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Energy, Infrastructure and Utilities

Drilling deep.

Unearthing the potential of digital oilfield technology

Introduction

The Digital Oilfield is much talked about, but often not clearly articulated. The truth is that many existing and new technologies contribute to the overall concept, and there is no clear-cut definition as to what is, and what is not, part of the Digital Oilfield. The Digital Oilfield potentially extends from the use of 4-D seismic imaging, through to "data-to-desktop" initiatives that take production data through to marketers and traders. This means that it can, potentially, impact the entire oil and gas value chain, with all the technical, process and human impacts that go with it. To date, emphasis has been put on developing the technology, but to deliver the true potential, the effort that will have to go into process and organisational change is likely to be as great if not greater. This paper looks back at where the Digital Oilfield has come from, where it may go in the future, and what challenges organisations are likely to face along the way.

The story so far ...

The Digital Oilfield has numerous synonymous labels such as "Smart Fields," "e-Fields," or "Intelligent Fields." Whatever label we choose to use, it is important to remember that the Digital Oilfield is nothing more than the evolution and convergence of a number of oil and gas drilling, exploration, and digital control techniques coupled with standardised communication technologies. The result is not just impacting the volume and types of data available, but is also reducing intervention times and increasing production optimisation potential.

Some of the basic concepts around drilling and exploration technologies used today began about 50 years ago. A horizontal well, for instance, was drilled in the late 1930s, a multilateral well in the early 1950s, and 3-D seismic was first field tested in 1964. Two and three-dimensional seismic – as 4-D – is now an important reservoir management tool; horizontal drilling technology helped lead to multilateral completion capability.

Some technology highlights of the 1980s

Year	Milestone
1980	3-D post time depth migration seismic survey, 50 sq files, cost $8 million.
1981	First offshore horizontal well drilled in Italy.
1983	Horizontal wells from vertical shaft, Kern River, California.
1984	First steerable drilling system.
1985	3-D vertical seismic profiling developed.
1986	Neutron porosity measurement added to measurement-while-drilling.
1987	First logging-while-drilling tool.
1988	First horizontal well drilled from semi-submersible.
1989	Only 5% of Gulf of Mexico wells based on 3-D seismic data.

Source: U.S. Department of Energy

By the end of the 1990s, advanced exploration, drilling and other technologies, many of which were coming together in the 1980s, doubled the amount of oil and gas developed per well, according to the Department of Energy (DOE).

At about the same time as drilling and exploration techniques were improving, enhancements to communication and information technologies were emerging.

Today's forward thinking oil firm links state-of-the-art exploration and production (E&P) technology with information and communication protocols to achieve economies of scale, real time oil well management and production, while saving on operational costs. For example, in its "smart fields" projects, Shell has experienced a 10% sustained improvement in production, 5-10% increase in recovery, as much as a 20% reduction in operating costs, and as high as a 75% reduction in workflow cycle times in its core processes. In BP's Gulf of Mexico project named "Amberjack", their engineers used a portion of Microsoft's Oilfield Connectivity architecture to link the production platform with the desktop. The company was able to realise a 7% increase, or 600 barrels of oil equivalent, per day for a system cost of US$860,000. Yet despite some success stories, as with most new technologies, there is more to their application than infrastructure, software and hardware.

Key challenges

A number of key challenges remain. We believe that the technologies will continue to mature, reduce in cost and continue to deliver more sophisticated, voluminous and timely data, from increasingly remote and hostile locations. We also believe that two key challenges are, as yet, not given sufficient consideration. Broadly, these challenges can be described as:

Organisational impact: The volume, frequency and complexity of data available drives a major need for organisational change. The tools, capabilities and skills required to analyse and act on the incoming data is significantly different from those expected of head-office staff in the past. Specifically, staff will need to have more and differing skills to take decisions, while systems will do some of the low value work. Organisations will be able to leverage geographically dispersed expertise, but risk losing some of the local familiarity that is often so important to asset optimisation. In addition, the technology available has the potential to enable new working models, such as the outsourcing of equipment monitoring and maintenance, more effective use of centres of expertise and deployment of resources.

Value management: Many impressive claims have, and continue, to be made as to the delivered benefits of Digital Oilfield Programmes, but as with many efficiency improvement programmes, insufficient effort and rigour is exercised on benefits management. Appropriate and well thought through Key Performance Indicators (KPIs) must be established up-front to ensure that the programme benefits are clearly distinguishable from other production or cost impacts. This is particularly difficult – and equally important – for growing or declining fields, where production variation is greatest.

New opportunities

The Digital Oilfield opens up a raft of new opportunities, three of which are are discussed in more detail below.

Centralised monitoring and maintenance planning

The technologies associated with Digital Oilfields allow real-time production and equipment data to be viewed in locations many hundreds, or even thousands of miles away. This raises the possibility of centralised equipment and maintenance planning. This has a number of potential advantages:

Supply chain benefits – centralised maintenance planning should allow more efficient management of equipment and spares, even if execution is managed locally.

Potential to outsource management of critical equipment – turbine manufacturers already service and maintain their own equipment in the airline industry, and there may be significant benefits in moving towards such a model for the oil and gas industry

Consistent application of a maintenance strategy – centralised maintenance planning will assist in the application of a firm-wide maintenance strategy, ensuring consistency as well as optimisation, where choices need to be made for the benefit of the company rather than the local business.

Value optimisation

Digital Oilfield Technology has the potential of bringing real-time data to many parts of the business, potentially allowing more informed trading and risk management (through sending production data to traders desktops), and potentially more informed decisions where other parts of the business depend on either the volume or quality of the crude, gas or condensate being exported.

Functional deployment

While most local assets have, by necessity, a degree of local expertise, often access to deep subject matter expertise lies with "gurus" within a centralised function, or is dispersed around a network. Perversely, this often has the impact of removing these people from the place where they are often most needed – at the operations "coal face". Digital Oilfield Technology has the potential to allow much closer integration between company subject matter experts, and local assets.

Summary

In summary, the technologies around Digital Oilfields have much promise and will no doubt become a key component of "business as usual" in the oil industry. However, the technology itself will not deliver, and the value realisation needs to be planned and managed. New organisational structures will be requried for the Digital Oilfield, and the resulting organisational change carefully planned and managed. Without organisational re-design or value management, the Digital Oilfield risks becoming a piece of clever and interesting technology, rather than an enabler for commercial success.

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