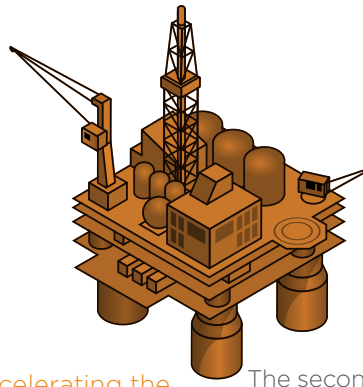




# The Connected Well

A New Framework for the Data-Driven Oil & Gas Business

## Increasing Importance of Analytics in Oil & Gas



Prevailing economic conditions are accelerating the adoption of analytics for timely business impact in the oil and gas industry. There are applications for data analytics throughout the industry. Business units such as production, engineering, operations and drilling are using analytics to improve productivity, increase efficiency, and reduce risk.

In fact, industry analysts, IDC, predict that fifty percent of oil and gas companies will have advanced analytics capabilities in place by 2016, in order to enable predictive analytics and optimisation in drilling, production and asset integrity.<sup>1</sup>

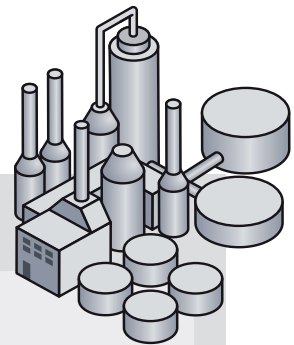
## Challenges Faced Within the Current Framework

There are two main challenges that oil and gas companies face when it comes to getting meaningful applications from data analytics. Firstly, most companies are rigidly structured, and so too is their data. It is common to find the data within the company stored by functional domain, data domain, application domain and performance requirements. These create barriers which prevent information sharing, and more importantly for analysis to take place over all the available data sets within the company to gain real insights that can inform decision making quickly and efficiently.

The second challenge that the industry faces is that of effective information sharing across what is a complex and multi-party ecosystem. Within each domain, there might be service companies providing bespoke solutions, in-house expertise, commercial off-the-shelf software (COTS), system integrators, and engineering consultancies, all generating data that could be of strategic importance to the company. The problem is that these are kept separate, and analysed in isolation, which means that it is difficult to understand how different activities in different domains impact on the business.

These two challenges prevent companies from making the types of decisions needed in the current economic climate. Thus far, the oil and gas industry has been good at making strategic decisions based on data in situations where the projects are five or ten years away, and when summary data is sufficient at the other end of the scale in the operational environment of the digital oil field.

However, scientific and engineering processes are being used at ever-larger scales and levels of complexity. Oil and gas companies need to find and understand connections and relationships between the scientific, technical and business transactional domains. And this means looking at ever-growing datasets, something that cannot be accomplished using existing tools.



### The Connected Well in Practice

#### A near real-time view for production surveillance and field logistics and development

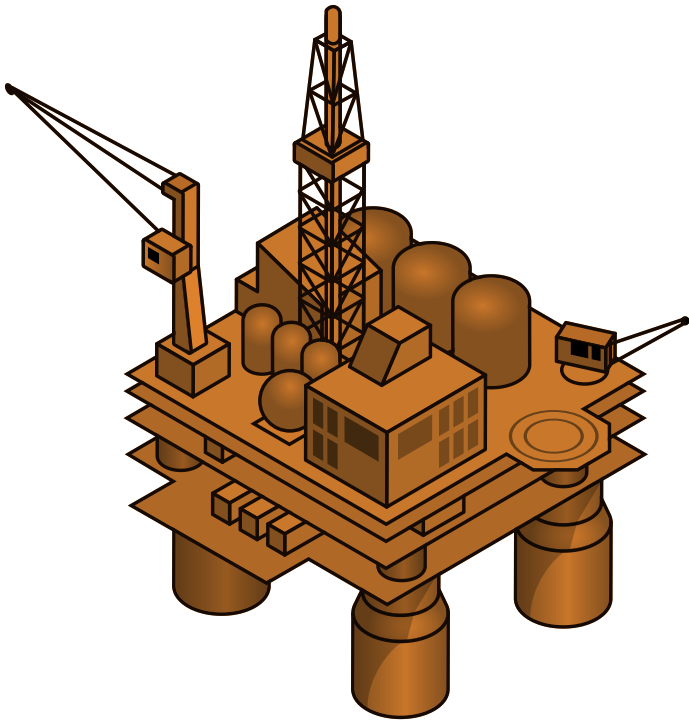
At a multinational energy corporation, daily computations were required to evaluate liquid production, inter-well communication, tank capacity and logistics schedule across diverse operational systems.

**Challenge:** This was causing frequent well shut-ins due to the difficulty of bringing necessary information together from all the systems.

#### The Connected Well Provided the Framework to:

Integrate data from across the operational environment which enabled daily analysis to be conducted.

**Result:** As a result of timely insights, well shut-ins decreased from ninety to ten per month. At the same time, production increased by 7,000 boe / month, which led to an increase in production revenue over the course of a year. The company also managed to save millions of additional non-productive costs.



Current architectures simply do not provide a single, yet granular, enterprise-wide, operational view of data for right-time decision-making. After all, the real value of the data is only realised when combined with people and context to produce insights that lead to remedial or preventative action.

Learning from other industries, the oil and gas industry could make agile, data-driven decisions on when to take machinery offline for maintenance so as not to jeopardise production. Companies could also provision non-urgent shutdowns or maintenance by considering current market conditions as experienced at their trading desks. Engineers could use this analysis to spot outliers and emerging patterns, rather than the current threshold-based alerting, to drive an early warning system to catch issues before they become significant and cause production to be halted.

To be competitive in current market conditions, companies need to be responsive enough to react to changes in market conditions. And in order to do that, companies need to take a hard look at their data.

## The Connected Well

The Connected Well is a framework that will allow oil and gas companies to address the challenges above – breaking down the barriers to information sharing across the organisation, and enabling the relationships between the data generated by different domains to be analysed.

### The Connected Well in Practice

#### More Efficient Development Drilling

A major operator in US unconvensionals wanted to consistently drill horizontal sections in a single trip in hard formations.

**Challenge:** Hard formations mean unpredictable and repeated equipment failures can occur. The company managed to achieve some single-trip sections, but did not know why they were successful some of the time and not at other times.

**The Connected Well Provided the Framework to:** Look for patterns that better inform operational decisions. The company was able to increase drilling efficiency to avoid catastrophic bit damage.

**Operationalise Insight:** The company was able to find combinations of a wide range of drilling parameters likely to avoid bit failure and model alarms to ensure efficient drilling. This was the result of analysing:

- Surface and downhole drilling data
- Metadata relating to well and drill string configuration
- Bit damage severity and profile
- Well position and trajectory
- Petrophysical information

**Result:** As a result, this operator was able to reduce bit failures, do fewer trips and reduce operational expenditure.

### What is the Connected Well?

- It is a flexible framework to integrate data across the organisation for deeper and more meaningful analysis.
- It can be used to provide a visually and conceptually consistent backdrop to show how data-driven insights across business units and technical domains can link up.
- It can drive the operationalization of insight as a central activity for the company.
- Where the barriers to information sharing are currently high, is where the Connected Well can make the most difference.

## Why is the Connected Well Relevant Now?

The sorts of questions that oil and gas managers need answers to is driving the need for ever more sophisticated analysis. Moving from descriptive analytics which answer the question “What happened?” to diagnostic analytics which address “Why did it happen?”. Once companies have that information, it would be natural to want to understand “When will it happen again?” (predictive analytics). And finally, companies will also want to find out “What should happen?” (prescriptive analytics) in certain scenarios, so that they can get repeatable results.

The value that the business can gain from the analytics performed increases as the company progresses from descriptive to prescriptive. However, the ability to progress depends largely on whether the data can be shared across domains in a timely and trustworthy form. If a company is to put into operation the insights gained from these analyses, there should be a high level of trust in the data. The company has to be satisfied with the quality of the data, and that the relationship between datasets and their context is clearly communicated.

The Connected Well then provides the framework for oil and gas companies to have a single view of planning, economic, operational, and technical data across the development, production and operations domains. This, in turn, allows advanced analytics to be performed, and for companies to adopt a discovery mind-set to gain new, quantified, insights into the complex inter-relationships at play in the oil field environment. Companies can visit these insights regularly as more data is acquired and use these insights to generate business impact and stimulate operational change. These can enable the oil and gas industry achieve cheaper, faster and safer oil field operation.

## Connected Well: Getting Started

The Connected Well agenda needs to be built on a foundation that enables the company to unlock the value held in its data, wherever it may reside.

### Establish a Data Strategy

Collect data from across the organisation so that it can be analysed as whole. Data sources can be diverse – from financial data to equipment condition – and are often stored in applications with governance applied by data type or domain, rather than holistically. By extracting the data out of the applications that it

currently resides in, such as ERP systems or data historians, employees who do not have access to those applications can make use of the data, ideally when it is as fresh as possible in the case of streaming equipment condition data.

Look beyond answering one question with the data, even if it is the question most pressing to a given workflow or business unit. What other questions could this data be used to answer? To extract the most value from the data, employees need to be able to use and re-use data to deliver insights for all parts of the business.

### Use Data for More Than Just Reporting

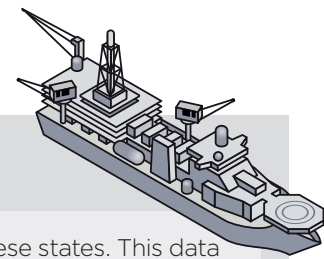
The value of data to the business is intrinsically linked to cost savings or increased efficiency e.g. through improvements in a production process or maintenance schedules. Performing advanced analytics provides answers to business critical questions, when it is needed by the business, from operational to strategic timescales. By enabling employees to run analyses on the data, when they need it, will allow companies to take decisions beneficial to their top and their bottom lines more quickly.

### A Cross-Functional Collaborative Approach

To be successful, the Connected Well demands a new way of working. Engineers and other lines of business have to allow IT and third parties with the appropriate skillsets and capabilities, into their domains and share an understanding of how processes work. Tomorrow's problems are too large for another few buttons on an application. IT have to be prepared to go much deeper in forging new partnerships with their engineering counterparts, while respecting established processes. This is not something the current array of services companies and system integrators can deliver. Instead of providing turnkey IT projects based on precise requirement specifications, the Connected Well needs a much more collaborative approach – with cross-functional teams working side by side, sharing insights and working together.

## Conclusion

A recent survey by Bain and Company found that companies with better analytics capabilities were *twice* as likely to be in the top quartile of financial performance in their industry, *five times* more likely to make decisions faster than their peers and *three times* more likely to execute decisions as planned.<sup>2</sup>



## Where to Start with the Connected Well?

For organisations working towards a Connected Well, a good entry point would be a finding a better way to decide high impact activities, such as shutting-in a well.

Shutting-in a well is not a decision taken lightly for safety, technical and financial reasons. It is often the case that a field manager will err on the side of caution and approve a shut-in even with data that is inconclusive, and rightly so.

Shut-ins are usually the result of a combination of factors, such as:

- The behaviour of the reservoir
- The state of equipment
- The response of fluids to activities around the well such as nearby drilling

If the behaviour of these factors from previous shut-ins is analysed, it is possible to identify the states that could lead to a shut-in through a set of potential scenarios. The likelihood of each scenario can be recalculated as the path through these scenarios becomes clearer.

Data Mining can be used to analyse production data (pressure, temperature and flow rates), reservoir properties, drilling activities, equipment condition and

maintenance activities that affect these states. This data mining could be re-cast at regular intervals as more data is acquired, further data domains enter the scope of exploration, and new questions are tested on the data.

Once a robust model is developed to spot these states, an early warning can be issued and a well shut-in avoided. Then this can be put into an operational setting so that it is constantly monitoring the data collected by historians, the outputs of production models, and the nature and outcome of maintenance activities.

This is just one of the instances that having a Connected Well structure could benefit the organisation. By working on projects like these and others such as recovery or depressurisation, the organisation will also be building their skills and experience of working with data and analytics. Over time, more complex problems can be tackled and solved – through the use of data and analytics.

This progression can only be achieved through a scalable architecture, which allows a smaller business problem to be addressed as a starting point. Organisations should also enable the data captured to be used to multiple times, not just to solve the business problem at hand, but other problems that might occur in the future, and build comprehensive view of the relationships and dependencies across domains.

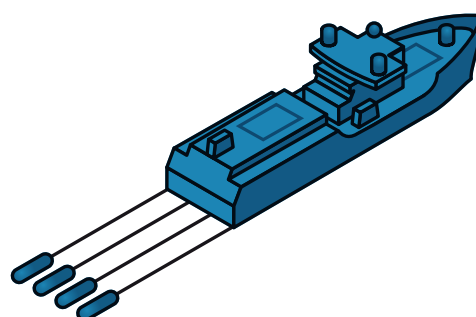
For the oil and gas industry, this means re-thinking the current framework with which data and information is shared across the organisation. By breaking down the silos of data kept within each domain, the company will be able to understand the dependencies and relationships of that data. And from deeper analysis, be able to put in place valuable actions that can repeat successful actions or prevent failure. It will also allow the industry to make faster and better informed decisions to take advantage of market opportunities as they arise. The Connected Well framework will enable oil and gas companies to use the data at their disposal to effectively compete, despite the most challenging market conditions.

## Endnotes

1. IDC FutureScape: Worldwide Oil & Gas 2015 Predictions, IDC Energy Insights, 16 Dec 2014
2. Big Data Analytics in Oil and Gas, Bain and Company, 26 Mar 2014

## About the Author

Duncan has been leading Teradata's expansion into the Oil & Gas domain since he was tempted out of geoscience teaching and research at the University of Manchester. There he worked on various academic and industrial projects around subsurface computing and data management. The promise of lots of travel and really cool data management technologies is still going strong – he is involved in joining the disparate worlds of science, technology and the “business” together in the upstream and midstream domains. He occasionally gets to do interesting projects with seismic data to prove that there is still a geophysicist in there somewhere.



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