities arise, which in turn drives greater efficiencies in the oil field through processes that will be optimized as workflows are streamlined and automated. An oil and gas company should have a cloud platform and strategy that:

■ Provides enterprisewide and near-real-time scalability for data storage

■ Offers secure yet flexible access to data across the E&P organization

■ Possesses a rapid and flexible app development platform

■ Uses machine learning and cognitive capabilities for business process automation

■ Enables connectivity to a wide variety of field and business systems

A cloud-enabled platform possessing the above capabilities, as well as the ability to manage an ecosystem of developers, allows any oil and gas company to rapidly innovate new business processes without developing a capital-intensive development organization.

Benefits

As oil and gas companies struggle to move beyond the monolithic and legacy apps that underpin their businesses today, there is immense opportunity for transformation. Leading players are evaluating and implementing transformational technology to drive innovation and operational excellence.

Tying the complexity of the upstream data architecture to the needs of the transformational technology means that an open architecture is a must. Combine that model with the agility in data access and app development, and you have an architecture that can't be locked into proprietary platforms. Even though cloud services are sometimes taken for granted, they are still the central enabler for all the other high-impact technologies within E&P organizations.

Oil and Gas Industry Trends

Cloud computing is a critical element of allowing the flexibility for an agile data governance and operational model. An effective and innovation-driving cloud system is one that:

- Supports flexible, outcome-based performance

- Uses open data standards to develop connections and governance

- Provides an agile development platform for internal and third-party app development

- Reduces the risk of technical debt or rapid obsolescence

- Enables continuous improvement and application enhancement through analytics and agile methodologies

The future must not rely upon letting individual parts of the E&P organization pick their own platform or systems in isolation. A governance model is not only needed for data but for using a cloud platform as well.

IDC Insights has worked with many companies in the oil and gas ecosystem that understand this aspect of governance. These companies are working toward a data and app development model based on an enterprisewide cloud strategy. The governance model applies to general IT and oil and gas standards for data transfer and connectivity. Examples of standards used in the upstream business are OLE for Process Control (OPC), Wellsite Information Transfer Standard Markup Language (WITSML), Reservoir Characterization XML Standards (RESQML), and OpenEarth Community (OEC).

The future architecture also means the need for transformation and innovation in talent. The demographics of the oil and gas technology ranks, both IT and operational, suggest that the relevant workforce is aging toward retirement in the next decade or so. The skill sets needed to manage and develop in an open platform–based environment are also constantly changing. Oil and gas companies must develop a talent management strategy that not only supports the transformed architectures but can take advantage of the capabilities opened up by the platforms. This is not an IT issue. Both business leaders and operational staff must be able to work with the platforms and understand their full capabilities in order to innovate.

Consider the automation of land contract management. Land management is a labor-intensive, complex, and error-prone business function. Even with a good land management system (LMS), it requires expensive and skilled legal and accounting staff. Automating a traditionally paper-bound process with AI and cognitive systems can remove errors, lower costs, increase speed, and better drive compliance. Tying back into the talent challenge, the automation of land contract management will allow oil and gas companies to transition from paper- and human-centric business workflows to highly automated AI-centric business processes. All this must be enabled by a cloud computing platform. The best part is that, as the LMS needs to change with new processes and regulations, the flexibility of the cloud-based system allows rapid and inexpensive change management.

Considering Amazon Web Services

The cloud platform offerings from Amazon Web Services (AWS) can be a foundational technology for transformation in the oil and gas space. AWS brings a partner network, suite of transformational tools, and the scale needed by companies of all sizes. The company's cloud services can help an organization achieve the following benefits:

■ **Faster time to decision making:** Reliance on machine learning and real-time analytics is becoming more valuable to oil and gas companies as they increase their digital capabilities. AWS can help fuel innovation by delivering a consistent and reliable source of new information and insights to speed decision making.

■ **Scale and elasticity:** AWS enables oil and gas companies to address market volatility by providing the resources and tools for achieving scale and elasticity to improve both cost and operational efficiency at the core and the edge of IT.

■ **Cost effectiveness:** Cloud services can lower total cost of ownership and optimize profits. AWS provides a range of services and solutions that can transform and simplify complex workflows, reduce management overhead, and put more money back into the business so that an organization can reduce its time to business insights, accelerate oil discovery, expand faster, and be better positioned to innovate and take advantage of new business models and opportunities.

■ **Security, compliance, and reliability:** Oil and gas companies need to protect sensitive information like raw seismic data, oil production numbers, and trading information. AWS can help organizations improve their security and compliance. While AWS manages security and compliance within the cloud, customers have control at all levels over who can affect the elements of their infrastructure and software, content, platform, applications, systems, and networks.

Challenges for AWS and Cloud Computing in Oil and Gas

Realizing and embracing the benefits of cloud will outweigh the concerns around using cloud technology. That being said:

■ Proprietary IP needs to be fully integrated with any transformation. For example, in seismic processing, the transformation must embrace the "go it alone" nature of geoscientists.

■ Regulatory development has not kept pace with technology change. There is still a risk that government regulators will develop new rules for how data is stored, who has access to data, and how it is disseminated.

■ Changing from legacy systems to cloud-enabled technology is a natural evolution, but oil and gas companies don't want to get caught on the downside of that maturity curve.

Conclusion

Oil and gas companies are typically siloed in data, systems, and organizations. Developing a governance model for all three will lead companies toward an open standards–based strategy architecture. This architecture enables the company to transform and have the ability to predict and react to the volatility in the oil and gas market. However, companies should consider the following items in laying the foundation for digital transformation:

■ Plan cloud deployments to start with critical business processes that require access across silos to move needed data.

■ Recognize that talent acquisition, whether internal or through third parties, must consider analytics and data skills as much as oil and gas subject matter expertise.

- Assess how you license applications, and determine how these apps fit into your cloud strategy.

- To support business agility in your organization, deploy a microservices architecture–based platform for app development.

- Plan to measure technical debt as a key metric for business agility and innovation.

Cloud platforms provide an approach for developing innovative business and IT solutions across the enterprise. One area of high potential is the creation of a data management platform for upstream analytics. Companies want the ability to predict failures, optimize performance, and rapidly ingest and manage IoT data. Cloud computing is the key to enabling technology for that transformation.

The biggest takeaway from IDC Insights research is that oil and gas companies must have a cloud computing strategy based on innovation and transformation to develop an upstream platform. This platform forms the core infrastructure for managing structured and unstructured data that enables collaboration, predictability, and intelligent operational insight. Again, market volatility is not going away. Oil and gas companies must transform their systems and business processes to not only keep up with the changes but to stay ahead of them.