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Using New Data Analytics and Visualization to Capture Value in the Upstream Industry

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Data is king in oil and gas, and that is something the industry has long recognized. For example, in its quest to accurately determine reservoir potential and maximize recoverable oil, the industry has pioneered many highly successful data-intensive applications—from wireline logging to seismic modelling. Business decision makers, however, struggle to fully use the resulting wealth of information.¹

As E&P operations have become exponentially more complex, the volume of data that companies must deal with has soared. Worldwide, sensors now generate upwards of 1 petabyte daily from offshore rigs alone², enough to fill more than 2,000 average-sized hard drives (500 GB) every day. While, on one hand, this data powers robust reservoir engineering and production management, on the other, managerial decision makers often lack visibility on basic information such as operating costs or the daily use of logistical resources. This is because data collection is typically scattered across many systems that tend to be specialized for a single technical function, such as ERP systems for finance, drilling scheduling systems, and logistics planning systems. The lack of integration deprives cross-functional decision-makers of information that can help them gain valuable fact-based insights that could dramatically improve their operations.

The result is an unfortunate paradox: an industry that arguably pioneered the Big Data concept for reservoir evaluation and production management now lags in the use of information for business decisions. This lack of data use has even greater implications in today's low-oil-price environment, which is exerting considerable pressure on upstream companies to optimize capital expenditures and improve current assets' operating efficiency.

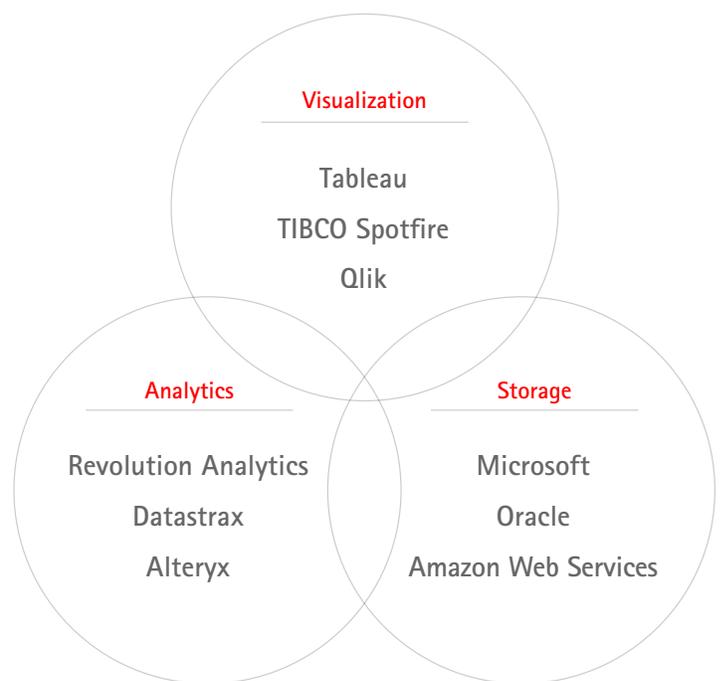
To be sure, oil and gas companies know they can use analytics to gain insights into ways to improve operations and investments. But many are reluctant to embark on projects to develop the necessary analytics capabilities. They fear such projects will be expensive and will disrupt current operations, and may not generate the desired ROI.

While it is true that IT transformations can be long, expensive and complex, development of analytics capabilities need not be. In fact, a new generation of data analytics and visualization tools can help oil and gas companies wring significant business value from their data at a lower cost and with minimal disruption.

Next-generation data analytics and visualization

Such systems fall into three overlapping categories: storage, analytics, and visualization (Figure 1).

Figure 1: The three overlapping categories of next-generation data storage, analytics and visualization tools



¹ See chapter 5 of Energy Perspectives, "Using the oil price crisis to transform in North America: Five fundamental breaks from the past."

² Considers circa 800 active offshore rigs worldwide and 1 – 2 TB of daily data per rig – Sources: RigLogix, January 2015, Cisco – A New Reality for Oil and Gas, April 2015

Storage systems enable companies to migrate their data centers to online external clouds, thus increasing agility and computing capabilities. The analytics category refers to a diverse set of data processing technologies. Visualization tools produce interactive dashboards that businesses can use to display various types of data and can share across an entire organization. In practice, many software companies provide solutions that span all three categories.

Among these services, visualization tools such as Tableau, Qlik and Spotfire are the most accessible to business managers unfamiliar with IT software. With recent innovations, these tools can reduce development times, integrate multiple databases with minimal disruption to existing architecture, and analyze large volumes of data (Figure 2).

One of these tools' biggest advantages is that building visualizations does not require IT-specific backgrounds or programming skills. They are optimized to process very large amounts of information and can integrate data from disparate sources. In short, these new tools make it easier to capture and transform data into actionable insight.

Additionally, a company can quickly set up pilot programs to demonstrate potential optimization benefits. And, in recent years, these tools have begun to incorporate built-in capabilities previously present only in analytical software—such as regression analysis, prediction, and spreadsheet-like computing functions. Yet they remain user friendly.

These characteristics can help oil and gas companies avoid the challenges they have traditionally faced when seeking to wring additional value from their data. One of these is access. Data is often spread out across isolated datasets without common standards and must be extracted as one-off queries. A second is that data is often displayed in non-interactive formats, which limit the analyses to a specific scope. Inherent in both of these challenges is that it will be difficult for a company to modify and update analyses. A third challenge is that complex software makes data processing impossible for business managers without relying on a dedicated IT task force.

Combined, these difficulties translate into a long development cycle—the typical timeframe ranges from months to years—and a feeling among managers that they are "drowning" in big data.

Figure 2: Next-generation tools enable more effective and less resource-intensive development of analytics solutions

Software	Key functionalities	Benefits
Tableau First version: 2007	<ul style="list-style-type: none"> • No need of IT-specific backgrounds or programming skills for development • Capability to display data in interactive dashboards that can be shared across an entire organization 	Reduced lead times
Qlik First version: 1995	<ul style="list-style-type: none"> • Optimized to process very large amounts of data • Capacity to get data from very disparate source databases across organizations 	Reduced investments
TIBCO Spotfire First version: 1996	<ul style="list-style-type: none"> • Built-in analytic capabilities such as regression analysis and prediction, in addition to spreadsheet-like computing functions 	Faster learning curve

In comparison, next-generation data analytics and visualization tools give oil and gas business managers an easy, quick and cost-effective way to identify and capture opportunities to create economic value from their data. In fact, agents close to the economic and operational realities of the oil and gas business can develop data analysis solutions that lead to improved economic performance in as little as two to three months.

A new approach to oil and gas analytics

The key to achieving such results is a new approach to analytics development. As illustrated in Figure 3, this four-step approach is focused on speed to value. It does not initially require a new data architecture, and it relies heavily on prototyping to begin generating benefits quickly. A number of oil and gas companies have successfully deployed this approach, as we highlight in the following examples.

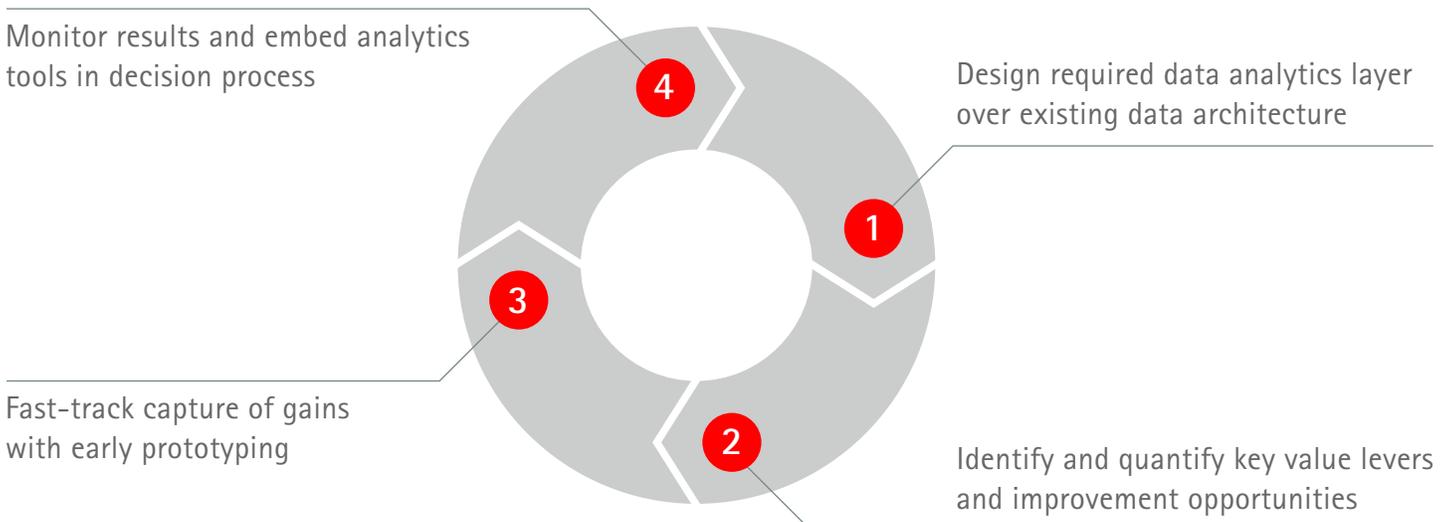
1. Design required data analytics layer over existing data architecture

The first building block for a leaner approach to oil and gas operations analytics is to design a data analytics layer directly over the existing data architecture. Doing so can reduce lead times from more than six months to a few weeks. It also leverages an important feature of next-generation data analytics and visualization tools: the ability to plug into the existing IT infrastructure and immediately integrate databases that vary by location (wellsite versus headquarters), function (operations, logistics, HSE, and finance), and source system.

A leading North American oilfield service provider recently benefited from this "light touch" approach. The company used different kinds of proppant for its fracking operations and needed insights into its supply costs at a granular level. With demand for proppant skyrocketing, the organization was under intense pressure for timely delivery to well sites. Unfortunately, lack of visibility into its cost structure and decentralized decision making had led to delays and shortages, high costs, and a very limited understanding of the problem's root cause. Further complicating the problem was a complex and decentralized logistics and distribution network, which left the company with little insight into cost lines and cost drivers and a fragmented information flow that made compilation and analysis difficult.

In response, the company established intelligent relationships among several data warehouses, including third-party systems, financial databases, local activity logs, and public oil and gas activity reports. Using minimal IT infrastructure and manpower, the company also integrated data from various parts of its supply chain network—including purchase order lists, rail and logistics databases, inventory registers, and invoice and contract records. By thus integrating data from previously isolated islands of information, the company paved the way for future analysis and supply chain optimization. Within 2 months, the company was able to define a set of improvement initiatives to reduce supply costs by USD 40 million—10 percent of baseline expenses.

Figure 3: A new approach to data value creation



A second company, an offshore drilling contractor in Brazil, used a similar approach to exert greater control over its inventory levels. With its existing inventory tracking software needing significant improvement, the company built an updateable external database for validating and reconciling inventory data—rather than engaging in a lengthy process to modify the software. By not altering the existing architecture or superseding the existing data capture systems, the project team gained ready access to key data in a matter of days.

2. Identify and quantify key value levers and improvement opportunities

Once a company collects relevant data, it can use next-generation visualization tools to quickly and more comprehensively analyze large amounts of data. In particular, interactive dashboards make it possible to immediately explore data at various levels of granularity. For instance, visualization tools' "slice and dice" features enable users to zoom in and out of their data, thus identifying key value levers and improvement opportunities much more quickly.

Using the tools in this way can be a boon for upstream business managers with P&L responsibility, who often find it time consuming to keep track of every single cost driver on their income statement. That is what one oilfield service provider in North America experienced when it recently built cost trees using next-generation visualization tools. These cost trees consisted of a hierarchy of costs that allowed analysis of drivers over time. The company designed 50 dashboards in only three months, which enabled it to quickly drill down on all its cost lines and value drivers. The dashboards revealed more than 70 improvement initiatives, and the system proved so useful it was rapidly implemented across the company's operations worldwide.

3. Fast-track capture of gains with early prototyping

The beauty of this approach is that it begins generating benefits in a few days or weeks, not months or years—as the offshore drilling contractor discussed in step 1 discovered. Even while the company was still developing its new inventory management system, initial prototypes helped prevent unnecessary purchases, thus improving financial performance in a severe cost-cutting environment.

Instead of aiming to develop a complete system at once, the company chose to start by building very simple initial dashboards, testing them with key stakeholders, and incorporating feedback on the processes. After several iterations over eight weeks, the prototype evolved into a full-fledged tool ready to be incorporated into the inventory management process. Importantly, the tool can be easily updated, which increases the likelihood it will continue to have a positive impact on the organization over time.

This "deploy-and-improve" approach allows companies to react quickly to changing conditions. User-friendly analytics and visualization tools make it possible for the company to rapidly develop tools and corresponding processes to inform emerging decisions.

4. Monitor results and embed analytics tools in decision process

While short-term results are valuable, the true measure of a solution's worth is its ability to generate ongoing benefits over a longer horizon. Thus, in the final stage, a company must find a way to embed a sustainable solution into the organization's decision-making processes.

That was the challenge a National Oil Company (NOC) faced in Latin America. The company used the previous stages of our approach to implement a new drilling and completion monitoring tool. The tool was designed to reduce Non-Productive Time (NPT) and improve planning efficiency—and, in the process, help the company remain competitive in a harsher competitive environment.

The tool was not disruptive to the existing IT infrastructure, which favored its quick development, and the dashboards' interactivity made it possible to involve key decision makers. In only two months, the prototype became a permanent monitoring solution within the company's governance, and is now used at various levels in the organization.

A first set of dashboards helped the company leadership perform monthly performance reviews. These visualizations allowed leaders to quickly navigate through key KPIs (slicing and dicing them at will), making meetings much more fact based and efficient, which lead to quicker and more informed decisions. Another set of dashboards helped drilling/asset managers by providing more detailed information—for instance, enabling them to get a much deeper look at each well or type of NPT problem.

A new approach requires a new mindset

As illustrated, companies using the preceding four-step approach can quickly capture value from data while optimizing investments. In fact, the approach can help companies escape the "data analytics paradox" and use the data they already have to improve their operations in the current economic environment.

But merely deploying technology does not automatically create economic value. More specifically, using analytics and visualization tools without the proper business context will not produce insights that optimize decision making. The reality is that successfully implementing a new approach to data value creation requires a cultural shift, a new mindset.

Decision makers leading design

Strong leadership from business teams is critical to ensure that new tools and identified changes will be accepted and implemented throughout the organization. Senior management must be involved in the process, and people from the business functions affected should be included.

IT as a partner

Although IT resources can provide extended capabilities for data analysis, business leaders should not expect IT to take the lead. The emergence of a new generation of analytics, with faster development cycles, makes it possible for IT to work as a partner in prototyping analytics tools, and later, in developing permanent solutions. Business teams and IT work together to test the effectiveness of solutions within operations and corporate governance, and agree on desired functionalities that are both useful and quickly deployable. This helps avoid the typical issues with poorly specified IT projects: high costs, long lead times, and disruption.

Immediate survival—and beyond

Surviving the new era of low prices requires oil and gas companies to view data analytics as one of their most powerful allies. Fortunately, a new suite of technologies promises to help oil and gas companies gain insights into previously invisible aspects of their operations. By tapping into the huge potential of already available data, companies can identify and capitalize on unexpected opportunities to recover their margins.

Looking forward, companies can unlock even greater value. Indeed, the type of initiatives just described represent a specific case of a more general data analytics trend that is quickly penetrating not only oil and gas, but the broader industrial society.

For example, estimates show that productivity gains from the Industrial Internet of Things could increase the rate of productivity growth from approximately 1.5 percent per year in the 2005–2011 period to over 3 percent per year over a span of 15 to 20 years. In fact, the Industrial Internet of Things phenomenon is expected to drive efficiency gains comparable to the Internet itself³, and it holds massive potential for the oil and gas sector.

The upstream industry must overcome the paradox of having a wealth of data but failing to exploit it to its fullest. By doing so, not only will the industry ensure its immediate survival, but it will also accelerate its adoption of the Fourth Industrial Revolution. ■

³ See Evans, Peter C. and Annunziata, Marco; Industrial Internet – Pushing the Boundary of Minds and Machines, General Electric, 2012

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