



DATA INTEGRATION IN OIL AND GAS

by James Gavin

Introduction

Oil and gas companies are faced with a bewildering array of strategic changes and decisions – and the advent of data integration is accentuating this process, rather than making it easier, as might at first sight appear.

Operators are faced with the task of integrating data, systems and business units across their organisations, leading to changes in traditional business models. The push toward data driven operating models has led to calls for more integrated ways of working. Operators have to re-evaluate the way they have done things.

This means bringing data to bear across their organisation, breaking down silos and building new systems and organisational capacity to handle the digital transformation.

There are a number of reasons why oil and gas companies are slow to adopt new technology. First, says Trond Ellefsen – a former CIO at Statoil who now runs Invatare, an AI solutions and services company – most operators are still hoping that the price of oil will go up rather than undergoing structural changes to how they operate. Second, they have never been challenged with existential threats to their existence like the last two years of downturn resulted in. Third is the culture of having functional focus rather than integrated value-chain performance. Implementing small patches offers very limited value.

Oil companies have looked at each other and benchmarked themselves against each other, and in general, do as little as they can to go through incremental changes. This has led to the distance between what is technologically possible and the reality in oil and gas being greater than ever before, notes Ellefsen.

Digital has been disruptive to many other industries, not just oil and gas. It is one more reason that half of the companies on the Fortune 500 have disappeared since 2000.

According to management consultancy McKinsey¹, while organisations have been digitizing for decades, the digital revolution is still only just beginning. Within a few years, the Internet of Things will consist of more than a trillion sensors that generate and share data.

Artificial intelligence and machine learning are no longer science fiction, and human-machine interaction is becoming ever more frequent.

Oil and gas companies are not unaffected by these trends. There are several issues that are helping drive changes in data integration in the oil and gas industry.

According to Kieran Kavanagh, Innovation & Data Analytics Director at Wood Group, technology has afforded an increased ability to communicate to oil and gas companies. “There is a general discussion linking sensors, technologies and intelligence and software, to create and enhance value. Then there is the emergence of data analytics, enabling the acquisition of increased inference from more available data. What these strong drivers help us to do is make more informed decisions. For example, data that would once have been available only to offshore stakeholders, is now – through connectivity – available to stakeholders onshore so that discussions can be taken onshore using information available offshore.”

This paper will look at the challenges of integration; who is driving integration, what organisational and technical blockages must be overcome. How are systems and data flows being integrated – especially when these emanate from a variety of external source, such as contractors and service providers. Above all, what are the implications for the oil and gas company business model, and the broader supply chain.

¹ <https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-oil-and-gas-organization-of-the-future>



Section 1: Operating Units and Integration:

The slow but steady migration towards data-driven operating models has significant implications for oil and gas companies' organisational structures. The rapid flow of information from wellhead to accounting, is forcing companies to overhaul the way they do business – whether in the way they nurture human talent, or the way that business units are charged with overseeing the transformation to a digital-led culture.

There is a strong sense that oil and gas companies are being held back less by the technology itself – complex and revolutionary though applications can be – but by the “digital muddle” that is deterring companies from achieving digital maturity². Today's companies were founded as large complex organisations with strong centralised functions. While this allowed them to tackle major technical challenges, manage great political and operational risks, it has not necessarily proved the strongest fit for the digital age³.

Cultural change is one of the biggest challenges to maximising value from increased data integration and analytics, says Wood's Kavanagh. “We need mind-sets that are open to these innovations. A lot of people need to be convinced that they will get a return on their investment, but to maximise value it's also important that they are open to the changes in workflows that these innovations may bring. And while some are happy to innovate, others are happy to be followers and adapt solutions that others have developed.”

The way that one senior industry figure puts it, oil companies' governance models are outdated and do not fit a hyper-connected world. “They are built for segmentation, fragmentation, and a different reality where the purpose is to share as little data as possible,” says Ellefsen.

“The current digital foundation is the opposite of having liquid data flowing across functional barriers,” says Ellefsen. “Ongoing AI and analytics projects will for this reason for the most fail or not meet their objectives due to the lack of foundational building blocks. The functional disconnect and inability to adapt to the demands of the hyper connected world of information make an average operator leave about \$2 billion on the table every year.”

While there are a limited number of companies with a remarkable and highly capable management team that understand that the world has changed and will lead the way, Ellefsen says “For most of the big ones, their initiatives are all about the outward focused optics and not really doing the required change”.

McKinsey expects to see continued experimentation with models that recognize the differences, including separate business units or holding-company structures. To succeed, this requires truly differentiated governance and performance metrics. In extreme cases, we may even see total separations or spin-offs as the best way to manage the complexity—much as we have seen the long-term separation of downstream from upstream.

Typically, there is no single business unit within an oil company that is responsible for driving change. But conversely, data can be an enabler of organisational agility – for example, through instant access to information for frontline decision makers or via the real-time deployment of maintenance teams linked to predictive-maintenance algorithms—an Uber model for the oil field.

Statoil, regarded as one of the industry's leaders in pursuing digital transformation, gave an engineering team full freedom to manage their own hours and working locations. This yielded the prototype of Statoil's new Cap-X subsea system, which cuts development and operating costs by up to 30%⁴.

Technical blockages are typical not responsible for stymieing data integration. “It's not the technology, it's the people,” says Jim Claunch, VP of operational excellence at Statoil. “Leadership is probably the biggest challenge.”

The latter point underlines the sense that digital trends in the oil and gas industry need to be embraced by the company's leadership if they are to be implemented successfully.

Top-down change can be transformative. At US oil company Anadarko, the movement toward improvements in technology started with the introduction to its board of directors of Silicon Valley software entrepreneur Sean Gourley, CEO of artificial intelligent software start-up Primer⁵. This put someone in the boardroom who had a strong technology resource

² <https://www2.deloitte.com/insights/us/en/industry/oil-and-gas/digital-transformation-upstream-oil-and-gas.html>

³ <https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-oil-and-gas-organization-of-the-future>

⁴ <https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-oil-and-gas-organization-of-the-future>

⁵ <https://industrial-iot.com/2016/09/maintaining-technology-investment-in-challenging-times/>

and understanding. Other oil companies are putting data-savvy people in senior positions.

According to Claunch, leadership, organisational culture and digital literacy must combine in order to be truly effective. All oil companies are trying to improve their performance by use of data analytics and the Internet of Things, he says. Yet for the most part, these remain at the edge of the asset team

“There’s a lot of functional solutions to do with managing the resource or a piece of equipment. The question is, when does this become more than just isolated, independent or asset specific solutions, and become part of a larger programme? That is where leadership comes in. Leadership can drive increased collaboration across functions and assets, and improve the ecosystem’s effectiveness,” says Claunch.

While company leadership sets the tone on collaboration, it is the organisational culture that really executes it. “You could have an organisational culture that treats those functional areas as quite independent silos and everyone works hard to optimise their silo without considering the impact of data management and digitalization along the whole value chain. Collaborating along the entire value chain and corporation is where we need to move as the new normal way of working,” says Claunch.

The most advanced oil companies tend to have data integration infused organically into the organisation. According to Jim Crompton, a former Chevron senior technical advisor who now heads Reflections Data Consulting, “You may start with a local business unit leader or COO, who will try to drive cross-functional data integration. In this industry, it often takes an external force to make things happen. A CEO’s message is strong enough to do that – as long as he or she gets involved and oversees the process, and creates different metrics for mid-level managers.”



Perspective:
Jim Claunch, Statoil

“In some companies – Anadarko, Statoil and Devon to name three – there is a strong corporate focus on driving data integration. The broader challenge is that in this industry, businesses are run down silos. We tend to run it down an O&M silo and silos of drilling and completion and run it down silos of subsurface. Each of those groups work their data in their own silo. What companies are now waking up to is the connectability of data.”

“The integration of data means looking at data across silos. But whether it comes down to drilling data to lifecycle to the well data, or whether it is production data, we’re still just infants on this journey.”

“Over time, you are going to see dedicated business units taking charge, and breaking out of the silos within silos. You will see us continue to be good inside silos, but the challenge with that is how are going to maximise the efficiency you get out of an individual silo? How do you leverage drilling data across the value chain, rather than just inside the drilling silo?”

“The challenge for organisations is to migrate, through the use of tools and data, to using the data in the value chain. It’s a journey; it starts with an individual focus, and moves towards a way of working. There’s no ‘one size fits all’ for this. We are going to see different operating models and different organizational structures that will better able this integrated way of working.”

Dataflows and Systems Integration

Digital enablement in the oil and gas industry requires an upshift in data integration founded on new ways of working. Understanding operational workflows and building greater connections between technical domains, can increase efficiency, minimize risks and amplify the application of expertise throughout planning and operational phases⁶.

Across the oil and gas industry, we are witnessing increased integration of data. According to Wood's Kavanagh, where previously there were disparate and separate applications, the technology available today – from visualisation through data analytics – pulls in data from diverse sources to be integrated together, in order to make more informed decisions.

"At Wood, we have been developing software to integrate event data – such as production data from offshore, with time trace information that might show when you last maintained the equipment. This enables better decisions on how to handle the operational maintenance of assets that you work on," says Kavanagh.

Integrating data is nonetheless a challenge even for the most advanced oil and gas companies. Donogh Lang, director of drilling at Wood points out there are multiple vendors offering solutions. Often that means forcing bespoke solutions, particularly when integrating data that might involve a variety of standards and formats, depending on the way that data is coming in. "For any organisation looking to digitise their business and integrate data, the scope of work that they need to undertake in bringing all that together can be immense," he says.

The emergence of different standards governing data formats will ultimately coalesce around a handful of preferred standards that will facilitate the transmission and the integration of data. The oil and gas industry is just one of a number of industries grappling with this issue, of moving towards standardisation and accepted standards that govern data transfer.

Statoil's Jim Claunch stresses that it is the complexity and variation of incoming third-party data that is the most pressing issue. The key thing, he says, is that you do something with it. "The advantage today is that we have way better tools in computing power that allow us to utilise this data using machines. The Internet of

Things is enabling the integration of real-time data with production systems. That present a whole new opportunity – and challenge – for data management."

Cloud computing also has a huge role to play in this. The question that remains at the heart of the challenge is: what is the ultimate use of the data? Is it for oil companies to benchmark against one another? Or do they take this data sets, run analytics on it and do some machine learning?

"We struggle to use our internal data effectively as an industry," says Claunch. "I have heard estimates that only around 3-5% of the data we capture is actually used. So that shows that data is not the issue; it's the convergence and how you use it. If all you're doing is capturing data and leaving it in the Cloud, then really it's just like the bad old days -- when a service company would give you a two-foot high stack of discs that would go into a corner and never get looked at again," says Claunch.



Perspective: **R&D Drilling at oil major**

"One challenge is how data is used for field optimisation. You are taking data and using inputs as part of a machine workflow. How then do we optimise it for decision making?"

One area I focus on is the time value. Before we started doing advanced analytics, data was used more in real time, to check if things were going OK, or if there was a problem. Now, the cycle time is shortened, and we've gone from post op mortem analysis to detection and prevention. That is the holy grail, when you are trying to prevent the escalation of a problem.

What we want to do is use our data in our measurement techniques and telemetry and to increase the quality of the data we are getting – and the timeliness of getting where we need to do. This is where real value lies in the data."

⁶ http://www.slb.com/resources/publications/industry_articles/technology-leadership/201705-wo-digital-transformation.aspx

Oil & Gas business model implications

If nothing else, the abiding message of data systems integration in the oil and gas industry seems clear – things cannot, and will not, go on as before. The company business model must adapt.

Trond Ellefsen highlights the dangers of failing to adapt, pointing to the legacy industry examples, if you look at the biggest “bricks and mortar” companies like JCPenney, Macy’s and Sears, these have had their revenues cannibalised by up to 95% – and that is because they’ve been attacked by companies like Amazon that do not have their legacy architecture, bureaucracy or internal politics that works as barriers against value creation.

While big companies have introduced digital technology across the value chain, many have not yet truly digitised the end-to-end value chain across the business. There is room, according to one oil major executive, to be “much more bold” in how some of these technologies have been adopted⁷.

Business models are nonetheless shifting. Operating and maintenance models are all subject to change. This is made easier by the commodity price climate. The downturn has created a greater level of disruption, whereby the disruption that is caused by adoption of some new technologies is easier to contemplate and swallow than was the case at \$100/barrel oil.

Statoil’s Claunch warns that if business models do not adapt, we will end up with the most expensive digital solutions in the world. “That is what digital does. It gives you the opportunity to rethink your business model and operating models. If companies are spending all this money on digitalization, but using it in a 20th century way of working, the benefits will be limited and the cost will be prohibitive”.



Perspective:

Jim Crompton

Reflections Data Consulting

“The bottom line is that some oil and gas companies have the drive, leadership and capacity to adopt the digital transformation challenge, but many others do not.

“We are coming from a history of functional information management. Drillers manage drilling data, production manages the production data. Any sort of data integration across these workflows was limited. Almost as afterthought, the IT department was bought in to provide a ‘band aid solutions’, not to evolve a systematic approach to the data chain.

“Nowadays we have arrived at a concept of a digital platform in the oil and gas industry. The problem is where the “digital core” is situated. The SAP site may want to be the digital core, or from the IT side, where the ‘data lake’ resides, they may want to be the digital core. You have different choices, and the challenge is in integrating between these. Now companies are saying ‘we’ve got so many wires to hook up to so many more places’. It’s a real spaghetti mess.”

⁷ <https://www.spe.org/en/print-article/?art=2955>

Conclusions

For many oil and gas companies, the challenge of data integration is one that is still on the “to do” list. But that will change – by necessity as much as by choice.

Oil companies may not yet have faced the existential challenge to their business model that other industries, such as retail, have. But that threat has not gone away, as a much wider array of stakeholders feel the impact of data.

The one certainty is that change will come and that means rethinking the business model, to think well beyond operational silos. Data is blind to those silos. Data cannot be kept insulated inside such corporate niches. Machine learning and the Internet of Things is accelerating this dynamic.

By putting digital and data centre-stage, oil and gas companies will be able to capture far more than the estimated 5% that the industry currently captures.

Organisational and technical hurdles will remain. But above all, the opportunities promised by data integration depend on people. Companies are only as good as their people and they need to be allowed, and encouraged, to develop this untapped potential. The next few years will show if oil and gas companies are ready to walk the walk, as well as some have talked the talk.

