digital energy journal

Why subsurface professionals are detectives

Improving understanding, attitude and leadership

Keeping workforce engaged with safety

Viable plans for small reservoirs

Persuading drillers to use analytics

April / May 2016

Issue 60

Finding Petroleum

Official publication of Finding Petroleum

Finding Petroleum

digital energy journal

Events 2016

Transforming Subsurface Science
London, 18 Apr 2016

Subsurface IT and competitive advantage
Aberdeen, 04 May 2016

Transforming subsurface insights
Stavanger, 10 May 2016

Finding Petroleum Opportunities in Iran
London, 19 May 2016

Finding investment opportunities in oil & gas industry companies
London, 07 June 2016

Finding Oil & Gas in Mexico
London, 20 Sep 2016

Doing more with Subsurface Data
Kuala Lumpur, 04 Oct 2016

Doing more with Offshore Engineering Data
Kuala Lumpur, 05 Oct 2016

Admission from £20

Find out more and reserve your place at

www.d-e-j.com

www.findingpetroleum.com

digital energy journal

Issue 60 April / May 2016

Future Energy Publishing Ltd
39-41 North Road,
London, N7 9DP, UK
www.d-e-j.com
Tel +44 (0)208 150 5292
Fax +44 (0)207 251 9179

Editor
Karl Jeffery
jeffery@d-e-j.com
Tel +44 208 150 5292

Advertising, event sponsorship and Exhibitions Manager
Richard McIntyre
mcintyre@d-e-j.com
Tel +44 (0) 208 150 5296

Production
Wai Cheung
wai@tankeroperator.com

Subscriptions:
£250 for personal subscription, £795 for corporate subscription.

E-mail: **subs@d-e-j.com**

Front cover art by Alex McKenzie, artist, Digital Energy Journal

Printed by Printo, spol. s r.o., 708 00 Ostrava-Poruba, Czech Republic. www.printo.cz

Digital Energy Journal shares expertise about how to get more value from digital technology in the upstream oil and gas industry

Subsurface detectives

by David Bamford, Petromall Ltd

Subsurface professionals use a range of different tools and methods to try to work out where oil might be. How should this toolset be updated to take advantage of new digital technology?

Ultimately, subsurface science can be summarised as "drilling profitable wells".

The key is to learn how to do this in a predictable, repeatable way (as opposed to drilling 'on trend', in a pattern, or effectively randomly).

We are really detectives, subsurface detectives, taking scraps of evidence, all sorts of expert insights, and coming up with a story. The available methodologies are rule-driven interpretation; data mining (using analytics); modelling and inversion.

Rule-driven interpretation

Well-established 'rules' have been proven for stratigraphy, structural geology, sedimentology and describing petroleum systems especially by creating Gross Depositional Environment (GDE), common risk segment (CRS) and composite common risk segment (CCRS) maps. Nowadays these 'rules' are most commonly applied through seismic data, especially 3D seismic data.

The key 'technologies' are a) large quantities of inexpensive multi-client 3D seismic and b) commoditised interpretation workstations.

In truth, this methodology has now become completely commoditised. Little commercial advantage accrues from getting it right, simply disadvantage flows from incompetent execution.

Thus, if future competitive advantage is to be found, it must lie in either data mining – applying analytics to data sets that are so large that they do not allow easy interpretation by humans - or modelling and inversion – especially those using and/or integrating more powerful geophysical technologies than towed streamer 3D seismic!

Data mining

We can access satellite and airborne data, a significant variety of well results (logs, cuttings, core, flow rates), potential field, seismic, surface geology from a wide range of proprietary and public sources in diverse formats, with different accuracy, coordinate systems, and units of measurement.

We can be confronted with truly huge amounts of data and it is critical that we extract the key information from all of it rather than looking at only a sub-set and/or simply entering the analysis with a 'going-in model' which we then look to authenticate. Analytic techniques allow us to do this.

The key 'technologies' are a) the ability to integrate large quantities of diverse data, and b) fast "analytics" applications, tuned to the problem in hand.

Modelling and inversion

Predicting physical properties such as density, magnetic susceptibility, electrical conductivity, seismic velocity from geophysical data whether gravity, magnetic, electro-magnetic or seismic. Also addressing complex subsurface structures. Of all these technologies, seismic remains the most powerful, offering the least ambiguity and the most resolution, providing a framework into which other geophysical data can be integrated.

The key 'technologies' are a) integration of physically diverse multi-measurements, and, b) currently 'niche' inversion + modelling applications.

The team

And so, we can make a conclusion about who does this work, in a team of subsurface detectives.

Rule-driven interpretation requires seismic interpreters and geologists
Data mining requires data scientists.
Modelling and inversion requires geophysicists.

Integration being the key to beating the competition!

David Bamford is a consultant with Petromall Ltd

Understanding, attitude, leadership

The oil and gas industry needs to understand the current situation, improve the attitude of its leaders, reduce bureaucracy and give young people more exposure to company activities, said Chris Bird, managing director of MOL Energy UK

"As leaders, how we choose our attitude really affects the industry," said Chris Bird, managing director of MOL Energy UK. "We can be grumpy, happy, excited or curious."

He was giving a talk called "transforming behavioural change," presented at the plenary session of the Aberdeen "Subsea Expo 2016" event on February 3, which is organised by subsea trade organisation Subsea UK. MOL Energy UK is part of Hungarian oil and gas company MOL.

Mr Bird is a former operations director of Venture in Aberdeen, and technical director for Centrica UK.

We need to change our mindset on how we deal with things - we are moving to a 'VUCA' world - Chris Bird, managing director, MOL UK.

Understanding the situation

The temperature in the oil and gas industry has changed, he said. "We have to understand it."

"The 20th century was great for oil, it will be known as century of oil. The 21st century will be known as the century of renewables and sustainability."

"Today, there's a myth oil is finite. No it isn't. It's infinite. We can't use all the oil in the ground today."

"Oil money is going to be hard to come by, that's my belief. If you have that belief your attitude changes."

We are moving to a "VUCA" world, he said, with VUCA standing for volatility, uncertainty, complexity, ambiguity. This means that "we need to change our mindset how we deal with things."

"I think currently oil is at the right price. Before, people paid more because they could."

If you look at oil price data since the industry began in the 1860s, adjusted for inflation, the price has only been above $40 three times, right at the start (1860 to about 1880), in the late 1970s / early 1980s, and since the mid-2000s. "$40 is only low compared to a few months ago," he said.

Meanwhile climate change is a big threat to the industry, with calls for a 30 per cent reduction in consumption over the next 15-20 years, and the world to be hydrocarbon free by 2100, which is just 84 years away.

In the past few years, the costs of oil production in the UK doubled, while the Brent futures price halved.

Meanwhile there are 2.5 times more reserves globally than there were in 1980s, and over 30 billion barrels of crude oil in storage tanks. Over $400bn of projects have been delayed or cancelled in the past few months – and a lot of that cost would have been spent on people.

"The UK Continental Shelf basin is the highest cost basin in the world, so we have to compete harder for money," he said. It doesn't sound like a good place to invest.

There are many changes which might happen outside the industry, for example travel by magnetic levitating trains could become cheaper, faster and quicker than by plane. Solar panels could overtake hydrocarbons in our children's lifetime, he said.

Leadership and behaviour

Companies need a mixture of leadership, management and coaching, three things which are rarely found in the same company.

There are many entrepreneurial companies with leadership and which are a bit chaotic. There are many bigger companies with good management but are very bureaucratic, with processes instead of leadership. "We need more empathy, we need an open mind," he said.

The industry will try to survive by putting effort into technology. "We're good at that. But what else?" Perhaps the industry should look to find ways to include trust.

Perhaps it would be good if more people had an understanding of how the oil and gas industry fits into the wider picture, and what it needs to do to make itself competitive.

Collaboration is often misunderstood in the industry. It is a process, a way of working, not a specific thing. It comes down to aligning your interests with other companies, choosing the right partners, and understanding what you know about and what they know about.

Oil and gas companies often do not have a culture to support collaboration, with managers often believing that a culture of competition works better.

The industry should be finding people who can be tomorrow's leaders, who can work in a VUCA world, he said.

The industry is not generally very interested

in these topics. "Every time we talk about behaviour and culture it's pushed to the side, we want to talk about compressor availability and supply chains."

"There's a lot of 'emotional stuff' linked to working with transformational change. "Men don't like it, so we need more females here," he said.

"It is really tough stuff, but if you do it right, we can be world class."

Companies need to plan organisational change with the same level of detail as planning an offshore project.

Leaders will need to develop skills in simplifying how they explain what the company does. "We mystify a lot of the time," he said.

"We have to make decisions on intuition. We want strength of character."

Companies need to make sure their culture is 'right', he said. "How do you know your culture is right? There are processes you can do to measure it. Look at blockages in the system and attack with vengeance.
Deal with people, deal with culture."

Another behavioural issue is that companies are perhaps too obsessed with reducing risk, to the point where they actually increase risk by increasing complexity. "Our industry is zero risk tolerance. We all want to reduce risk to zero. But it actually increases our risk," he said.

Reinventing ourselves

The UK oil and gas industry could go the way of the coal industry (ie nearly extinct), or it go the way of the car industry, reinventing itself and producing high value cars like the Aston Martin.

"My dream is that the UK industry becomes high quality. We can continue to explore the fields in the UK, and be an exporter of technology."

"We have to understand the economic engine, what drives our business.
We need an organisational change process, good leadership, supportive coaching," he said.

"The worst thing is when managers say it and don't believe it. We call it a 'plastic fuzzy'."

"Ask yourself, how much time you spend each day on 'mindfulness', thinking about your business today and tomorrow. Do you spend your time running around like a headless chicken? What you do today will be your destiny tomorrow."

Delegates at the Subsea Expo Plenary Session in Aberdeen

"People change for two reasons, they want to change and we help them to learn, or because they've been hurt and need to change," he said. "So how do we help our people to learn so they want to change?"

Why did costs go so high?

In the panel session Mr Bird was asked why he thought costs in the North Sea rose so much.

"In 1998 I went offshore, we were batch completing 7 wells," he said. "Today it takes 3-6 weeks to drill a single well."

"In 2008 we did 5 subsea projects in 1 year, all under £80m. Today its £180m for [one] subsea tieback. We've let our business increase in costs by 200-300 per cent in 5 years."

During 2008 to 2014, "everyone thought that $110 was the lowest price and we'd go to $200 and the costs would escalate."

If you had to try to finger what is to blame for high costs, Mr Bird blames firstly "The complexity of our infrastructure and subsequent commercial deals," he said.

Secondly, "at the time there was a tax grab. That sent people flying."

Thirdly, "because of $110, there was a huge demand for resources [people]. We started losing a lot of our resources internally."

One tendency the industry has is that the first reaction to failure is to put in a process. "We become bureaucratic. More focussed on managing the process," he said.

Training and experience

Mr Bird was asked about whether the industry will come to regret the way it is currently reducing training budgets.

"I do a lot of work with young professionals," Mr Bird replied. "We want to give them training but we also want to give them exposure."

"One guy came from downstream to upstream and told us he needed 10 years of [upstream] experience before he [was allowed to] do anything."

"In my early days [in a previous oil company] we took someone in their late 20s and said, 'you run this big project for us.'"

"We've got to give youngsters ability to come onboard."

"We need better mentoring, ensure they have someone to talk to when going gets tough."

This is serious

"The key thing is, is the industry in a disaster or a catastrophe?" he said.

Perhaps you can draw an uncomfortable parallel with the Piper Alpha disaster.

Some crew members thought it was a 'disaster' went to the designated fireproof safe refuge and perished.

Others realised it was a 'catastrophe' and put on a life jacket and jumped. "Quite a few of them survived," he said.

Chris Bird's presentation can be downloaded at www.subseaexpo.com

OGA is selecting its priorities

The UK's new Oil and Gas Authority (OGA) is selecting its priorities, and pushing the industry to drive down cost, said Gunter Newcombe, director of exploration and production with OGA

"Is it tough? Absolutely. There's huge efforts needed" - Gunter Newcombe, director of exploration and production with the UK Oil and Gas Authority

The UK's new Oil and Gas Authority (OGA) is putting together a clear five year plan of what it will try to do. It has a list of priorities, ranked for urgency, said Gunter Newcombe, director of exploration and production with the Oil and Gas Authority (OGA).

The areas of focus are put in four themes - regional development and infrastructure; technology and decommissioning; revitalising exploration; and asset stewardship. There is a strong strategic focus on 'what is best for the UK'.

Mr Newcombe was formerly in a number of senior roles with BP including VP decommissioning and HSSE manager. He was speaking at the plenary session of Subsea Expo 2016 in Aberdeen on Feb 5, an event organised by UK trade body Subsea UK.

The Oil and Gas Authority is scheduled to become an independent regulator in summer 2016. It will be paid for by oil and gas companies by a levy on production.

There will be an emphasis on improving regulation, including how licenses are allocated, but also 'soft' persuading, such as influencing and promoting.

Challenges include making sure the assets are properly looked after ('asset stewardship'), encouraging exploration and discovery, stopping the decline in production, and finding ways to stop the cost escalation.

This means a change of focus for UK oil and gas regulation. Before OGA was formed, the UK government's role was mainly regulating oil and gas operations, but not really encouraging it, he said.

Fighting back

"We are fighting back," he said. "In 2015 we discovered more than the Norwegian sector for the first time in 13 years, but only 13 wells drilled."

Production efficiency, the percentage of time that oil wells are actually producing (rather than closed for maintenance for example), has risen from 60 per cent in 2012 to 70 per cent now.

The production cost at the end 2013 was $30 a barrel. "There's a real push to halve that cost," he said.

"Is it tough? Absolutely. There's huge efforts needed in all those areas."

But "there's evidence people are working together and collaborating to try to recover."

Boards

OGA is setting up a number of 'Maximising Economic Recovery' (MER) boards, to replace the previous "PILOT" group (a partnership between the UK oil and gas industry and government), and the Oil and Gas Industry Council.

There are 8 MER boards, covering exploration, asset stewardship, regulatory development, cost and efficiency, technology, decommissioning, supply chain and export, skills.

The boards will have representation from different industry groups, including the regulator, industry body Oil and Gas UK and government.

Each board has 3 specific deliverables and will meet once a quarter, and report regularly to government.

"The government is listening. The oil and gas industry is important to the UK, they want to help," he said.

"There's a real effort and focus in ensuring regulators, government and industry work together, attack risks and make sure opportunities are realised."

Persuading

OGA sees a few times when it would be beneficial for companies to collaborate, "but sometimes you have to force it," he said. "To change behaviour is incredibly difficult."

"Everybody tries to do the best for their company, understandable. But if everybody does that, nothing happens. You can have a smaller piece of a bigger pie, not a bigger piece."

"At OGA was have facilitated change by getting people in a room and show them the common goal and get them to see it," he said during the discussion session.

"We're the facilitator [but] it would be great if companies could do it by themselves."

"OGA tries our bit to facilitate but we don't have any powers, we are using persuasion. It has to be invoked right now."

Young people

Mr Newcombe was asked if he thinks the industry does enough for young people.

"When you started your career many years ago you had a lot more opportunity," Mr Newcombe said. "The oil and gas business has stopped doing that."

OGA is aiming to support academia, with some of the funding in exploration being allocated to set up a university subsurface data visualisation facility, he said.

Safety

On the topic of safety, Mr Newcombe, a former HSSE manager with BP, said, "to me, safety and efficiency are one thing. There's nothing wrong with superb safety - you should become more efficient."

Gunther Newcombe's presentation can be downloaded at www.subseaexpo.com

How Bibby Offshore keeps the workforce engaged with safety

In the current business environment, many people might be distracted about job security and not thinking about safety, said Howard Woodcock, CEO of Bibby Offshore. Here's how his company keeps them engaged

Using a video about a serious incident to help get workforce more engaged with safety - Howard Woodcock, CEO, Bibby Offshore

The most important factor in safety is the behaviour of the workforce, and the workforce should be engaged with safety, and ideally, leading safety, said Howard Woodcock, CEO of Bibby Offshore.

He was speaking at the plenary session of Subsea Expo 2016 in Aberdeen on Feb 5, an event organised by UK trade body Subsea UK.

Bibby Offshore is based in Aberdeen and provides subsea construction and offshore operational and maintenance support. Mr Woodcock started his career as a seafarer, as a deck cadet with Bibby Line, and so perhaps has more understanding of the risks of being offshore than many senior management.

At the moment, "a lot of people are distracted and worried about job security, [thinking] safety is maybe not that important," he said.

"We believe further improvement in safety can only be through engagement with the workforce, more walking less talking."

"Workforce engagement increases when positive behaviour is seen to be the norm. That sounds simple, but we all have a role in this. Senior managers need to establish correct behavioural expectations."

Incident in 2012

A serious incident in the company in 2012 prompted a lot of thinking into how to get the workforce more engaged on safety.

A diver was working 262 feet underwater when his 'umbilical' line supplying air and heat became severed, leaving him with just an emergency air tank.

It took 38 minutes for colleagues to find him and pull him into a diving bell, by which time he had fallen unconscious. He since made a full recovery.

"We could have just investigated it and shared root cause analysis. But we decided to use this story to drive workforce engagement," he said.

Bibby commissioned a professional media company to produce a 44 minute documentary on the incident, with the length of the video similar to the time the diver was underwater.

Bibby provides the video in a large black box, together with a box of tissues, "because you will feel something emotional," he said.

Bibby wanted to use the video to build a more emotional connection with its staff, using the power of stories.

Measuring engagement

Bibby embarked on a program to try to measure how its workforce feel about safety. It put together a survey, posing questions like, whether they would feel comfortable challenging senior management.

It took several months to complete the survey, with all crews completing it, collecting 22,000 data points altogether, he said.

Based on the results, the company scored itself on average 'level 3,' meaning that 'workforce is 'routinely engaged with safety effort'.

There is a higher score available, for when the workforce is 'leading' on the safety effort, he said.

The survey found that every single worksite crew was different. "It gives you specific feedback and information on the areas of engagement," he said.

Using the information from the survey, the company could develop unique improvement plans for each worksite.

An interesting result was that "workforce thought that senior management support was poor," he said.

As an example, consider whether an individual at a worksite really does have the confidence to 'stop the job' on seeing something unsafe.

As a manager, "everyone says, 'it is OK for you to stop the job,'" he said. "But the workforce think, 'do they really mean that?'"

"[As managers] how well do you understand the way your people feel? Do your people believe your story?"

"We had a discussion with teams onboard and did an improvement action plan," he said.

As a result, "our statistics have improved, the feedback has improved, maybe our workforce thinks we listen to them."

"We reached into our extensive toolbox of initiatives."

As a result, "we've changed the way we do things, our divers have changed the way they do things."

To build confidence that senior management mean what they say, "I personally speak to everybody who gets injured and discuss what went wrong," he said. "You'd be surprised how honest people are."

"It is not a witch hunt, it is to demonstrate senior management are interested in why people got hurt."

Bibby Offshore "spent years and hundreds of thousands of pounds developing the tool," he said. It is now sharing it with the rest of the oil and gas industry free of charge.

Mr Woodcock chairs the Subsea UK safety leadership forum, where all managing directors share information.

Improving safety "isn't going to happen on its own," he said. "There are lots of tools to help you. Share your experiences and stories internally and externally."

"If we engage with the people who work for us, we'll quickly start to reap the benefits. That takes leadership."

Training but no commitment

In a discussion session following the talk, Mr Woodcock said that the industry needed to solve the problem of employers being reluctant to pay for training, if the possibility exists that the staff member might leave for another company, and "repay that investment to another employer."

"We have to find a way of getting around that," he said.

"We have the knowledge and ability to solve all of these problems, it is within our capability. It comes down to the will and commitment of individual companies."

But "the action coming out is slow to manifest itself."

Cost inflation

Mr Woodcock was also asked why he thinks North Sea costs went up so much over 2008 to 2014.

"I blame engineers for a lot of things. But we've been building cost on cost for best part of the decade," he said.

"We didn't make it stick in the 1980s. What chance do we have now?"

"The common them for me is leadership and engagement. As leaders we have the power I would encourage everybody to think about how they engage."

Howard Woodcock's presentation can be downloaded at www.subseaexpo.com

Developing small pools - Matt Nicol

If the industry could reduce the cost of developing small discoveries, or 'small pools', it could make a massive difference to the overall viability of the North Sea, said Centrica's Matt Nicol

A 50 percent reduction in the cost of developing small pools .. would make $20bn investment a viable proposition - Matt Nicol, director, Production and Non-Operated Assets, Centrica

There are 210 'small pools', discovered reservoirs of between 3 and 15m barrels of oil equivalent, in the North Sea, said Matt Nicol, director, Production & Non-Operated Assets at Centrica (previously UK operations manager for CNRL).

"These are not exploration plays, they are discoveries," he said, speaking at the plenary session of Subsea Expo 2016 in Aberdeen on Feb 5, an event organised by UK trade body Subsea UK.

A study has been carried out into what could happen if the capital cost of developing 'small pools' could be reduced.

It found that a 50 per cent capital cost reduction would lead to a big reduction in the minimum economically viable field size, and 150 of the 210 'small pools' would be accessible. This would lead to a billion barrels of new resources in the North Sea.

By comparison, 100m barrels of new resources were discovered during 2015 which were in larger pools.

It would also make $20bn of investment a viable proposition, and extend the life of many existing assets, and have positive impact on suppliers and employment.

The majority of the small pools are in the Central North Sea and the Moray Firth (an inlet of the North Sea, North and East of Inverness).

The UK North Sea Technology Leadership Board has identified 'small pools' as one of three main technology priorities for the entire industry, with the other two being innovations in well construction, and advances in inspection methods to manage integrity of aging facility. It has set up a small pools group, chaired by Centrica and Enquest.

Hackathon

The National Subsea Research Initiative (NSRI) recently organised a 'hackathon', bringing people from a range of different industries to come together to try to work out ways to solve the problem of making small pools viable from a subsea perspective. 160 delegates from 80 companies attended, including from academia.

The solutions were divided into 'facilities', 'subsea', 'process and flow assurance', and 'free radical', meaning anything goes.

The solutions were put together in a report, where the solutions were split into short term efficiency, potential joint industry projects, strategic initiatives, and long term projects.

Ideas for joint industry projects included "hot taps" (methods to plumb a subsea pipeline into an existing pipeline without closing it down); new connectors, and subsea boosting (pumping).

"Strategic initiatives" could include subsea storage and subsea processing.

Long term projects could include separation, flow assurance, biological cleaning and some kind of 'downsized EOR'.

The group is aiming to match technology suppliers with where the technology can be used.

"2016 will be an incredibly important period," Mr Nicol said. "We've identified a huge potential opportunity, if we can bring some of these technologies to bear."

Bringing small pools could also bring efficiencies in other ways, for example the cost of running infrastructure per barrel will be lower if there is more production, and the costs of decommissioning can be pushed into the future.

Matt Nicol's presentation can be downloaded at www.subseaexpo.com

How to be lean - Aker's Matt Corbin

The only way companies can survive at low oil prices is to improve productivity. How should they do it? Matt Corbin, head of subsea product management, Aker Solutions shared his thoughts

You can look at your entire value stream and work out how to make it more lean - Matt Corbin, head of subsea product management, Aker Solutions

"I believe we can have an industry successful at $30 [a barrel oil price], but not at the way we operate today," said Matt Corbin, head of subsea product management with Aker Solutions.

When the industry wants to reduce costs, the first option is generally to reduce manpower. "It means you do less with less. Let's not fool ourselves this is the answer," he said. Similarly if we reduce contractor's rates, it doesn't solve the problem.

The only answer is to find ways to do what you currently do at lower cost, or be 'lean'.

He was speaking at the plenary session of Subsea Expo 2016 in Aberdeen on Feb 5, an event organised by UK trade body Subsea UK.

Everybody thinks they run an efficient company, but every time Aker Solutions assigns a new team to try to find ways to achieve efficiencies, they manage to find some, he said. "I urge you to put a new graduate or apprentice on your 'lean' programme, they will open your eyes."

As well as looking at individual processes, you can also look at your entire value stream and work out how to make it more 'lean'.

"How many project managers manage project managers?" he asked. "It works for individual companies. But as an industry, the opportunity is massive."

Standardisation and simplification

There is also a "standardisation and simplification" subgroup, part of Oil and Gas UK's Efficiency Taskforce.

The industry has been talking about standardisation for many years but not making a great deal of progress. Mr Corbin found an acetate presentation on standardisation from pre-PowerPoint days. "I think we'll have to ban the word at some point," he said.

Perhaps the word 'simplification' is more useful, and for people to focus on short term quick wins, he said.

The group identified how much the costs of certain items such as valves and fabrication vary, and found that very similar items from different suppliers can cost 70 per cent more.

A great deal of money is spent on documentation, inspections and qualification

A lot of this could be cut for example if the industry all agreed on the same specification for paint, or it avoided the need to trace simple items such as fasteners.

There is too much bespoke engineering in the subsea industry, which is partly as a result of people's "drive to engineer", he said.

It all leads to much more documentation than is necessary. One item can have a 200 page document, where the first page is a 'certificate of compliance', the other 199 pages are all the details.

Centrica's Matt Nicol also had a view on this, seeing lack of standardisation as one reason for the cost inflation.

"We produce a 4 inch valve today, there are 27 different specifications all with 1mm difference," Mr Nicol said. "27 companies ask for essentially the same valve." It is because "an engineer in a company considered it should be slightly different."

In the panel session, Gunter Newcombe, head of exploration and production with the Oil and Gas Authority, also expressed a view on this. "Everybody has their own 'innovation'," he said. "It's not innovation, its, let's make lots of different widgets."

Condition monitoring

The industry should also move to better condition monitoring and maintenance regimes to help with asset stewardship.

As an example, consider that a few years ago we took our cars to a garage after a breakdown. Now we are moving more to doing maintenance at regular intervals, or cars which tell us when they need to be taken to the garage. At the same time, the average car mileage has increased from around 100,000 miles to 150,000 miles.

"Why is that beyond us in subsea - why can't we move to a proactive asset management?" Mr Corbin asked.

How to be more collaborative

In the panel Mr Corbin was asked how the industry can be persuaded to be more collaborative, when there is such a competitive culture.

"I think it's a silver bullet if we can find the answer to that question," he said. "We have a very commercial industry where everybody is out to win."

"We're going to have to be willing to give up commercial advantages and I don't think that mindset is there. Are we moving fast enough? Absolutely not."

Chris Bird, managing director of MOL UK, also on the panel, had a different answer, saying that people just need to try a bit harder and understand what collaboration really means.

"People think it means 'we're going to be friendly," Mr Bird said.

"But it is about alignment, selecting partners and an exit strategy.

Matt Corbin's presentation can be downloaded at www.subseaexpo.com

Ikon Science's Ji-Fi now used by "leading US indepents and supermajors

Ikon Science's "Ji-Fi" or "Joint Impedance and Facies Inversion" software is now used by "leading mid-size active independents and supermajors in the US, and have provided valuable results on two of the largest oilfields in the North Sea" just one year after commercial launch

Ikon Science's "Ji-Fi", or "Joint Impedance and Facies Inversion" software, which aims to provide a much clearer understanding of the subsurface, is now used by "leading mid-size active independents in US," just one year after the commercial launch of the software.

It is also used on two of the largest oilfields in the North Sea, and one of the world's largest oil discovery in the last 10-12 years.

The software is used to 'invert' seismic data by creating an optimum model of rock properties, or impedances, which can reproduce the observed seismic image. These impedances are related to the speed of sound and the density of the rocks. With increased understanding of these properties, the geoscientist can better detect and predict the presence of high quality reservoir rocks, oil and gas in the subsurface.

"I've been in this business 37 years, and Ji-Fi is as close to the holy grail [of understanding the subsurface from seismic] as I've ever seen," says Martyn Millwood Hargrave, CEO of Ikon Science.

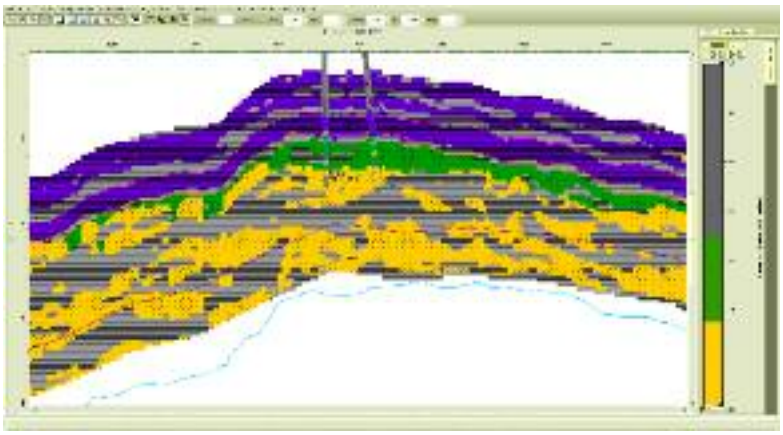
"The thing that makes me excited is that we're right at the beginning of it. The more data you see and the more results you get, the more enthusiastic and competent you get."

"It is going to make a big change to the way people explore and produce. This is an innovation the industry will make great use of, over the next 10 years."

"America has taken to it very quickly. They are quick to adopt new technologies."

"Here [in the UK] we're mainly using it on service projects on producing fields and helping to de-risk drilling prospects," he says.

Tullow Oil, which financed the development of the system, had exclusive access to use it for a while. Tullow has used it on its TEN (Tweneboa, Enyenra and Ntomme) and Jubilee fields in Ghana.
"Like most people, Tullow tried it out on areas they had good well control and thought they knew what was going on," Mr Millwood Hargrave says. "Now they use it in new areas."



Ji-Fi is designed to extract geological facies and petrophysical properties from the complex seismic signal and deliver directly a 3D description of the spatial distribution of facies and properties within a reservoir

The system has been commercially available for since early 2015. "We've got 10 or 12 customers who weren't using it a year ago, now using it very happily."

The company has been working towards this for 15 years, and been working intently on it for 5-6 years, with some of the company's top technical staff, including company technical director Drs Michel Kemper, described as one of the world's leading experts in rock physics and inversion technology.

Partly as a result of developing the technology, Mr Kemper has been appointed an 'honorary lecturer' this year for the Society of Exploration Geophysicists, and will be talking about it at SEG events.

There was also innovative mathematical and algorithmic methodscontributed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia.

The software aims to make the work as uncomplicated as possible. Since Ikon Science is a software company rather than a research company, it takes seriously its role to "make things easier, more effective and more efficient, so things don't break," Mr Millwood Hargrave says.

The software is available with a wide range of different packages, including leasing the software rather than purchasing it, or purchasing a service.

What it is

Ji-Fi is a complex piece of software – but one way to explain it is to say, it is pre-programmed with algorithmic models of impedance and seismic reflection characteristics of general number of rock types.

For example, if you are looking for carbonates, you can do the seismic inversion on the basis that the rock actually is carbonates. If you end up with a good model, then it probably was carbonates. If you don't, then you know it wasn't carbonates, and you know that the rock doesn't hold what you are looking for.

"When you are looking for rocks there's only certain types of rocks that exist," Mr Millwood Hargrave says. "Wherever you drill in the world you're going to find the same rock types, there's only five or ten."

"In petroleum geology you're looking for certain types of reservoirs, carbonate reservoirs, clastics, sandstone reservoirs- or unconventional reservoirs - a mixture of sand or shale, that's kind of it. There are subtle gradations between them all."

"If the program finds something that 'smells' like a carbonate reservoir and has rock properties of a carbonate reservoir - it probably is a carbonate reservoir."

"And if you know what you're looking for, you can reduce the complexity of the inversion problem."

"It is basically a way of calibrating seismic

data using rock physics, and a very sophisticated mathematical model," he says.

The results of the seismic inversion are detailed information about the rock structure, and perhaps information about fluids.

You can get a rough starting idea about what rock you are likely to encounter from regional information, outcrops or nearby well logs. The well logs don't necessarily need to be close by - they can be from wells hundreds of km away.

Another way to explain Ji-Fi is to say that you start off with separate 'low frequency' or simplified models of the subsurface, covering any rock you expect to find, such as shale, water bearing sand and gas bearing sand.

This is much more powerful than developing a single low frequency model covering all phases, as interpreters were previously trying to do.

Previously, rock physics was usually being used as a separate process to the seismic interpretation.

"It is a combined problem," Mr Milton Hargrave says. "You've got a problem for rock physics, and problem of doing the inversion of seismic data. We focus on both of those problems (at the same time).

Seismic inversion

Other than Ji-Fi, there are two main techniques for 'inverting' seismic data to get a model of the subsurface.

The first is 'model based simultaneous inversion', where you build a model of how you think the subsurface actually looks like, and then gradually improve it.

The second is geostatistical inversion, which uses statistical techniques and advanced mathematics to work out what the subsurface most likely looks like.

The problem with both techniques is that you usually need to have a lot of wells in the region under study.

Model based simultaneous inversion is a "fast technology which is good - but doesn't give you a reliable result unless you've got a lot of wells to constrain the inversion," says Michel Kemper, director of technology with Ikon Science.

Ikon Science receiving the Queen's Award for Enterprise International Trade 2015. From left to right - Steve Hunt, COO, Ikon Science; Martyn Millwood Hargrave, CEO, Ikon Science; Sir Ken Knight, Representative Deputy Lieutenant, on behalf of Queen Elizabeth II

If you have a well in the region, you can directly measure rock impedances with a well log tool, rather than trying to guess or estimate it from seismic data.

Geostatistical inversion "also needs a lot of wells, typically, it is very difficult to set up and only very skilled people can run it," he says. "It can take weeks or months."

"We felt some innovation was needed in this area."

Benefits

With Ji-Fi, less subjective interpreting is involved, and less assumptions need to be made during the process. You are not working as though the rock is simpler than it actually is.

The 'geological rules' can be acknowledged during the process, so you won't end up with something which makes no geologic sense (such as if you have water bearing sand above gas bearing sand in your model.

All of it leads to a much clearer understanding of the subsurface. It is particularly helpful when there are thin reservoir beds, small reservoir pools, or complex geometry. It may also show up reservoir formations that you didn't know about.

The process does not require having wells in the region under study. If you do have wells, you can use the well data at the end, to see if they give a value for rock impedances similarly to your study.

It fits an exploration pattern around the world where operators are moving from focussing on exploration to focussing on working out how they can get more oil out of their existing reservoirs at the lowest possible capital costs.

It could also be explained as 'bridging the gap between geology and geophysics".

Because Ji-Fi is not completely dependent on wells, it can be used in frontier exploration (where no wells have been drilled before).

You can also develop a number of different facies models and test them. For example you can do an 'amplitude vs offset' analysis and see if your actual AVO data matches what your facies model would give if it matched reality.

Ji-fi also creates a framework which could be used to add in other types of data, including wide azimuth seismic, 2D seismic, time lapse and PRM monitoring data electromagnetics. Ikon Science is working on ways that these types of data can be combined.

Case studies

The system was used over in one North Sea project, starting with trends derived in a regional North Sea study, with no direct well calibration involved.

The results of the project matched the facies and rock properties where they were known from well logs.

Another test was a giant North Sea Palaeocene oil field, where Ji-Fi came up with a result which was similar to the conventional methods (simultaneous inversion and geostatistics), but with a 'fraction of the time, and involving only light work on a handful of wells', Ikon Science says. The work could have used regional information instead of well data and ended up with just as good results.

It was used by one oil company in Ghana, and revealed significant additional oil volumes which have acceptable porosity and permeability values, and which showed fluid characteristics which were similar to those seen in the main oil-bearing reservoirs.

Ji-fi was used by Woodside Petroleum off the Northwest shelf of Australia, to help predict fluids and lithology near to existing wells, with work needed within 3 weeks.

The project was run on seismic data for Australia which is often available for open use. The oil company wanted facies models consistent with the wells and the geology, and investigate potential in open acreage.

Cray - building a supercomputer is getting harder

If you want a really efficient supercomputer for seismic processing, you can no longer build one to handle the expansive data sets coming out of the field by just adding more processors, explains Bert Beals from Cray Inc

Showing a pathway for oil and gas supercomputing - Bert Beales, global lead energy industries with Cray Inc

For about 20 years, one of the general ideas behind supercomputing was that as faster processors came onto the market, you can purchase them and install them in your computing centre, and immediately take full advantage of the regular cadence of clock upgrades that came with each new generation of microprocessors, says Bert Beals, global lead, energy industries, Cray Inc.

But that doesn't work any longer, because Dennard Scaling no longer applies, he says.

This means that faster and faster microprocessors are now requiring more and more power to run them, and more and more cooling to take away the heat.

Dennard Scaling has been one of the key theories behind the gradual increasing power of computers over the past few decades. It says that you can add more and more transistors into the same space but with a constant power density (amount of power per unit volume).

In other words as transistors get smaller you could get more processing capacity from the same space without using much more power.

The theory was first written about in a 1974 paper by Robert H. Dennard.

But the law stopped working around 2005 to 2007, mainly due to an increase in current leakages, leading to chips overheating as the transistors got smaller.

This meant that if you want to increase the computing capacity, there will also be an increase in power consumption, even if you can fit more transistors into the same physical volume. This leads to an increase in heat and so cooling required.

This leads companies to think much more carefully about how to put their supercomputers together and has led to microprocessor designs that support many cores on a single chip versus increasing the core clockrate.

Massively parallel

This means that supercomputers must support an architecture which is much more 'parallel' – often with several separate machines working on the same computational problem at once.

This requires a different kind of interconnect, memory hierarchy, and input-output strategy versus a serial optimization approach, "You have to think about the overall systems architecture, combined with software architecture, combined with the people skills, necessary to deal with processing requirements at massive scale," Bert Beals says.

"We have to carefully design our system architectures to keep all the cores 'fed'. It is very different from buying 1000 machines on internet and cabling them together yourself with Ethernet switches."

About Cray

Cray is a supercomputer manufacturer based in Seattle, Washington.

The company has a performance engineering organization which provides expertise to Cray's customer and partners to help optimize their applications to take full advantage of the parallelism inherent in Cray's platforms.

Cray has designed a special interconnect between the different computing nodes, which is far more efficient than Ethernet or even Infiniband. The interconnect topology is known as 'dragonfly', with a direct, dynamically routable connections between any node and any other node in the system.

Oil and gas supercomputing

The oil and gas industry has been using high performance computing since the 1970s for seismic processing. That use has continued and grown since that time. For example, it is estimated several large oil companies and seismic processing service companies have seismic processing power that measures in single and double digit petaflops.

"One key example of supercomputing usage within the oil and gas industry is the system employed by PGS to process some of the most complex and largest deep-water surveys ever collected.

The Cray system at PGS, named "Abel" after the famous Norwegian mathematician Niels Henrik Abel, is 14th on the Nov 2015 "Top 500" list and is the top commercial system on the list. (The list is online at www.top500.org/list/2015/11/)

Seismic processing

Seismic processing algorithms exist that will require supercomputers that are dramatically faster than what is available today, Mr Beals says.

We have requirements from the oil and gas industry which show a need in the next 3-5 years for machines that are 10x what we're running on today. In the next 10-15 years, we're going to need machine capabilities that are 100x what we're running today," he says.

Current seismic processing methods still must make accommodations for the limitations of current supercomputing technologies.

How will we design and deploy systems to support the explosion of algorithmic complexity and massive increase in the amount and resolution of data needed to accurately, realistically model the earth's subsurface?

To maximise drilling predictability, improve recovery ranges, and optimize production, you need as good an understanding of the subsurface as possible. "We want to be able to develop a highly accurate, high resolution elastic model of the subsurface of the earth which is as easy to navigate as Google Earth is for the earth's surface," Mr Beals says.
By having more processing power, geophysicists can do more processing iterations of their data before their deadlines, and the more iterations, the better the quality of the final result.

Seismic shot records are also getting longer. It is not unusual for recording times to be 3 or 4 times longer than shot records in the past. This leads to a tsunami of data to be processed.

One Cray customer has said that current full waveform inversion processing would have taken 'thousands of years' to run with the computers available 'not so long ago', now that time can be reduced to days or weeks.

Data management in the downturn

The industry response to the current oil price will lead to changing attitudes to data management. Does it become more important or less important? Oil and gas data consultancy NDB put together a panel of experts in London to discuss what is currently going on.

Data management in the oil and gas industry – the practise of ensuring compliance, high quality and availability of business critical data – was enjoying greater recognition at the point when the oil price began to fall. How is this progress affected by the oil companies' response to the low oil price? What are the essential data activities for the oil companies?

Oil and gas data consultancy NDB put together a panel of data management experts, including people who had worked at for many years with many oil companies and service companies, to discuss the question. This article is based on the key points raised in the discussion. The full list of participants is shown below.

The oil companies response has to reduce contractors reduce staff and cancel or postpone projects. Business projects as well as any projects to address data. Typically the data models and plans that are created in projects that are stopped are not effectively archived. Meaning that the technical records are lost and will need to be recreated.

However, the low oil price could mean that oil companies take data management more seriously, because there might be mergers and acquisitions of companies coming up, and a company with better organised data might be more valuable to a buyer.

One of the barriers to better data comes from a lack of engagement from the business, at all levels. Perhaps the discipline and management teams have more time at the moment to examine their own practice and how it is recorded and managed (through data).

Divestment projects

The quality of the data impacts the value of the asset.

Divestment projects have been a major source of work for data management consultants over the past year and a half. It can involve a great deal of work, sometimes feeling like untangling a ball of wool.

There was one example of a UK company who wanted to sell a UK offshore asset, but their data was not in very good condition, which meant that the sale dropped through, the buyer didn't want to take on responsibility for the data.

Under UK law, companies are responsible for managing data about their operations forever, and the only way they can avoid this responsibility if by finding a buyer for the asset.

There is another example of a sale of some offshore oilfields, which was close to agreement. The sale included all of the seller's assets in and offshore UK.

A data management consultant, assisting with the transaction, found that the selling company had also done some onshore drilling, including on land which was later paved to make a road leading to the company headquarters, which the company had completely forgotten about.

The buying company would have been responsible for this forgotten onshore well – and liable if it had caused any problems.

Increase capability

Consultants – people who previously worked in the industry in full time positions but are now available for a daily rate – could find themselves in much bigger demand after the industry gets going.

"You can get consultant onboard quickly and cheaply," one participant said. "Consultants [will be] the main sources of expertise."

However companies might be advised not to outsource too much. One participant recalled an example at a (name undisclosed) oil major that went too far with outsourcing – and found it did not have in-house personnel with the skills to detect when a vendor was changing the scope and extending deadline unnecessarily.

The phrase 'big crew change' has been used in the industry since around 2008, where companies believed they were about to lose a big chunk of their skilled staff to retirement, and wanted to implement systems to 'capture

Discussing data management in a downturn - from left to right, Dave Cowen, Steve Hawtin, Andy Thompson, Chris Eastment. Photographer and discussion facilitator, Ed Evans.

their knowledge'.
Looking back on those times, it seems that the industry did not really address the problem.

Perhaps it will be the same after the current downturn – the industry might lose may people and have new people entering it when the business picks up – but still without the habit of getting better at capturing knowledge.

Getting people to care

A fundamental problem with oil and gas data management is that staff and managers still don't care about it enough. Looking after it is nobody's job, and the people who benefit the most from it are the people who will need to use it in future, not the people who are using it at the moment.

Perhaps the only way to get people to care about data management is through company enforcement. The company needs to specify the minimum that needs to be kept in good order – for example say that the well logs, at least, must be well managed.

One issue is that oil companies often seem to treat the entire IT function as a commodity, something necessary but which adds no value, and so the emphasis is on doing it for less cost. This approach is perhaps not the best for oil and gas data management, because good data management can increase the company's competitive advantage.

Perhaps in low oil price era companies can be more persuaded of the value data management can give.

"Data management is a core competency of an oil company," one participant said. "That's the only way an oil company makes money. And yet senior managers see it as IT - something they want to do as cheaply as possible."

Data management can help subsurface experts get a better understanding of their reservoirs, which becomes more critical in a low oil price era, where there is less room for error. One company plotted a fault 110m away from where it actually was, due to misaligning their subsurface data. This meant that they actually had a lot more oil than they thought when planning the development.

Medium sized companies

Data management is perhaps a bigger challenge for medium sized companies.

In smaller companies, there often just a few people doing technical work, which knows where everything is. In smaller companies, there are often individuals who will do all of the data management as well as many other roles. They are unlikely to be cut due to cost savings.

Larger companies, oil majors and NOCs, will typically have entire departments covering data management and spend all day worrying about it. Someone can move from Nigeria to Aberdeen, and they know where to find things. The data 'service' for a large company is a relatively low cost.

It is the medium sized companies who have problems as they are trying to achieve a certain maturity level and define a service for technical data. They are likely to abandon these efforts and revert back to a reliance on one or two individuals.

Roundtable discussion

This article is based on a roundtable discussion forum hosted by New Digital Business at their office in London on January 28.

The participants were Steve Hawtin, author of a book "The Management of Exploration and Production Data" and formerly solution architect at Schlumberger;

Dave Cowen, senior consultant with New Digital Business with over 30 years working in petrotechnical computing, predominantly with oil majors.

Andy Thompson, a consultant, former senior account manager with Schlumberger Information Solutions;

Chris Eastment, a data management consultant, who spent 25 years in full time oil industry roles, including with Burlington Resources and Premier Oil.

The facilitator was Ed Evans, MD of New Digital Business.

Essential data activities in a downturn

By discussion facilitator Ed Evans, managing director, New Digital Business

Should the recession persist or worsen then further options such as outsourcing, offshoring, remote data storage (cloud) and 'applications as a service' will become more common.

Decisions such as these require competency in E&P Data Management to sift through the hype, risks and potential benefits for such a service and to ensure that benefits are realised.

This leads nicely to the most important factor for the 'essentials' identified by the panel:

Retain or build data management competency within the organisation. It is critical to the E&P organisation that data management competent resources are working in your interest, ideally as employees.

Ensure that the formal organisation is in place and is supported by effective Governance.

Redraft your "strategy and principles" around data management, in order that all activity is in support of the business purpose. This means that 'vanity projects' and 'cottage industries' can be cut.

Data relating to safety critical systems is managed as an essential to the business.

Activity (business cases) should be examined with more scrutiny. This is already happening and it is a good thing that the decision makers look more closely at data management business cases and the claimed costs/benefits. This is high quality business engagement.

In the UK the new Oil and Gas Authority (OGA) compliance rules will allow reduced obligations and costs.

What to stop

These are things that destroy value and increase the sense of division between DM/IT and the business.

Poorly conceived and poorly defined projects and activities with unrealistic expectations

Stop implementing software as 'the solution' without understanding consequences for the business – including user productivity, team productivity, workflows, project data and corporate asset data management, support and infrastructure costs.

Zolnai - Helping companies map their processes

UK company Zolnai.ca is helping oil and gas companies put together maps of their processes, which can be used to understand who does what at which time, and where the constraints are, and if the right information resources and software are in place

Helping oil companies map their processes and information supply chains - Andrew Zolnai of Zolnai.ca

UK company Zolnai.ca is developing a service to help oil and gas companies understand their processes in more detail and put the information in a diagram, so people can have a better understanding of what they need to do when, and make sure the right information and software is in place.

"Business process mapping" or "business process management" is not something new, but probably needs to be done in a different way in oil and gas exploration to how it is done in other business sectors, such as insurance and aviation.

For example, oil and gas companies might have a small team of people, or individuals from a number of teams, doing a complex process such as mapping a play fairway, or preparing for a licensing round.

The oil and gas industry does not work from a single central database (as airlines or insurance companies might), it has many different databases and file formats, which all need to be passed from one person to another. So the processes cannot be managed with one monolithic piece of software, as we might see in other industry sectors.

Also oil and gas exploration can't really be structured using "Gantt charts", which show who is going to do what in a schedule. They don't show the various dependencies involved (ie what different processes need to happen in what sequence), and how the information needs to flow.

Applications

For example, the service could be used to map the process a company follows in preparing for a license round.

It could be used to map the processes involved in doing a "Play Fairway Analysis" of reservoirs, to try to identify if a region of interest has all of the necessary components for an oil reservoir - a source rock, a charge, a seal, a reservoir. There are a number of steps which need to be taken to do this, all requiring different software tools.

It could be used to map standard subsurface modelling processes, and make sure everybody is aware that the master data needs to be in place before the modelling work starts. "That sounds very obvious but you wouldn't believe how often people put the cart before the horse," Mr Zolnai says.

Perhaps there are lessons learned from how well the company co-ordinated its work for one license round, which would be useful in the next one, and this can be included in the process map.

Andrew Zolnai says that based on his past experience doing this sort of work, "half the time people never really thought about what the processes are".

The processes are nearly always unique to the company. "No two process maps will look the same between different departments," he says.

Benefits

Process mapping can benefit all domain experts in the company, including geoscientists, engineers, IT people, business people, financial people, and senior managers. The process map can be understood by both technical and non-technical staff.

It can help people determine what is most important. The tool could also be considered a 'mind map' – it helps experts get a better understanding of where they are at the moment.

The tool enables experts to spend more time doing what they want to do – expert analysis and decision making – and less time trying to chase down the right piece of data or working out what they need to do next.

Having everything laid out in a process diagram can help the company understand where weak points are, for example a high amount of reliance on a certain vendor, or that there will be a certain task with a short time window coming up, due to a delay to get a necessary government permission.

People know what to expect from their colleagues – what work should arrive at what point in the process, and what they should leave for the next person to do their shift. You can track the information which needs to be shared between different disciplines, such as engineers and geoscientists.

This process mapping can help companies work with new staff, particularly staff from other cultures, who may pick up differently on the way the company works, where things are not explicitly stated.

You can see clearly who is expected to do what at which point in the process. There is much less potential conflict.

Once you have the map in place, you can see exactly what software tools specific individuals need to do their work and understand what is going on, and make sure they have them.

This work can help identify problems with your information flows – for example where a certain piece of information (which might be required later) is not being properly stored or labelled, or if someone does not have the software they need to do a task.

This process can sometimes show up the reasons why some things aren't working as well as they should be, for example a certain step hasn't been followed (like analysing the understanding of the oilfield), which can lead to problems (e.g. you might be working on a wrong assumption about the structure of the reservoir).

Software

The core software to make process maps for the information supply chain is produced by a company based in Wellington, New Zealand, called LINQ Ltd. (website www.linq.it) .

The LINQ software is designed as a tool to "bridge the communication gap between technical experts and non-technical executives," helping people to "target the most valuable IT improvement first."

Paradigm: updated software, GE tie-up

Subsurface software company Paradigm has launched version 15.5 of its subsurface 'Solutions Suite' - and announced a tie-up with GE to give reservoir tools to production engineers

Subsurface software company Paradigm has launched version 15.5 of its subsurface solutions suite, with an aim to help geoscientists improve productivity and maintain high resolution models throughout the interpretation and modelling process.

Version 15.5 also has tighter integration with other Paradigm products, and better connectivity with software from other companies.

Seismic data is increasingly being acquired in high resolution, and when companies want to reduce seismic costs, they are tending to cut back on the lower resolution surveys, not the higher resolution ones, says Indy Chakrabarti, senior vice president of Product Management and Strategy at Paradigm.

It is important to be able to work with this high resolution data all the way through the subsurface interpretation workflow, otherwise there's not much point in having it.

Oil companies are demanding more accuracy from geophysicists, because their drilling budgets are lower. This means that they need geophysicists to rank, or 'high-grade' their projects, rather than just give them a list of places which look like they are worth drilling.

"In the past, they'd say, 'we have 10 prospects, we'll go after them all,'" he says. "Now they say 5."

To help geoscientists work faster, Paradigm is making efforts to reduce the number of mouse clicks required to do a particular workflow, with a 2 per cent reduction being seen as worthwhile.

Paradigm is also aiming to increase 'automation' of the workflows. This doesn't mean automating the actual interpretation of the data, but making the steps easier – so (for example) the data you might need next could be pre-loaded. This is like the way that Google Maps pre-loads a map next to the one you are looking at, so it is available quickly if you need it.

The computer system can also remember the procedures you are doing. So if you are doing a certain analysis process on an area of your interpretation, you could move the cursor to a different area, and the computer would run the same procedures on the new area.

Cross domain workflows

Paradigm has also been developing 'cross domain workflows', where people from different disciplines such as petrophysicists and geophysicists can work more closely together.

They can work on the same data, but it is displayed in their respective software applications the way they want to see it.

Also the petrophysicist's updated data is immediately available to the geophysicist and the subsurface modeller.

There is also better integration between the geologic modelling and interpretation applications, and better ways to add Paradigm well display and mapping capabilities.

"Applications plug together, and data naturally flows from one user to the next," Mr Chakrabarti says. "Now the guys downstream don't have to load the data".

Paradigm and GE Oil and Gas

To help production engineers get a better understanding of the reservoir, GE Oil and Gas as announced a plan to tie together its "RDPO" (Reservoir Driven Production Optimization) service with Paradigm's subsurface modelling software.

This means that they can do their RDPO analytics with a 3D model of the subsurface immediately available.

In the future, RDPO can run on GE's "Predix" cloud service designed for industrial big data and analytics.

Production engineers – people who make decisions about day to day production – typically only have information from specific wells to use as a basis for their decision making.

They can see the trends in production from individual wells, and use this to make decisions about adjusting chokes, artificial lift, changing an injection strategy or infill wells.

The weakness with this is that production engineers are not using the available knowledge of the subsurface to make their decisions.

For example, production from one well could be lower because water injection is pushing oil towards another well, and their overall injection is up. The best move might be to do nothing, rather than increase production from the first well as well.

Or production could be lower because water is entering a reservoir close to this well. The best move might be to drill a new well at another point in the field, far away from where water is entering.

To be able to take these factors into account when making decisions, production engineers need an understanding of the reservoir. Not a massively high resolution one (that a reservoir engineer might have), and not one with any detailed subsurface data (that only a geophysicist might understand), but just one which shows the key points which are useful to a production engineer, similar to the ones described above.

An analogy is the way GE has sophisticated analytics systems to monitor and understand what is happening with aircraft engines – but it realised that the value of this analytics is limited if you don't know anything about the atmosphere around the engine – air pressure, temperature and quality.

There is a big prize to helping production engineers make better decisions. GE estimates that oil companies might be able to save 10-25 per cent on the lifecycle costs of operating wells, if they can improve problem detection and treatment design.

Production engineer decisions

A typical production engineer today might have 200 to 300 wells that they are managing, says Indy Chakrabarti, senior vice president, product management and strategy with Paradigm.

"We are adjusting the reservoir model so that it's relevant to a production engineer," Mr Chakrabarti says. "A production engineer doesn't need to see all the seismic and all the complexity of facies change".

Further information is online at www.pdgm.com/paradigm15-5

How to make a 'data lake'

There has been a lot of talk lately about the benefit of putting all of your data in a 'data lake' so you can run analytics on it. But how do you make this approach work? Ketan Puri of Infosys shares some ideas

Designing a data lake for an oil and gas domain is quite a challenge. We rarely see success stories in this domain. To extract value out of the data is more challenging than extracting oil itself.

The Data Lake is more than just data storage. It is a concept that defines the Data, Infrastructure, and the services that enables an enterprise to have a holistic view of their assets.

This covers a number of factors.

Linear Scalability/Elasticity – it should be possible to expand the storage, and compute independent from each.

Multi-Tenancy – data should be available to different user groups without actually replicating it, serving different uses on the most granular data sets.

Cost Transparency – the sponsors of the project should have very clear expectations on what they are going to get out of their investments in both short term and long term basis.

Multi-Protocol Support – the data can be accessed and operated leveraging multiple protocols. A UNIX administrator should be able to work on the same data as compared to the Windows user. Even Applications should be able to seamlessly communicate with the same data set without the need to store a copy of the data

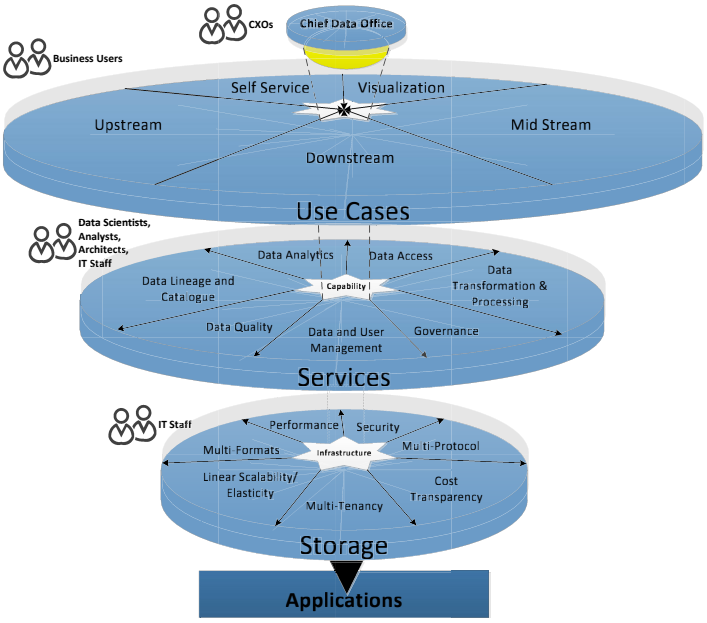
Security - to seamlessly integrate and apply security policies on the data, services and infrastructure across the enterprise. To make the data secure where ever it resides.

Performance - to meet the expectations of the data users (Real-time, batch, or transactional). The hardware and software should be optimized for every use. Every business unit should define their performance parameters before even starting the design of the data lake.

Multi-Formats - provide support for various data formats and standardize it for different types of data sets. It's not about cleansing the data but to make it consistent across the enterprise governed by business standards and policies.

Services

A good Data Lake should support the following services.



Data and User Management: To provide seamless services (both for business and IT) to manage their data and define policies for variety of user groups with different needs

Data Quality: To provide basic quality processes to ensure the lake is not getting dirty (Data Swamp). These processes vary from business to business depending on their data sources and governance around it.

Data Lineage and Catalogue: To understand how data traverses across the different layers of the enterprise from the source to the end user/applications. It provides the data stewards a hawk view of their data and its transformations enabling them to apply enterprise specific policies related to data retention, archival, access etc.

Data Analytics: To enable the enterprise to run tools and techniques (home-grown or 3rd party services) to crunch the data and apply models (real time and historical) leveraging best brains of the enterprise which is often very limited in this domain. Businesses should be able to leverage their 2nd most valuable assets (their knowledge workers) to work with the machines to extract real value for the enterprise. I would call human assisted machine learning.

Data Transformation and Processing: Provides data scientists the ability to cleanse the data, apply business specific transformational rules, and business policies governed by operational norms for executing high end data science work.

Data Access: To make the data freely available to the businesses in a consistent, secure and standardized fashion enabling them to work on the data sets that concerns their specific needs. The focus should be on Value generation than on devising ways to extract and manage the data.

Governance: Provide the ability to manage data lifecycle, build business processes, apply policies that promote the enterprise from data generator to value creator based on core principles and standards. CDO can enable the entries as a Data Driven Value based organization where the operations are governed by KPIs.

Self Service: to enable this capability the Data Lake needs to be well architected based on the key tenets defined above. It is about handing over the data back to the business to work on it seamlessly with minimum IT intervention.

Visualization: this is one of the most in demand capability from perspectives of the business, IT and data scientist community to operate on their data. Visual analytics and advanced visualization is not only useful but creates a totally new perspective of the richness of information and value that the Data Lake can provide.

Amy Zeringue - How to optimise drilling with data

Persuade drillers to change by appealing to their competitive nature; managing the number of software packages in use; develop low cost agile tools (perhaps in-house); and have people on staff with expertise in both oil and gas engineering and digital technology – some recommendations on how to optimise drilling with data.

By Amy Zeringue, manager of information technology, Chevron Global Drilling and Completion, and co-chair of the executive committee of SPE Intelligent Energy 2016

Amy Zeringue, Chevron

Start with the business problem

It's best – it's essential, actually - to start with a problem, described in business terms by the users who are experiencing it, and define the best way to address the business problem through a solution that incorporates improved or refined processes, information technologies (if applicable) and the right skills to enable the solution.

From a data perspective, the biggest error I've seen is that data management efforts are often pursued from a strictly IT point of view.

We capture and present copious amounts of data, often overwhelming the user with visualizations or dashboards that don't get to the heart of the business problem they're trying to solve.

Focusing in on a specific business process and breaking it down from the top – What information do I need to make this decision? What and where is the data that constitutes the required information? - is always the better method.

Persuading drillers to change

In Chevron, we used drilling data and analytics tool to offer insights into rig and drilling performance that had been on the decline in one of our offshore business units.

The data and the tools we presented allowed our engineers and managers to be more efficient in having instant access to the insights they needed to gauge their performance.

We then used that analysis to identify trends, behaviours, and designs that had caused the decline, and then put in tools and processes that drastically changed how our teams were managed, how our rig contractors were rewarded, and how our operations were planned and executed.

The analysis drove our drilling department and our business partners to think and work differently. Eventually, the tool and data became secondary – the change was engrained in the teams.
Taking the example above, we were able to motivate our drilling personnel to change through a combination of factors.

First, we appealed to their competitive nature. We compared drilling performance trends across rig teams and made performance improvements visible.

Incentives helped too – things like performance awards and management recognition. Performance improvement is a key focus item for us – if process change through information technology is a means to that end and if management supports the change, it will happen.

Too much software

One challenge to new software adoption is that we have too much.

As a major operator, we have hundreds of software packages – large and small – resulting in redundancy and confusion.

Perhaps what's driving the fact that the industry is not "taking advantage" of available software is that it's hard to justify additional investment in new tools when we have invested for years in multiple software packages and feel we haven't realized their full value proposition.

We have implemented centralized governance for our IT investment with Chevron's D&C department, looking for ways to leverage common tool sets across our organization in support of our key business processes.

More agile tools

Also, while the need for large scale, integrated engineering and geophysical application will persist, there is an opportunity for more agile development of tools that can meet specific business needs and offer great value.

We've had some recent successes here at Chevron with business intelligence and analytics solutions that were developed for a fraction of the cost of commercially available software- they solve a particular business challenge and have a rapid rate of delivery.

In today's world of on-demand apps, this approach offers a more immediate value realization vs. traditional major IT solution undertakings.

What is the role of analytics

[The role of analytics] goes back to the identifying and addressing a business problem that needs to be solved.

Investing in analytics for analytics sake without a value proposition or having IT departments shop around an analytics platform becomes perceived a solution looking for a problem. This is not the environment for that.

Experts should identify where analytics can offer the most benefit and pursue those with energy and focus. Business sponsorship is essential and subject matter expert involvement is also a key to success.

One of my favorite mentors, Jim Crompton, co-wrote a book titled, 'The Future Belongs to the Digital Engineer'.

In it, he describes the evolution of a hybrid skill set, the Digital Engineer who is 'engineering-talented, information-technology-competent, and business-savvy'.

Our digital world is going to insist on alignment between traditional information technology teams and the business customers they serve, almost to the point where the two could eventually become indistinguishable.

Amy Zeringue is co-chair of the executive committee of the SPE Intelligent Energy 2016 conference, to be held for the first time in Aberdeen from 6-8 September 2016. www.intelligentenergyevent.com

BP and Tessella using analytics to improve drilling

Oil major BP, together with analytics company Tessella, developed a "Well Advisor" tool, to help analyse and present data, which could be used to improve efficiency

Oil major BP has developed a tool called "Well Advisor", working together with analytics company Tessella, which can help company experts to avoid drilling downtime and improve drilling efficiency.

Using this tool, BP's experts have access to clear visualisations of vast quantities of real-time drilling data, allowing them to spot potentially unsafe and expensive issues before they happen, and to identify how to continually improve operational processes.

High volumes of different kinds of data are captured throughout the drilling process by a variety of sensors which transmit data at different intervals and often in different formats.

Parameters such as pressure, torque, hook load, weight on bit, mud flow, rate of penetration and RPM are captured and fed back to BP's rig site operators and engineers.

This data can be used by BP engineers to ensure their process operates at peak efficiency and to respond quickly to warning signs.

For example, stuck pipe, where the drill, casing or completion string gets physically stuck in the wellbore during tripping (moving the tubular in the wellbore), can cost $10,000 to $1,000,000 per day in NPT. There are also environmental and safety risks of the intervention needed to resolve it.

"The BP Well Advisor is one of best examples of real-time data aggregation and visualisation in the industry," reckons Mark Mundo, BP Well Advisor Program Manager.

"We have deployed this technology across a number of challenging wells and it has already saved us an estimated $200 million capital expenditure in reduced non-productive time."

Tessella's role

Tessella worked closely with BP's experts to understand not only the potential real-world issues that could occur, but also the information needed to make the wisest operational decisions.

Tessella staff spent time understanding the work processes for drilling operations, the data that is most valuable to engineers and rig site operators, and the best way to present the information to allow them to make timely decisions.

Part of the challenge was to develop and adapt the underlying data aggregation and visualization platform so that it could best meet the needs of BP engineers and rig site operators.

Tessella worked closely with all parties to specify new, feasible visualization approaches, and associated data analysis components, in order to ensure the evolving system supported BP's workflows.

BP drew on Tessella's rich experience of handling and presenting similar data in various industries to guide their thinking.

Shaping the system

Tessella specified detailed requirements, in IT and programming terms, of what information needed to be displayed and in what format, what calculations needed to be performed, and the qualities of the data feeding the displays.

The requirements collectively add up to the system features that become key to effective decision-making.

An example is the demarcation of real-time data feeds into operational activities, and the further punctuation of data feeds with connection event markers, for example to indicate where the drill string is placed into slips to connect a new section of the string.

Engineers are able to readily identify correlations and trends from the data when the visualisations are demarcated by such connections and high-level activities.

Analytical components also benefit through the implementation of models that are fine-tuned to the activities being undertaken.

Other examples include progress of cement jobs, pressure test assessments and rate of penetration analysis.

In order to improve make-up torque quality assurance, Tessella worked together with Kongsberg, the supplier of the underlying SiteCom platform. It also worked together with a number of Tubular Running Service companies.

It was able to create a bespoke extension to the WITSML data transfer format that accommodates a detailed make-up torque assessment data package.

As well as identifying functional features, Tessella worked to ensure that data management, configuration management and data quality were also addressed and incrementally improved with each new release of the product.

Tessella has also worked with the platform vendor to ensure that specifications are aligned to their product vision whilst verifying that the final feature set met BP's requirements.

During software development, Tessella continued to work with BP to verify that the system did what it was supposed to.

Upon delivery of the software, Tessella played a key role in confirming acceptance of its features and also in assessing its trial deployment in the field.

Making it meaningful

BP's Well Advisor handles hundreds of thousands of data points, as well as graphical inputs such as tubular schematics, lithologies and wellbore geometries.

Even trained experts can't immediately spot areas of concern amongst such vast quantities of data.

So it was important that the displays were clear, concise and focused on presenting key information, both raw and derived, so BP's experts could quickly assess the situation and take the appropriate action.

For example, when tripping tubulars into or out of a wellbore, analytical components in BP Well Advisor identify static friction events, break-overs, pipe stretch, and recoil behaviors.

By observing trends in these events, BP's engineers can predict problems before they occur.

Another key benefit that BP Well Advisor promotes is global shared situational awareness. This means that engineers are seeing the same information regardless of where they work.

Not only is the data itself robustly replicated between networked databases, Tessella has worked with BP and the platform vendor to ensure replication of data configuration across all servers.

This involved a powerful data mapping service that abstracts the variation in service company naming conventions from the data management requirements, and also allows automatic switching of data feeds based on prioritization rules.

This service, aligned to BP workflows, has ensured BP Well Advisor is fit for purpose for its client and equips the product for an exciting feature roadmap.

Presenting data

"The BP Well Advisor visualisations present important data in a completely clear and comprehensive way, so it's not overwhelming," says Mark Claxton, energy sector director at Tessella.

"This provides advisory information on which BPs engineers can make informed decisions in real time.

"It's a bit like a car dashboard. If you see your temperature is too high or your tire pressure too low, you know you should pull over and do something about it.

"The BP Well Advisor is far more complex, but the concept of clearly presenting information you may need to act on, via a summary dashboard, is actually pretty similar."

Making projects more integrated

Imagine planning entire development projects around a certain profit margin – rather than trying to be as effective as you can and hoping you achieve a project margin at the end of it? io oil & gas consulting explains how it could work

Mark Dixon, COO with London consultancy io oil & gas consulting, suggested that the industry should look at development projects in a completely integrated way, and design them around achieving a certain profit margin.

He was speaking at the "Subsea Processing and Infrastructure Session" at Subsea Expo in Aberdeen on February 3.

So the work starts with the end in mind, identifies the top level requirements, and then they can cascade down.

You can start with an understanding of the entire project, both subsurface and surface, and identify what you think are the most important issues and then cascade down. For example, you can see which contractor commitments are the most important.

If there is a concern, for example different vendors not agreeing on a standard for a subsea electrical connector, this model provides a basis to work out what the impact might be on the overall project. If it delays or increases the overall cost of subsea equipment, will that capsize the project.

This way you can "understand how important or otherwise any piece of the project is," he says.

You can see what happens if you change any part of the project.

You can always see where you are, in terms of what net present value (NPV) you expect the project to be worth, and what your uncertainties are.

You can refine your 'master asset model' until you have the desired business outcome – a positive net present value of the project, and a sensitivity you can live with (ie if production is at the lower end of the expected range, you can still operate).

"You focus on things which really matter, not on the detail," he said.

"You can see how you generate value and where the break points are. As flow goes up and down, you can see what effect it has on value. You can make sure you hit minimum returns."

Above all, you "understand how your system works."

This practise is known as 'systems thinking', and is widely used in other complex industry sectors, such as aviation and defence, to understand the interdependencies and the levers, he said.

Working with vendors

This way, oil companies and contractors can work together, defining where they want to get to, and working with a common definition of value for a particular project.

Instead of going to the market and saying "right guys, what are you going to do for us" to try to get the best price, you start off with cost as an independent variable (ie how much you are able to spend) and ask the supply chain what they can do for that cost, he said.

This way you can "take advantage of the market conditions without taking advantage of the supply chain," he said.

Uncertainty

Big areas of uncertainty come from the rate oil flows from the subsurface, and the amount of time projects will take to get onstream, both of which have a big impact on the viability of the overall project.

You can model what you think the variance is, in production rates and through life costs, using error bars. "You can see how robust your solution is," he said.

"Robust" is a different objective to "optimised", and leads to a different way of looking at it, he said. "Optimised" suggests that you work out exactly where the parameters should be. But you can't do this because of the uncertainty involved in the revenue stream, i.e. the reservoir.

io oil and gas consulting

io oil and gas consulting is a joint venture between GE and engineering, procurement and construction contractor McDermott, aiming to help the industry move forward in the current environment, and help struggling projects get going and stick to their budgets.

io used this technique in a project for a major operator, developing compression facility on a large gas field.

The company wanted to spend the right amount on compression every year during the lifecycle of the project, taking into consideration the increased requirement for compression as the field declines, and basing the decision-making around the target NPV.

Primavera - improving efficiencies in turnarounds

Software company Primavera is developing solutions to improve the efficient delivery of turnarounds of offshore assets which should help companies hit their time and budget targets

Helping get turnaround work within budget and to schedule - Geoff Roberts, director industry strategy with Oracle Primavera

"Turnarounds", where offshore assets are shutdown every 3-5 years for necessary maintenance work, don't have a very good track record of hitting targets.

Over 68 per cent of projects take more than 10 per cent longer than planned, says Geoff Roberts, director energy industry strategy with Oracle Primavera.

The costs of this are enormous, when you consider that it means that the maintenance work takes longer than expected, and the platform is offline, and not producing oil, longer than expected.

Turnarounds are usually planned in great detail, with planning sometimes starting 18 months before, and work with contractors and suppliers – for an "execution window" of 20-30 days.

The organisation and other stakeholders (including regulators and contractors) have accepted this plan, agreed that the work needs to be done, and accepted that the shutdown for a certain period of time makes business sense.

There have been many studies into the reasons for turnarounds taking longer than expected, and it usually comes down to the scope of the work insufficiently defined before starting, and the resources – people and equipment – not being utilised as effectively as they could be, Mr Roberts says.

A big cause of the problem can be poor communications and co-ordination between departments, such as engineering, operations, maintenance, procurement, and external organisations such as contractors, suppliers and regulators.

In recent years, companies have got better at developing and managing processes and capturing data, but the overall outcome, in terms of turnarounds completed on time, hasn't been improving, he says.

Project management software company Primavera, owned by Oracle, is developing tools which aim to make scope definition, co-ordination, resource utilisation management and department integration much easier, he says.

Scope control

Poor "scope control" has been identified in a number of studies as a major cause of turnarounds taking longer than planned, Mr Roberts says.

Scope control means getting a clear idea about what you are going to do and what you are not going to do, which everybody involves accepts and understands.

We have to "capture scope, challenge it, and get everybody to think about what they're going to do, he says.

"The ability to understand what you're going to do still seems to be broken. "We're not pulling together to deliver one common source of scope."

There may be differing ideas about what exactly needs to be done, some ideas which are not relevant, or which can't be fitted into the 'execution window', the time when the plant is shut down. In which case it is better to sort it out beforehand, of course.

With good scope control, "everybody will have a vision of what needs to be done."

The scope discussion should start at the 'macro' level, looking at which major components are going to see work done on them – once that is agreed, the more granular discussions can take place.

As part of controlling scope, you will be identifying which are the best contractors and suppliers you want to work with, and making sure all of the necessary items can be delivered on time.

Companies are also starting to think harder about cost management. Planning discussions used to be about 80% on schedule and 20% on cost, now they are more 50:50, Mr Roberts says.

This gives another dimension to the "scope" discussion – working out what can be achieved for the budget available.

Keeping resources working

To complete a turnaround efficiently, you need to make maximum use of your 'resource pool', which means both people and equipment.

Mobile computers – tablets and phones – can be a great help here, Mr Roberts says.

You can capture 'status' – information about what has been done – as the work is done, rather than wait until the end of a shift to update systems.

This enables work planners to keep track of how the work is developing and be aware of any problems. If the schedules need to change, then everybody can be co-ordinated. Planners can also use the information do to 'what if' scenarios, testing what might happen based on the current status.

The mobile computers can also be used to keep site managers and executives alerted of anything they should know about ("management by exception") so they can quickly replan.

The plant manager knows exactly where the project is at any point in time, how the project is going, whether the right materials are available. The right documents are ready before the work starts, and the information is captured as the work goes ahead. You can make predictions about what is going to happen and act when things don't happen to plan, including recasting an entire schedule.

If there is a change to plan, people and equipment can be put to work on another activity, rather than wait.

The displays on mobile computers can be configured to the needs of the person working with them. For example a top manager needs a 'dashboard' of how the whole project is moving, and individual workers need information about their current activity.

You have the information each individual needs, and you have the overview of the whole project, all based on the same data.

Monitoring onshore wells by satellite

Satellite communications are proving very useful in monitoring onshore wells, because of their high reliability. The cost per megabyte can be higher than cellular, but that might encourage people to optimise the information that people need to fulfil their tasks, says Inmarsat's Chuck Moseley

Providing a larger volume of data from wells can be more of a headache than a benefit - Chuck Moseley, director of global accounts, M2M and IOE, Inmarsat

Many oil companies are choosing satellite communications for monitoring onshore oilwells, because the data communication can be more reliable than sending it by cellular or radio, says Chuck Moseley, director of global accounts M2M [machine to machine] and IOE [internet of everywhere] with UK satellite operator Inmarsat.

Oil and gas engineers and pipeline operators really don't like even short outages in data communications when they are monitoring something important, he says.

The cost per megabyte of sending data by satellite can be more expensive than using cellular or radio communications, but reliability often justifies return on investment.

Production engineers and other people monitoring wells from the company office often do not need a large amount of data.

Actually providing more data can be more of a headache than a benefit, Mr Moseley says. Effective automation delivers necessary information like changes, or threshold violations, instead of large amounts of data indicating no problems. It means that instead of starting to think about what to automate, you start by thinking about what data you actually need, who will need it, and what they can do with it.

"I've seen some very extreme cases, where people go from massive amounts of data which no-one is looking for, to just the pertinent data which is very useful," he says.

If you have less data, the oil and gas engineers "don't have to sift through piles of records and spreadsheets to get to the data which is meaningful to them. We've helped with the quality of data itself," he says.

What to monitor

Remote monitoring capability is often used in artificial lift (rod pumps and electrical submersible pumps) and sending measurements, for example well measurements, pressures, temperatures, tank levels and chemical injection rates, Mr Moseley says.

In many cases, the most critical data is simply to know if a well stops producing, because this means lost revenue which is viewed as revenue which has been lost forever.

Or engineers might want to know if something goes outside a certain range. "Usually engineers have a clear idea what tolerances (operating range) is acceptable, and at what level they want to be alerted," Mr Moseley says.

A rod pump can have a device recording pressure, temperature and the weight of the rod string, and can send data if there is a change.

Rod strings can be 10,000 feet long, and have an enormous weight. If operated improperly, they ca break, causing very expensive and time-consuming repair jobs – meanwhile, production is lost.

Similar for electrical submersible pumps, it is useful to know if there is a change in pressure, temperature or flow rates, which could indicate a problem. If the pump starts 'torqueing up' (requiring much more force to move the same amount of fluid), then it could lead to damage. Or there could be a change which leads to a higher electricity consumption.

There is usually a controller on site which logs data continually, and then sends data by satellite according to pre-defined criteria, such as a dynamometer card (for a rod pump) is not shaped as expected.

Data is commonly sent back at regular intervals (for example weekly or monthly), whether something is going wrong or not, just to give people in the office assurance that everything is operating normally.

Companies are looking harder at remote monitoring due to cost pressures – previously they may have had one field engineer per 20 wells, today it could be 500, which can be time-prohibitive for personal visits, Mr Moseley says.

L band communications

Inmarsat's satellites can be accessed via very small terminals, you don't need a big satellite dish.

These small terminal devices communicate data in the "L" radio band.

The small terminals do not need specialist satellite expertise to install or use, and draw very low power, easily powered by battery and solar cells.

The radio signals in the "L" are not susceptible to interruption from rain, dust storms or snow which is found in the traditional "Ku" and "Ka" band satellite communications.

Satellite vs cellular and radio

Oil and gas companies have used standard radio for data communication for many years, in licensed bands and unlicensed (free to use) bands.

But implementing radio requires a lot of infrastructure, such as radio towers, and associated cabling and planning, as well as right of way.

The other option is cellular communications (which are used by mobile telephones). Cellular is often cheaper than satellite, and it is easy to implement, but the reliability depends on the availability of the cellphone towers, and whether coverage is available.

Cellular communications often need to be managed regionally to keep costs down – ie if the data is being sent to another country, you need to pay additional roaming charges.

This isn't the case with satellite data, which can be sent anywhere you want for the same price. This is a helpful capability for service companies operating internationally, who might want to monitor the data from all of their electrical submersible pumps from one worldwide location.