digital energy journal

Report from March SPE Intelligent Energy in Utrecht

Local motors - a model for oil and gas technology development?

Streamlining the screens in drilling

June/July 2012 Issue 37

Using Microsoft's Kinect in vessel simulators

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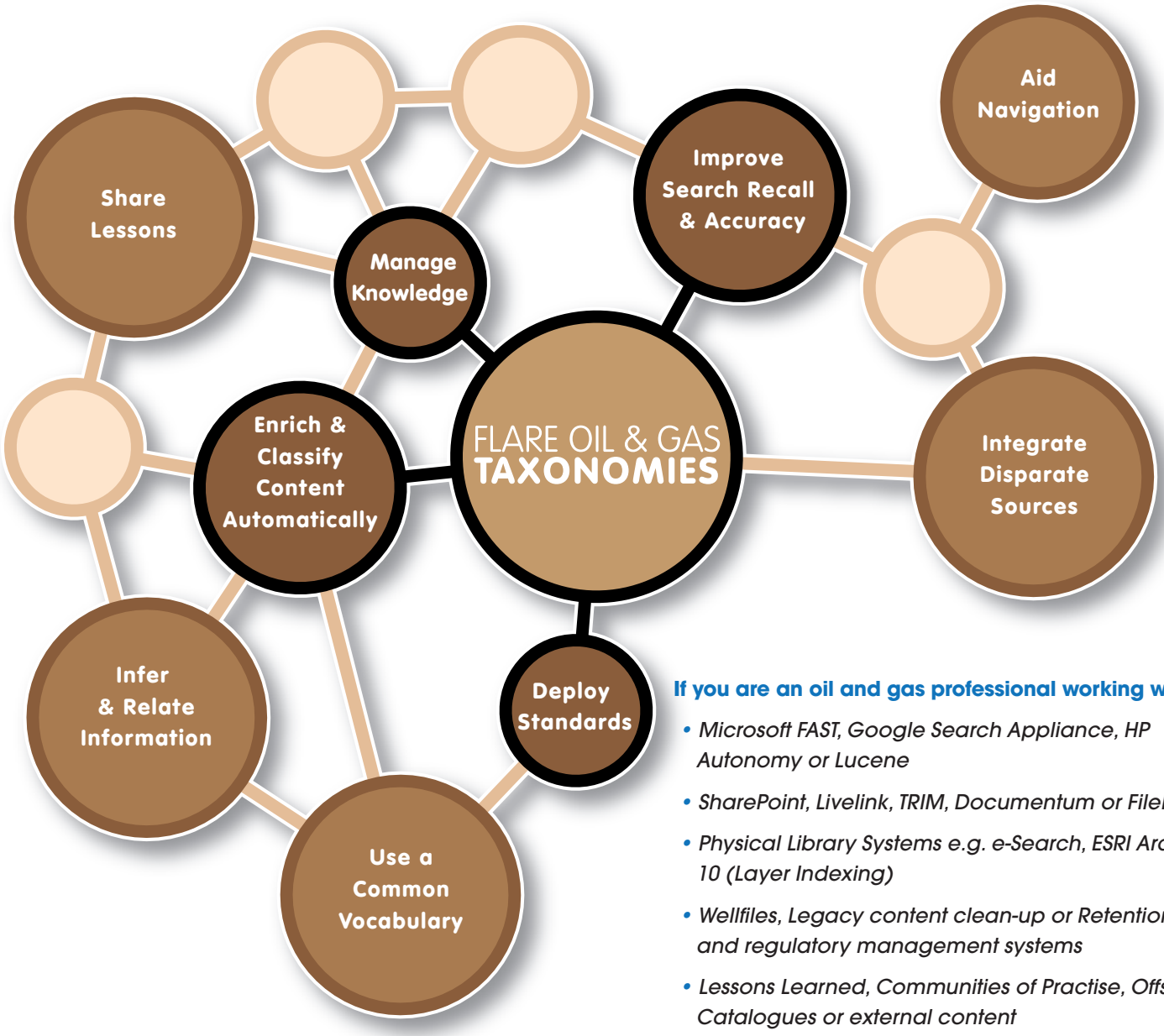

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Cover: Simulation using Microsoft Kinect. Students can walk around a room in the simuation centre, carrying a Microsoft "Kinect" body movement detection device, and see themselves walking on the deck of a seismic streamer vessel. This simulator has been installed at Vestfold University College, Norway, and developed in co-operation with Petroleum Geo-Services (PGS). The simulator is based on the PGS seismic vessel Ramform Viking.

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Learning from meteorologists

David Bamford
Consultant Editor,
Digital Energy Journal

Meteorologists are used to distilling all of their complex models into a simple message – what the weather will be like tomorrow. Is there a lesson for reservoir engineers?

Many years ago, I wondered whether meteorology had anything to teach explorers about forecasting and risk analysis, and so I entered into an intermittent dialogue with the UK's Meteorological Office.

Before I abandoned this line of inquiry, I discovered two things: firstly that the Office tried to predict our weather by building huge models and using big mainframe computers (IBM 360's strapped together as I recall) and secondly that statistically the most successful predictions were "tomorrow will be similar to today" or "tomorrow will be rather similar to the same day last year".

I have often thought of this experience when reservoir engineers have been describing the results of reservoir simulation; building such models has always seemed to me like a labour of love and sometimes an end in itself – comparable perhaps to the building of Chartres Cathedral or the Grand Mosque at Cordoba, the latter of which was begun in the late 8th Century and 'finished' in the late 15th.

Back to weather forecasting – I'm sure you too will have noticed that our forecasters now have a wealth of monitoring data of all sorts – from satellites and ground stations – on which to base their predictions and that they seem pretty good at integrating what must be a large amount of time-lapse information. And their predictions seem to be improving – at least they seem to have been pretty good at forecasting a dismal April and May here in the UK!

Equally, we have available to us in our industry a large amount of data which can inform us what is actually happening in our reservoirs. For example:

In my previous editorial which related to the notion of dilatancy of aligned micro-cracks within reservoirs that are under production, I made the case for Permanent Seismic Monitoring with 3 components. Whether we are talking about sensors ploughed into the seabed and/or installed down-hole, with a surface vessel firing a source, or cross-well seismic, this will be available 'as often as you like', once the upfront capital investment has been made.

Likewise, and for similar reasons, time-lapse measurements of electrical conductivity/resistivity may be of increasing importance (if we can deliver a technology that offers sufficient resolution on a reservoir scale).

Both these geophysical methodologies are capable of monitoring the movement of fluids within a reservoir, away from the well bores.

What is arriving at a well can of course be measured with conventional production logging techniques to which I would add the use of down-hole fibre optics and/or carbon rods which can 'listen' to the fluids entering the well bore, yielding a huge amount of precise information on rate fluctuations.

Finally, analysis of inter-well correlations in these rate fluctuations – for example between any one producer and the corresponding injectors that 'explain' its production - offers a low cost means of interpreting specific flow paths between wells, also in time-lapse fashion, for input to reservoir model history-matching.

This is but a partial list of the reservoir monitoring data that is now available. The prize available is one of great commercial significance – the improvement in recovery factors by perhaps 10's of % points, for example.

What is missing? What is missing in my humble opinion is the ability to integrate all this time-lapse data – of which there could be massive amounts - in an easy to use, easily understood form.

Perhaps I am over-impressed by the ability of our weather forecasters to do this in front of us every hour or so on TV and wonder why exactly we in the oil & gas industry seem to be behind the times!

David Bamford is non-executive director of Tullow Oil, and a past head of exploration, West Africa and geophysics with BP

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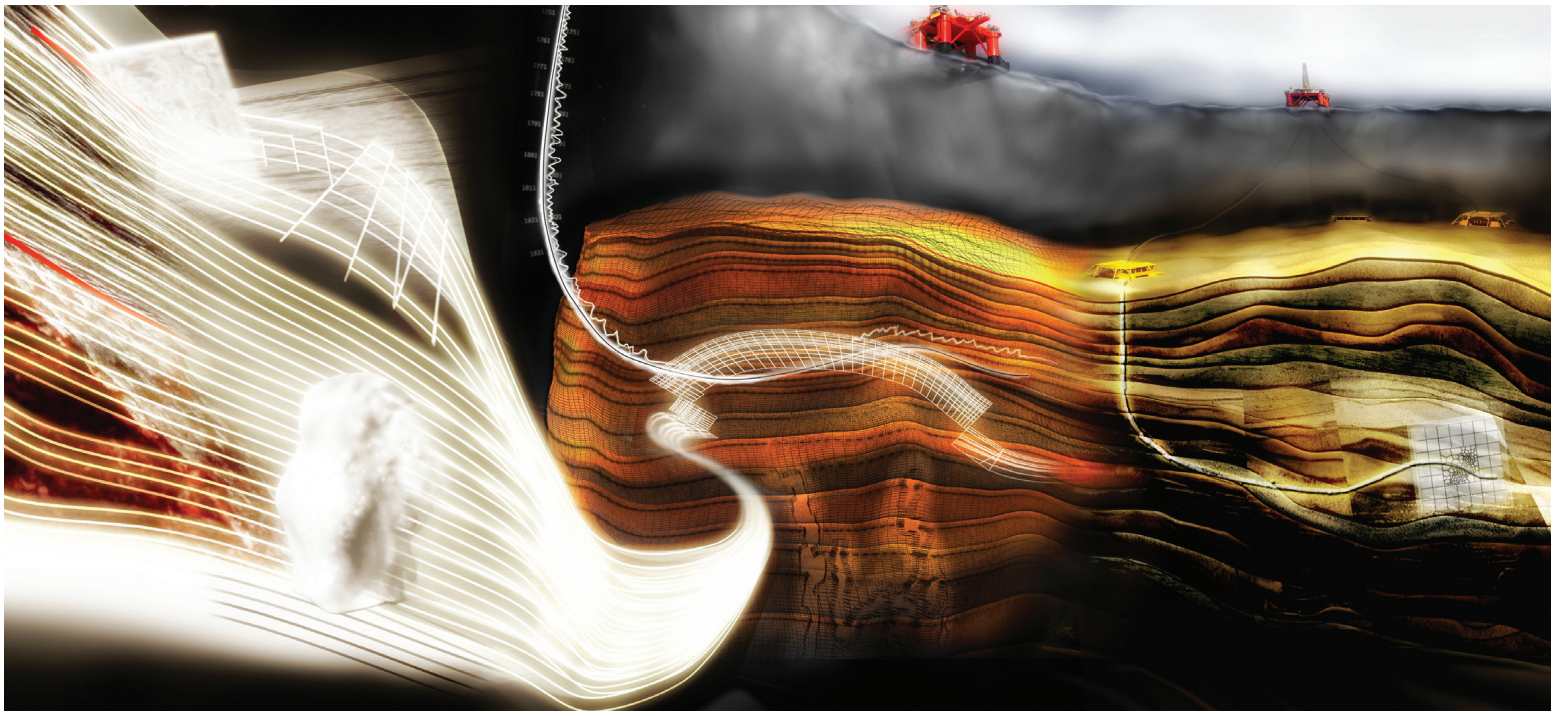

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BP - streamlining the screens

A major focus for BP's "Field of the Future" project is providing more integrated information and reducing the number of screens people have to look at, says Steve Roberts, VP of BP's "Field of the Future" program

People working offshore are starting to say, don't give me another screen..says Steve Roberts, VP of BP's Field of the Future

It is becoming common to hear people say, "don't give me another screen, instead give me integrated information," says Steve Roberts, VP of BP's "Field of the Future" program.

Perhaps too often, when people need more information, the solution has been to give them another computer screen or window to monitor.

But there is a limit to how many screens people can manage.

The airline industry has managed to carefully synthesise a wide range of data and information for pilots onto a relatively small footprint of screen, Mr Roberts said.

"That's the journey we are on."

"We can synthesize [all the information] into screens of rich information that shows you what you need to know when you need to know."

One model for doing this is an online banking system. When you log on to your bank you can see only information which you need to know, taken out of the bank's complex IT systems which have all customers' account data together.

Field of the Future

The Field of the Future program aims to help improve production, and improve performance of production equipment, by providing digital technologies to help petroleum engineers.

BP has separate projects looking after exploration (including managing seismic data).

In 2005 BP set a target of adding 100,000 barrels of oil per day by the year 2017 through its Field of the Future Program, and by the end of 2011 it had achieved 73,000 bopd.

All of the figures have been signed off by the managers of the asset, to confirm that they agree that Field of the Future program caused the production increase, Mr Roberts says.

There have been 400 examples documented at BP about how production has been improved as a result of these technologies.

80 per cent of the technology in Field of the Future concept is bought off the shelf, but the challenge is to use it consistently, he said.

The other 20 per cent needs to be developed specially, including sensors and algorithms. BP works with several university maths departments to develop its algorithms, and employs statisticians with PhDs in modelling.

This work gets more important as data sizes get larger.

It has wired up 80 per cent of the company's "most significant wells", providing information to experts anywhere in the world.

One area of attention is improving flow issues – faster well start-up to stable flow, management of sanding, controlling slugs, and removing bottlenecks. The Field of the Future team developed 14 solutions which are deployed in 8 of its key regions, covering 80 per cent of its high value wells.

Collaborative working

With a team of different experts monitoring the asset, you can make sure it is being fully monitored and getting extra attention where it is required.

"Collaboration is at the heart of this, bringing the right experts together in a collaborative way, so they can interact around a common set of data," he said. "The world of the past is people in their siloed environments."

"We encourage a culture in BP around debate around information and interpretation of that," he said. "We try to create systems better."

There are 35 "Advanced Collaborative Environments", across Upstream assets but in Houston and Sunbury (UK), "We're developing 2 centres where we can access information from anywhere in the world, so our scarce experts can sit in these centres and provide advice," he said.

Data standards

Common data standards are very important in helping gather data, put it together, share it and bring it to experts, he says.

"We still need stricter data management standards, for example making sure everybody uses the same name for a well."

Steve Roberts is vice chair of the board of Energistics, the oil and gas data exchange standards organisation. "BP is fully behind the need for standard data exchange," he says. "We're fully supportive of standards bodies like Energistics."

BP is a firm supporter in the production data exchange standard PRODML, and believes that a data standard will be much more important the more complex the field and production arrangement is.

"We don't operate every field we have an interest in," he says. "Everyone wants access to the information to help make their own decisions. A standard like PRODML will help facilitate that."

Analytics

Analytics is an important part of the field of the future project, converting data into something which can be worked with.

There are analytics systems for facilities monitoring, including valves, chokes, pipelines, corrosion management, safety valves, equipment, predictive maintenance.

Analytics tools can alert the facilities engineers to the equipment they should be paying the most attention to.

There are analytics for drilling. "We have a well advisor system under development," he said. It can help manage "hole control" issues and avoid stuck pipe.

There can be automatic 'alert an expert' systems.

Doing this requires continuous WITSML data feeds on every drilling rig.

Graduates

An interesting question is what current graduates expect from their working environment at a company like BP.

Mr Roberts says he spends a lot of time asking graduates what they expect a working environment at a company like BP to be like.

Graduates say they do expect to come into an office. "They want to come together and meet and collaborate," he said.

Many of them expect touch screens built into tables. "They want to press the desk and the information comes up," he says.

They don't expect to have to carry laptops, and they don't expect to do their work on social media, he says.

Local Motors: a model for oil and gas?

The opening speaker at the Intelligent Energy conference in Utrecht in March was a man who set up an open source car manufacturing facility in Arizona. Does he have a model for the oil and gas industry?

John Rogers of Local Motors - could his open source design and construction methods for car manufacturing work in the oil and gas industry

The opening speaker at the 2012 Society of Petroleum Engineers "Intelligent Energy" conference was John B Rogers, president and CEO of Local Motors, a company based in Arizona which helps people design and build their own cars.

He was invited by conference co-chairs Derek Mathieson, President, Western Hemisphere Operations at Baker Hughes, and Edwin Verdonk, Vice President of Subsurface Expertise and Technology Deployment at Royal Dutch Shell.

Derek Mathieson told Digital Energy Journal that he first met Mr Rogers at a Baker Hughes conference for its 200 high potential employees, where he gave a talk on leadership.

"He blew everybody away," Mr Mathieson said. "A lot of the younger staff thought he was great."

Mr Rogers' car manufacturing company, Local Motors, is unique in that all of its designs are put together by 30,000 contributors over the internet, rather than by company employees.

Could this be a model for the way the oil and gas industry develops its equipment?

Mr Rogers believes that 'atoms are the new bits' – or to put it another way, the most exciting frontier for industry is not the internet and data any more, but how that data is used to build and move physical items (such as cars, heavy machinery and oil).

"The browser cannot allow you to small, touch and taste things," he said.

Mr Rogers is also sceptical of the idea that some things need centralised control for safety reasons, citing the Linux operating system, which is developed open source and extremely stable, as providing a counter argument.

Car manufacturers place tough restrictions on people fixing their own cars today, but at Local Motors everything is open, with wikis for how to fix everything.

Mr Rogers ended his talk by asking, "someone is going to create a platform for information sharing (in the oil and gas industry). Could it be you?"

Local Motors

Mr Rogers got the idea for Local Motors following a posting as company commander for the US Army in Iraq in 2004, where 2 of his friends lost their lives.

"The region was primarily war torn over energy production," he said.

"I decided to make a difference on the side of consumption."

So he decided to start a car company in Phoenix, with funding of just $200,000.

Industrial engineers, modellers, designers and fabricators, amateur or professional, can collaborate online with their designs, and then build the cars themselves in Local Motors' factory.

There are over 100,000 projects currently under development.

People who build cars on Local Motors get a lot of attention. "People say, the best and worst thing about it is that I have to plan an hour to talk to people about my vehicle when I go to the grocery store", Mr Rogers said.

The company was a winning entry sub-

Local Motors vehicles - designed like Wikipedia

Report from SPE Intelligent Energy in Utrecht, March 2012


Derek Mathieson

mitted by Mr Rogers in Harvard University's annual business plan competition, as a way of harnessing the creativity of the world's underemployed car designers.

Mr Rogers had some knowledge of traditional vehicle manufacturing – his grandfather owned a motorcycle manufacturing company in the 1940s, which subsequently closed when faced with competition from the UK and Japan.

Mr Rogers thinks it is ridiculous when he hears car industry executives saying that the future of the car industry will be software running inside the car – he thinks it is new ways of actually building the cars.

Benefits

The company put a new car design on the road for a $3m investment, a tiny fraction of what larger car companies spend developing their designs and production lines for a new model. It also got the car onto the market five times quicker than conventional car manufacturers do, Mr Rogers claims.

The company also developed a military vehicle for $350,000, which Mr Rogers personally handed over to Barack Obama in June 2011.

People working on the project have also seen many personal advantages – some engaged their children in the work. "People say, I took my 7 year old and 11 year old, taught them process, it taught them pride in tools," he said. "We're giving people pride in making things."

Motivation and steering

Motivating and directing 30,000 volunteers is somewhat different to motivating 30,000 company employees. The trick is to understand that money is just one of people's primary motivations, Mr Rogers said. People also want to "Learn, socialise, achieve and win. Then you are getting at the basic motivation. That's a big change."

The role of Local Motors is to lead the community by developing a vision, and managing tasks which the community can't or won't do itself.

It also has to keep people focussed on a narrow range of goals, similar to how Wikipedia makes careful definitions about what it does and does not want people to do on its encyclopaedia entries.

Local Motors also needs to get people engaged. "The people you steward, is the new currency," he said.

Energy efficiency

So did he achieve his original aim, to build cars which were more energy efficient?

Mr Rogers says that Local Motors cars achieve mileages of between 30 mpg and 300 mpg.

But he has come to understand that vehicle efficiency is not a technology issue, it is an issue of choices.

Shell built an experimental vehicle in 1973 which could do 376 miles per gallon, called the Opel P1.

"It's a question of the trade-offs people want to make, not about technology," he said.

Getting people uncomfortable

The conference co-chairs made an effort, in the words of Baker Hughes' Derek Mathieson, to take the audience "slightly out of their comfort zone," with the opening session.

"Conferences tend to fall back on a formula, but don't get to the heart of it," said Mr Mathieson. "We want to get people uncomfortable. We were trying to create a different trajectory."

It included actors playing TV news presenters in the year 2020, announcing a new technology which could generate electricity from oil reservoirs in situ (without taking the oil to the surface).

The session can be viewed online at http://speie2012.igloocommunities.com/.

There were actors playing the role of 2020 energy industry executives, talking about how all of their technical staff happily work together without worrying about who owns the intellectual property.

Many oil industry researchers privately complain about how they could work much more efficiently, in terms of developing new technology and getting it used, if they did not have to keep what they are doing secret in order to protect the company's Intellectual Property.

The audience was also treated from a range of comments from industry figures around the world presented by video, including that:

- An important metric with any new technology is how large it could potentially be – can it change all of society or just a part of it
- The US National research laboratories don't co-operate as much as the oil and gas industry needs them to
- In future we'll use more gas than we do now, and less coal – and probably more nuclear
- Oil companies have gradually become "oil and gas" companies and now more "energy" companies
- In most parts of the world, energy companies work closely with government, but that's not the case in the US
- There are many people with just a small knowledge about the oil and gas industry but which get a very big audience for their remarks on it
- If there was more training about economics in high schools, people might understand more about resources
- Although people are likely to have more problems finding energy in future, they are unlikely to have world wars about it, because nations trade a lot more with each other than they used to
- If people didn't have to put so much effort and tension in energy, they'd be able to do all kinds of other things like go to Mars and extend the human lifetime.

Are these ideas useful?

Baker Hughes has 500 to 1000 different engineering projects going on at any time, and might be able to learn from Local Motors in the best ways to pull the work together, said Derek Mathieson, President of Products & Technology at Baker Hughes, and event co-chair.

"I don't think anyone understands the length and breathy of the technology we have in place."

Conventional 2 dimensional company organisations have their limitations.

Edwin Verdonk, Vice President of Subsurface Expertise and Technology Deployment at Royal Dutch Shell, also event co-chair, said that you could have a crowd sourcing model for company employees, to decide which direction the company should take.

However it might be a step too far to allow the general public to participate in business discussions and equipment design, as Local Motors does.

Mr Verdonk said he was keen that the discussion shouldn't be seen as one about IT. "I'm really hopefully that people take the technical discussion to a more industry changing discussion," Mr Verdonk said. "That was our idea between 2020 scenario. Technology is not a gadget any more."

An intelligent energy company could be described as one which is fast and nimble, adapting to changing circumstances, and achieves very good results, Mr Verdonk said.

One of the most important themes for the conference is helping people interpret data, Mr Verdonk said. "It makes no sense for the engineer to have 1tb of data. You need to filter this data to a decision space," he said.

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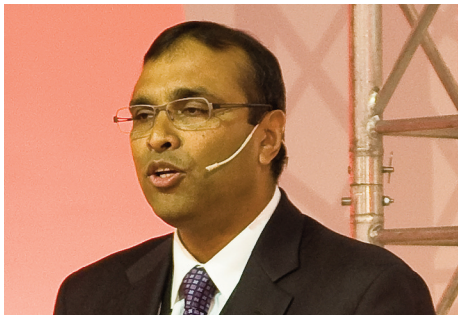
Don't forget – it's about atoms
Intelligent Energy plenary session report

Amid all the talk about 'intelligent energy', don't forget that it is the atoms which ultimately count, said Satish Pai, VP operations with Schlumberger, speaking at the SPE 2012 Intelligent Energy conference opening session in Utrecht, Netherlands, in March



"Most people who work on a rig are not ready for this digital technology" - Satish Pai, executive vice president of operations with Schlumberger

"The atoms part of the industry is going on a rig and drilling a well," said Satish Pai, Executive Vice President of operations with Schlumberger, speaking at the SPE 2012 Intelligent Energy conference opening session.

"Clients make their money by taking a very expensive rig and drilling a well somewhere.

"It is very mechanical and hands on."

"Most people who work on a rig are not ready for this digital technology."

"I recently visited a 6th generation rig in the Gulf of Mexico. The driller has 15 to 20 screens. The directional driller is on one workflow, the mudlogger is on another work flow. I thought 'how is he making decisions with all of this data?'"

Mr Pai said that he is not concerned about the retirement of the industry's senior personnel. "I don't think that the 'big crew change' will be a problem," he said. "I think young people will do just fine."

[but] "the fact that we keep agonizing that we have a people problem I think is good. As an industry we are not recruiting enough people. There is a big cottage industry poaching people from one industry and taking it to another."

"It is pretty clear that our industry is getting much younger. But a huge emphasis is placed on experience, and you hear a lot about that at Schlumberger," he said.

Workflows

An important area of technology development is developing workflows for people to work together, said Mr Pai.

"We have a geomechanics expert who is very good. He is watching 10 wells for us in different parts of the world. But it is the challenge of mapping that is very difficult."

"The technology exists, what doesn't exist is the workflows."

We also need better workflows to co-ordinate work between operators and service companies, he said. Many decisions being made on a rig are taken jointly by service companies and operators. "I think going forward, we'll have to come up with a more robust way of connecting people in a virtual workflow."

Structured workflows will also help with regulatory compliance. Increasingly, "you need to show the authorities your decision making chain. Technology is going to have to play a big role here," he said.

Meanwhile there have been big improvements in knowledge management systems. Automation has taken big strides. This is all leading to "remote operations getting normal in many parts of the world," he said.

Automotive and aviation

"Quite a lot of industries are nimbler than us and learning a lot faster," he said.

For example, perhaps the industry can learn from the automotive industry in making downhole tools which are reliable.

"People tell us, I don't care about functionality, just make sure it is reliable," he said.

Perhaps the oil and gas industry can learn from the aviation industry in predictive maintenance. "People know what to change when the plane lands," he says. "In oil and gas we have [yet] to get that level of predictive maintenance. People say only fix it when it's broken."

Shell

Gerald Schotman, CTO, Shell, gave a round-up of Shell's most interesting technology developments.

For exploration, Shell is developing improved seismic sensing technology, including a million channel land wireless seismic system being developed with HP.

It is developing a nodes offshore recording survey technology, which "could lower the survey cost by a factor of 2," he said.

It is also working with HP to convert data into accurate information.

For drilling, Shell is seeing advances in automated drilling, where computer controls functions such as weight on bit, rotary speed and mud flow. "Automated drilling improves consistency," he said.

One route towards faster innovation is more replication and packaging, like with mobile phones - Gerald Schotman, CTO, Shell

Downstream, Shell uses technology to increase its 'intimacy' with customers, with smart phone apps to help motorists work out how to save fuel and plan routes.

One route towards faster innovation is more replication and packaging, he said, for example like the way mobile phones provide everybody with a fairly standardised package of technology.

BP

Ellen Williams, chief scientist with BP, said that when it comes to sensors and field automation, "We have to resist the temptation of just looking sequentially," she said. It is better to look at the overall system.

There are questions about how much automation systems should have, and whether a fully automated system is desirable.

There are also questions about how to manage the data – and as data sizes get bigger you reach a point where it "can only be dealt with on the cloud," she said.

Ms Williams said she had an "outsider's perspective", having joined BP in 2010 (previously she was Distinguished University Professor at the Department of Physics at the University of Maryland, USA, and spent 30 years in academia.)

"The oil and gas industry has lagged behind many industries in implementing tools," she said. "There are many reasons, the harsh environment, [difficulty of] downhole communications."

Report from SPE Intelligent Energy in Utrecht, March 2012

"We have to resist the temptation of just looking sequentially" - Ellen Williams, chief scientist with BP

"We've been digitizing some of our sensors in field and reservoirs, and every point has resulted in a big win," she said.

"We've been able to avoid well interventions, we've been able to improve efficiency. We immediately see gains formed."

Petoro

Kjell Pedersen, President and CEO of Petoro, noted that people often find it easier to make high risk decisions when planning a new well, when there is very little data available, than they do when deciding to extend an existing field, when there is large amounts of data available, although the potential return on investment can be higher.

When there are large amounts of data, there's always one piece which doesn't fit and casts a shadow over the decision to invest, he said.

Petoro is an organisation which manages the Norwegian government's exploration and production licenses and keeps an eye on Statoil.

"We have so much data from 100,000 wells, there's always one piece of data that says, 'can we really invest, the data doesn't' fit."

"So we go from risk non -averse and no data, to risk averse and lots of data."

"Why can't managers say, I'm willing to put another billion NOK into this field?"

"We need to bring forward the ability to take all data and put it quickly into a model, to create a feeling of 'I know what is happening in this field,'" he said.

"We are taking much longer to get wells drilled and put into operation."

Another problem is getting acceptance from people working offshore for new technology. "We have not succeeded," he said. "They see some of this as a threat. There's a lot of work that we as companies and employers need to do."

On the plus side, recovery on the Norwegian continental shelf is increasing "on a daily basis," he said.

"We have been blessed with finding big discoveries in a very mature part of our continental shelf, putting a new life info what we thought the Norwegian continental shelf would bring us."

"We have much better collaboration between oil companies and service companies."

Saudi Aramco

A big problem with reservoir monitoring is that you can only have sensors on the surface of the ground or in the wells, said Dr Nabeel I Afaleg, manager, Southern area reservoir management, Saudi Aramco.

"The industry has to go deeper in the reservoir."

"The sampling points in the reservoirs are very small compared to the size of the reservoirs."

Saudi Aramco is developing sensors which can flow through the reservoir itself.

The company is also developing much larger reservoir simulators.

"They bring the recovery factor from 50 per cent to even more than 70 per cent," he said.

At Saudi Aramco, people no longer talk about justifying investment in intelligent fields,

The conversation has now moved on to "how to maximise the value of intelligent fields," he said.

Recovery

Speakers were asked what recovery level they think is possible.

Saudi Aramco's Mr Afaleg said that he did not think 70 per cent recovery is a far-fetched. "I think we will achieve that number. We're very confident we can meet it and exceed it someday," he said.

"Some of our fields have reached that number. One of our oldest fields has reached that number."

"We have multiple technology that will bring us to that level and beyond."

But "technology itself will not achieve recovery if you don't have the practise," he said.

Shell's Mr Schotman said he thought "35 per cent is an average type of number. Not all centres have the same type of reservoirs that the Kingdom [of Saudi Arabia] has."

Mr Afaleg said "not all reservoirs are created equal, even in Saudi Arabia."

Schlumberger's Mr Pai said "it's very good to hear our clients way they want to go for 70 per cent recovery and have complex fields, it is good for the service business."

Petoro's Mr Pedersen said that "we should be talking about increases in recovery relative to the size of field we are talking about. How do we increase it by 20 per cent? Or if we define it as 'we have achieved 65 per cent, that is something we shouldn't get comfortable with'."

If you increase recovery using injected fluids, then that raises issues about additional energy inputs (eg for pumps) and associated CO2 emissions (from creating the energy), he said.

Convincing leadership

One audience member said that he has a problem in his company persuading his company leaders to invest in digital technology.

"We have a groundswell of people who say, we need the technology. Then it goes up a chain and leadership say, why do I pay for sensors when all I want is oil out of the ground," he said.

Petoro's Mr Pedersen replied that the strongest argument for technology is to explain that the additional knowledge you get is key to improving the industry and working on difficult issues.

"I need to get the data, I need to communicate it, I need the guys and girls to do it on a regular basis."

People also need the information to work out how to reduce costs. And "if we have the best knowledge and lowest cost, I have a much higher possibility of handling safety issues," he said.

Saudi Aramco's Mr Afaleg noted that when it comes to management, "justifying a piece of equipment is significantly harder than justifying a whole [system]", he said. "Rather than see it as a single well, put the case for the whole asset, the whole type of measurement you want to do."

Sharing data

Speakers were asked how keen they are to share data, particularly between service companies and operators."We share data with service companies on specific issues," said Saudi Aramco's Mr Afaleg. "No-one will release all data. "There are some safeguards for proprietary and regulatory information."

But "we work collaboratively, together. Research will not flourish if the collaboration is not there," he said.

"I don't see it as one [service companies] has the technology, one [operators] has the data," said Schlumberger's Satish Pai.

"The operators have a very thorough knowledge of the field. We come in with different work processes. There are different strengths that need to come together."

Giving people more attention

The topic of people "deserves a lot more attention than we usually give it," said Jim Crompton, manager of Upstream IT Architecture, Chevron, opening the second plenary session at Intelligent Energy, "the digital engineer."

In project report presentations, people often leave a note buried in one slide, where they say, "the hardest part of the whole thing is around people's mindset," he said. "Normally it gets 1 bullet line."

There have been suggestions that the industry should create a discipline for people who specialise in making software systems easy to use and helping people get comfortable using them, perhaps called a 'digital engineer', he said.

"Some people's capabilities are best understood as a T shape" - Jim Crompton, manager of upstream IT architecture with Chevron

But it isn't obvious what knowledge such a person should have – they will need a broad understanding of different aspects of the oil and gas industry.

At Chevron, "we still recruit, manage and organise based on traditional themes, (eg petroleum engineering)," Mr Crompton said. "We've got long histories that know how to do that."

"We're starting to create jobs for 'digital engineers', but we have a problem managing their careers."

Some people's capabilities are best understood as a T-shape, where people need both technical depth in specific subjects, and a broad understanding of different subjects, he said.

"We're beginning to understand these T shaped capabilities," he said.

People make mistakes

One of the main reasons why people need digital technology is because humans are susceptible to mistakes, said Dr Iraj Ershaghi, head of petroleum engineering and specialist in digital engineering at the University of Southern California.

"We first come up with an estimate of oil in place. We have problem tracking how water pushes the oil out. We miserably fail on forecasting. In facilities management things are in our control, but it still fails. On environmental safety, we can see that sometimes you are taken off guard."

"We have complex systems, multivariable effects, sometimes inconsistent data sets."

"That's the kind of culture we have."

"As we are moving to the future, you have a physical system, a software system and a human system. You have to figure out how to manage these three components," he said.

Training at BP

Deanna Alaniz, instructional system design director, Upstream Learning, BP, talked about a training program BP has developed for operational geologists.

The program lasts 120 to 180 days, including workplace learning, "since 80 per cent of what you learn is on your job," she says.

BP includes staff from some of its main service companies in the training program.

The learning program has an online classroom where people meet virtually, can watch webinars and interact with each other.

"At BP we don't start a learning program until we identify key business drivers," she said. "We're trying to build long term career paths.

"We want to develop a community where people can share expertise and learning."

"People need digital technology because humans are susceptible to mistakes - Iraj Ershaghi, head of petroleum engineering and specialist in digital engineering at the University of Southern California

BP is also experimenting with 3D virtual reality and virtual worlds learning, she said.

Young and old

One audience member said it was a myth that younger staff take to new technology faster than older staff. "I work with the technology department of my company and we educate our engineering staff," he said. "We find that 20 per cent of all our staff, no matter how old they are, grab the technology and run. 10 per cent won't use them regardless, whether they are 20, 50 or 80. Then the middle set will come along with us if we get enough momentum."

"80 per cent of what you learn is on your job" - Deanna Alaniz, instructional system design director, upstream learning, BP

"We need to be cautious about saying older professionals aren't interested."

Pieter Kapteijn, Director Corporate Technology and Innovation at Maersk, said that in his view the "world is not divided into young and old generation, but in people with a development mindset and a fixed mindset."

He also noted that maybe what the industry needs is people with a 'systems' view, rather than a 'digital view'.

Jon Lippe, operational manager of Center for integrated Operations in the Petroleum Industry at NTNU (Trondheim), suggested that maybe oil and gas personnel should be trained to work together in their different roles, like a football team trains.

"Soccer teams spend most of their time training on co-operation and every now and then they play a match," he said. "In our industry it is the opposite – they work together then train independently."

Unconventionals drive new ways of thinking

Development of change unconventionals is driving new ways of thinking, particularly learning from the manufacturing industry, said Jonathan Lewis, Senior Vice President, Europe and Sub-Saharan Africa Region, Halliburton

The development of unconventional gas is helping to "question our traditional ways of thinking," said Jonathan Lewis, Senior Vice President, Europe and Sub-Saharan Africa Region, Halliburton, speaking at the 3rd plenary session at the SPE Intelligent Energy conference in Utrecht.

"Operational process innovation is difficult to deliver," he said, because it involves changing the way people do things. "It needs strong external stimuli and strong internal leadership."

"We took a decision a year ago to reinvent how we deliver unconventionals. We have a 'frac of the future' strategy, including IT, supply chain, digital workflow," he said.

"Unconventional operations have become a crucible for operational innovation and realising our tolerance for inefficiency."

"It has always struck me how tolerant we are in the oil and gas industry to inefficiency," Mr Lewis said.

People in the manufacturing industry, by comparison, "have had no option but to be extraordinarily efficient."

"There is much we can learn from the manufacturing industry, particularly how we realise process efficiency."

"We had an operational excellence individual [working in Halliburton] who had [previously] worked in vinyl flooring. In vinyl flooring you have to be extraordinarily efficient."

With manufacturing industry techniques, Mr Lewis said that it is possible to reduce drilling non productive time so you have 99.999 per cent uptime. "The question is how much do you want to pay for it," he said.

Halliburton has improved its systems for keeping track of its activities. "We know where employees are and what they are doing," he said. This makes it easier to provide field employees with the right technical advice.

Too often, companies try tackle problems "with a fixation on existing business structure," he said. It would be better to work out the best workflow first, then work out what operational structure you need to support that.

Halliburton has put together a digital framework to manage its procedures globally. It has defined and released 7 advanced 'workflows' covering tasks such as full field production management, and reservoir stimulation.

Halliburton is creating many new workflows, including for managing safety and process assurance, and putting them together like building blocks.

"We thought these were products that would be consumed by operators. [however] adoption rates were much slower than we would have imagined, given the production gains," he said.

Improvements in productivity can mean a lot more to service companies than to operators, because margins for service companies are tighter. This can mean "we are uniquely incented to drive adoption perhaps more than operators," he said.

ConocoPhillips

ConocoPhillips celebrated 40 years of production from its Ekofisk field (in the Southern part of the North Sea) in June 2011, and on the same day received approval for a $40bn redevelopment of the field, said Brage Sandstad, Manager Norway Operations, ConocoPhillips, also speaking at the 3rd plenary session of Intelligent Energy.

There are 1,300 people working offshore at Ekofisk at any time. It supplies gas to Northern Germany, and oil to Teeside (North East England). "It has been and still is a great field," he said.

Conoco Phillips uses the "Six Sigma" methodology to try to reduce defects and minimise variability. It has over 60 Six Sigma "black belts," or people specially trained in it.

To figure out how to make its integrat-

Packed conference room - the third plenary session at the 3rd Intelligent Energy conference in Utrecht

Report from SPE Intelligent Energy in Utrecht, March 2012

ed operations work, ConocoPhillips staff have visited neighbouring industries to see how they do it, including aerospace, automobile, shipping industry, Norwegian mail services (to see their planning and scheduling system), he said "We have much in common with those industries."

The predicted total lifetime of the field has doubled, he said, and the recovery [ratio] has increased 3 times.

The term "Integrated operations" at ConocoPhillips means integrating offshore and onshore, integrating the company with its service providers, and integrating people in different disciplines, all to drive "improvement across the entire operations."

"IO is more a philosophy we are proposing than a project we were implementing," he said.

The company has 11 different onshore control rooms all looking at different aspects of the field. "These centres are our arena where integration takes place," he said.

For most of the rooms, work to develop the new work processes started after people had moved into the room, he said.

Probably the biggest driver for integrated operations is the need to improve safety, he said.

It can do this by making it easier to get the right experts involved.

"In the past we had no choice but depend on the expertise we sent to the field. Now we can provide additional expertise to view and consult," he said.

Integrated operations has also helped improve maintenance efficiency by over 15 per cent.

The production activity is "more stable with fewer shutdowns," he said.

"Our supplier boat services have become more efficient. We could take one boat out of our fleet and eliminate spot charters."

Judson Jacobs, IHS CERA Research Director; Leo De Best, COE Manager, Shell Smart Fields; Brage Sandstad, Manager Norway Operations, ConocoPhillips ; Naji Al Umair, Saudi Aramco; Steve Cassidy, Manager, Applied Reservoir Management, Chevron; Jonathan Lewis, Senior Vice President, Europe and Sub-Saharan Africa Region, Halliburton

The challenge now is to make the improvement sustainable, rather than just short term gains.

In future "we aim to be more proactive and predictive," he said.

Chevron

Chevron has 17,000 wells in Southern California, with an average production of just 10 barrels of oil per day, said Steve Cassidy, Manager, Applied Reservoir Management, Chevron, speaking in the Intelligent Energy conference plenary session.

However by reducing the costs of managing the wells it has become one of the most profitable business units in the company,

Production is assisted with steam injection. Most wells get intervention once a year.

To improve its management of the field, Chevron has invested heavily in instrumentation for the wells to gather data, and also puts together plans about how much it would like each injection well to inject.

It also wants to get a better understanding of the subsurface, and in particular which injection wells are the most critical.

It wants a solution to be 'workflow driven' – following a plan – rather than technology driven (geared around trying out different technology).

This includes "management by exception" tools, which mean that management only have to pay attention to weaker areas of the field.

It also uses sophisticated scheduling technology, including GPS and mobile computers, for its field crews, to make sure they are as efficient as possible.

It also has a range of analytical tools for reservoir management.

Chevron would like more predictable analytics, to try to work out what is going to go wrong before it actually does, he said.

Managing a field "doesn't have to be people in a room looking at big screens," he said.

Mr Cassidy says that 'key performance indicators' are proving very difficult to use to assess value, but the six sigma techniques work much better.

Case based reasoning tools provide a "definite opportunity," he said, where people can stop making the same mistakes.

"Unconventionals provided Halliburton with an opportunity to question traditional ways of thinking", said Jonathan Lewis, Senior Vice President, Europe and Sub-Saharan Africa region, Halliburton

Doing more with data

Kuala Lumpur,
October 24-26, 2012

Finding Petroleum / Digital Energy Journal is running 3 one day conferences in Kuala Lumpur, Malaysia, on October 24, 25 and 26 on doing more with petroleum data, covering drilling, subsurface and production data.

These 3 events will present the most exciting new technology to help manage and work with all aspects of data in the upstream all and gas industry.

The conferences are for people who work with drilling, subsurface and production data, who want to learn about new ideas and new technologies to make their data work harder, to improve efficiency and safety of drilling, ability to find new reservoirs and extend existing ones, and maximise production.

The event is scheduled to coincide with the Energistics National Data Repositories conference in KL on October 21-24.

Attendance is free - register now to secure your place

October 24 - Doing more with with drilling data
October 25 - Doing more with subsurface data
October 26 - Implementing data tools faster

The aim is

(i) to make it easier for people working in KL oil and gas companies and service companies to find out more about the latest new technology to help manage data, and

(ii) to provide technology companies attending the National Data Repositories event with a chance to meet a local audience during the same trip.

The events are supported by the South East Asia Petroleum Exploration Society and Energistics, and timed to co-incide with the Energistics National Data Repositories conference in KL.

The events will be free to attend.

For days 1 and 2, we will look for financial contributions from speakers - in the range 14600 MYR / USD 4760 / GBP 3000 for a morning slot and MYR 9750 / USD 3200 / GBP 2000 for an afternoon slot. Sponsorship opportunities are also available.

The third day "getting data implemented faster" will be panel discussions, chaired by Jerry Hubbard, CEO of Energistics, and participants in the first 2 days' sessions will be invited to join.

For enquiries about sponsorship and speaking please contact our sales manager John Finder on +44 208 150 5292, e-mail jfinder@onlymedia.co.uk

Reserve your place now at **FindingPetroleum.com**

Fibres for equipment and wells

Fibre optics are being used in more sophisticated ways for equipment condition monitoring and to gather data downhole

UK company Smart Fibres is developing technology to use fibre optics for monitoring the condition of subsea equipment.

Fibre optic strain sensors can be placed close on the bearing race, and can provide data showing how much the bearings are vibrating and the frequency of the vibration.

Doing interventions on subsea equipment normally requires a heavy lift vessel, which is very expensive. So there is a big incentive to know as much as you can about condition of subsea equipment before bringing the vessel onsite.

All bearings have normal or characteristic vibration signature, but if the bearing is defective, the vibration signature will change, said Matthew Powell, business development manager with Smart Fibres.

"You can see when it's time to take action and intervene, or predict how much time we have left," he said. "Then you don't do it if you don't have to".

This is intelligent 'Condition based maintenance' rather than 'Interval based maintenance' or 'Run to failure'.

Smart Fibres works together with bearings manufacturer SKF, who have extensive experience in bearing monitoring.

The technology has also been used on risers, clamped onto the side of the tubing or built into the riser components.

The company's sensors use single optical fibre, 9 microns in diameter, wrapped into a sensor which is 0.15 or 0.25mm diameter.

The fibre optic sensors can also work at much higher temperatures – Smart Fibres is developing sensors for use in steam assisted gravity drainage applications - 300 degrees C compared to the limits of 100 degrees C for quartz standard gauges, he said.

The company was founded in 1998, initially to do monitoring of carbon fibre masts on yachts and display the strain being measured in the mast. The sensors were embedded inside the carbon fibre mast.

It has been doing work in the oil and gas industry since 2003, and downhole work since 2007.

Silixa - advanced fibre optics

Silixa Ltd of Hertfordshire, UK, a company which develops advanced fibre optic technology for downhole, reports that it has grown the company from 6 employees to 35 in the past 2 years with an initial investment from Chevron Technology Ventures and Lime Rock Partners.

The company has recently opened a facility in Houston and anticipates growing employee numbers to 40-50 during 2012.

Making downhole fibre optic technology with an "order of magnitude" better response in resolution - Mahmood Farhadiroushan

Silixa's fibre optic technology provides "an order of magnitude" better response in terms of the resolution, the measurement time, the distance, and the sensitivity," claims CEO Mahmoud Farhadiroushan.

The company's technology, "Intelligent Distributed Acoustic Sensor", or IDAS, can measure the acoustic field at every metre along tens of kilometres of optical fibre, capturing the amplitude, frequency and phase of the incident acoustic signal with a dynamic range of over 120dB.

Fibre optic technology can be used for many applications including cement evaluation, fracture analysis, integrity monitoring, flow profiling, artificial-lift optimisation, monitoring casing leaks as well as wellbore seismic imaging without the need to shut-down the wells.

The company has demonstrated the benefits of its high performance monitoring systems both in flow and seismic imaging, working working with Chevron, Statoil and Saudi Aramco.

The company has developed a wide range of installation methods for in-well surveillance applications.

It has completed a multiple logging operation in high temperature deviated gas wells using its micro-coil tubing fibre optic sensor.

The company is currently working on a permanent in-well installation of combined distributed temperature and acoustic sensors to monitor the well life-cycle performances.

Silixa has developed a number of signal processing techniques for handling and processing the distributed acoustic data. One of the key applications is distributed downhole flowmeter. The acoustic noise generated and propagated through the fluid can be characterised at every meter along the wellbore.

Using an array processing technique, the speed of sound can be determined at different intervals along the wellbore.

The speed of sound can be used to evaluate the fluid composition which can be then determined from the Doppler shift induced between the speed of sounds propagating in the same and opposite directions with respect to the moving fluid at different intervals.

This means you can see which fluids are flowing into the well at different places, or understand the fluid composition in different places.

People have asked about using it to monitor CO2 sequestration. "Every day we get a new enquiry with new applications," Mr Farhadiroushan says. "Some of them are very intriguing."

A lot of the work can be done with existing fibre cable installations, but cleverer processing, he says.

Pointcross - big data on the cloud

Pointcross of Houston is helping companies structure big data storage on Amazon's cloud data service

PointCross Inc. of Houston, Texas, is helping oil and gas companies store, analyze and distribute large subsurface data volumes on Amazon's Elastic Compute Cloud and Amazon's Elastic MapReduce service.

With the ultimate goal of providing unified "bigdata" stores with analytics, pattern detection, and distribution facilities, PointCross is presently running trials with undisclosed companies for drilling data and separately for SEG-Y data.

"We are combining the use of open-source for MapReduce data store technologies and analytics while leveraging the power of public and private clouds on top of our core ontology engine, Orchestra," said Suresh Madhavan, CEO.

The industry senses and collects huge volumes of seismic data, as well as during drilling and production but very little of it is used for retrospective analysis, learning, or

Report from SPE Intelligent Energy in Utrecht, March 2012

Helping you store big data on Amazon's cloud server - Suresh Madhavan, CEO of PointCross

future decision-making, Dr Madhavan says.

The DDSR (Drilling Data Server and Repository) delivers any data from any well from its "bigdata" store in WITSML format to any external analytics system as well as provide native search and discovery services.

The results of these analytics forms layers of additional metadata which are then used to create predictive models, macros or apps that can be later used at the well site for early warning for safe operations and optimizing exploitation of reservoirs.

The Hadoop Distributed File System and HBase table repositories are supported by Map/Reduce technology along with Pig, Mahout, R and other tools sets configured for analysis of raw data from tens of thousands of wells.

Separately, the SEG-Y Server helps companies hold all the seismic data companies need access to on a common "bigdata" Hadoop store on a public or private cloud with the ability to find the right data using a GIS front end, and get small snippets of traces needed for viewing or analysis on demand.

"Storing the data within national borders, finding the right data and then loading these large data sets on a geophysicist's workstation is an age old problem for the industry and SEGY-Server will help solve this problem," said Dr. Madhavan.

PointCross is located in Foster City, CA with offices in Paris and Bangalore, India. The company employs about 170 people worldwide. A sister company, PointCross Life Sciences, serves the Pharmaceutical R&D industry with similar solutions and analytics. The company is deploying the Non-clinical Information Management System of the US Food and Drug Administration (FDA) on the Cloud.

Improving drilling – Intelligent Energy

The SPE Intelligent Energy conference in the Netherlands included a range of technical papers on how to improve drilling performance with better data and better use of data

Matthew T Prim of ExxonMobil said that his company has managed to increase rate of penetration by 80 per cent in some cases, with the help of a drilling performance management system.

The paper was SPE 150208 "*The Critical Role of Digital Data in a Physics-Based Drilling Performance Workflow.*"

If you ask drillers how to drill faster, they always say 'more weight on bit', he said. But you eventually get problems, such as bit balling (cuttings sticking to the bit); bottomhole balling (when the drilling fluids can't carry the cuttings away from the drill-bit fast enough), or vibration.

With better data, you should be able to work out how hard you can drill without running into problems.

There are many new data sources you can work with, including photographs from downhole, photos of cuttings and cavings, measuring torque and drag on the drill bit, gathering log data, monitoring cuttings.

All of these digital data streams are evolving, he said.

For vibration it is possible to work out exactly how much the energy losses are.

Pressure while drilling (PWD) data gives an indication of cuttings in the fluid.

To make it work, "we need a deep understanding of the source, quality, filtering of the data," he said.

To monitor if the drill bit is jerking ("stick-slip"), it is important to take surface torque at high frequency. Conventionally, surface torque is measured every 20 seconds, but the jerks can be only 3 seconds long and impossible to detect this way. So Exxon mandates that all of its rigs collect torque data every second, he said.

There are "almost definitely" stick slip cycles without a shorter period than 1 second, he said.

Mr Prim made a differentiation between "complicated systems," which have more parts than the brain can process, and "complex systems" which are not understood well at all.

"We can't automate what we don't understand," he said.

In order to use digital data in a performance management workflow you have to reduce the complex to the merely complicated, he said.

"There are so many things going on - to ask a small group of individuals to focus on all the limiters is impossible," he said. "But we do believe that specific modules are suitable for automation."

Better drilling data

Roar Nybø, PhD research scientist, SINTEF, said that there isn't much sign of improvement in quality of drilling data. "Unlike computing power or data storage capacity, data quality does not follow Moore's law, it is in the same place it has been for several years," he said.

His paper was SPE-150306, "*The Overlooked Drilling Hazard: Decision Making from Bad Data*," written jointly by SINTEF and Shell. The paper is a summary of experience with real-time drilling simulators in an operational setting, gained over five years in the Center for Integrated Operations in the Petroleum Industry.

Drilling data isn't getting any better - Roar Nybø, PhD research scientist, SINTEF

Many people in the industry are interested in real time drilling simulators, a computer model of the drilling which is continually updated using live data, because you can use the simulator to get a better idea of what is going on.

But these developments are being held up by poor data quality, he said.

A common problem is when a new

piece of background data is provided just before drilling starts, such as information about the BHA configuration and there isn't time to verify or correct the latest information. "We sometimes had to stick to the old data, because the low data quality meant the new data could be even more misleading", he said.

Then once the drilling starts, there are often problems with sensors and middleware, he said.

Operators also rarely record real time data about their drilling. "In our experience the operator gets access to the real time data during the operation, but often leave permanent storage to the service company," he said.

On one project, SINTEF (working on behalf of an operator) tried to track down the person at the service company who had the real time data to ask if they could have it.

"He was shocked, no-one had ever asked him for data. Then he said 'This data will need quality control before I hand it over, who's going to pay for that?'. This issue had simply not come up before.

"If you have real time data you can feed it into a model. If the result doesn't fit, there's either something wrong with the model, something wrong with the data or something wrong with the well. This means the model output is a versatile resource, which can be used for both automatic quality control and reduction of false alarms in alarm systems. In addition to decision support, which is of course its main purpose.

"But just like any other equipment, models need calibration" he said. "What you find is that ordinary drilling operations don't give you an opportunity to calibrate your model. Then you can't even tell if you have bad data or not, because you have nothing reliable to compare against."

It is frustrating that people commonly see data quality as an IT issue. "But bad data quality is not a computer problem it is a drilling hazard and should be treated accordingly", he said.

"Nor is it just a technology issue; it is also a people and process issue. We can draw an analogy with the computer industry. While computers are getting faster at an exponential rate, you're not seeing the number of software bugs falling exponentially. Avoiding and fixing bugs take human effort"

"Similarly, faster computers and broadband connections to the platforms are not going to solve the data quality issues, we have to do that ourselves."

Among Mr Nybø's recommendations is to start using the data, even if the quality is not good enough initially. "Establishing the human connection between those who produce and those who consume data is just as important as connecting the right cables. People need to know that the data they provide is used, by whom and for what purpose. In a busy operation, nobody would prioritize the quality of data that nobody asked for." The human connection is also vital for providing real-time feedback on data quality, so that it can be fixed there and then.

That's not to say technical improvements should be ignored. Wired drill pipe, which can carry a lot more sensor data from downhole and sensors along the string, provide a lot more redundancy in the data, letting you both calibrate your model more accurately and spot if a sensor is malfunctioning, he said.

WITSML

Majid Al-Shehry, system analyst at Saudi Aramco, and member of the WITSML Executive Team, talked about the developments with WITSML.

The paper was SPE-150278, "*WITSML: Laying the Foundation for Increasing Efficiency of Intelligent Wellsite Communications*," written by staff from Digital Oilfield Solutions, Baker Hughes, Schlumberger, Halliburton, Saudi Aramco, Petrolink and Energistics.

With WITSML 1.4.1, Energistics wanted to simplify the process, he said.

So for example instead of having separate objects for different logs, doe MWD/LWD, mud logs, wireline logs, and pressure pump logs, it just as one "log" object.

Altogether the number of data objects has been reduced by 60 to 70 per cent.

Saudi Aramco started implementing WITSML 1.3.1 in 2008 with the help of Petrolink. It started moving to version 1.4.1 in 2011, testing the new data objects.

Saudi Aramco has an online system for gathering drilling data, called "Saudi Aramco Drilling Knowledgebase" or SADK, which connects to the drilling site.

The rig sites provide real time data in a variety of formats, with some still generating WITS data only.

The company has centres to monitor geosteering and look at lithology in real time.

The new WITSML version is "more robust than previous versions and has faster performance," he said. "It offers more strong functional support."

The new WITSML version can also be compressed using GZIP, which should make it faster to move data, he said.

WITSML 1.4.1 should also make data easier to manage, which should lead to easier quality control, commented one audience member.

Integrating WITSML and PRODML

William McKenzie, IT Strategist at Chevron, talked about the work Energistics is doing to integrate its standards together.

The paper was SPE-150057, "*Integrating WITSML, PRODML & RESQML for Cross-domain Workflows*," written jointly with Total, Paradigm, IFP, Computer Modelling Group, Energistics and Schlumberger staff.

WITSML covers data exchange for drilling; PRODML covers production data and RESQML covers reservoir data.

PRODML is seen as the 'middle child' in the 3 main Energistics standards. There are still people in the market asking for explanations about why they should be using it, he said.

To develop the standards, Energistics has a range of 'special interest groups' or SIGS, covering discipline areas such as drilling and completions, production, reservoir management, asset and data management.

Some people sit in several SIGs, which helps integrate the work across different disciplines, he said.

Also, each "ML" has its own steering committee, executive team and functional work group.

"We've been successful with 'MLs' because we've broken the system down, that has enabled us to come up with far more useful standards," he said.

"We all want the same thing, to share data and for data to move seamlessly across boundaries."

Involving the SIGS is important in any new initiative. There were efforts to develop an all encompassing 'ML' called 'EnergyML' but this initiative is "gone away" because "it was presented in the wrong way," he said.

"If you don't make people part of the process you're going to fail."

Energistics is moving towards a structure where there the executive team of the Energistics has representation from each of the special interest groups.

Companies often use the standards together, for example when Chevron is doing gas lift it uses both WITSML and PRODML, he said.

To make this easier, there is some commonality of data objects between the standards, for example each "ML" has the same data object for wells.

The RESQML exchange standards for structural models can use drilling data from WITSML, covering the wells and wellbore, he said.

Standardization is the enabler for our ability to integrate knowledge across the organization. Open standards from Energistics are the key to Integrated Operations being 'the way to operate' in Statoil.

Peter Eilsø Nielsen
Chief Geologist Production
Statoil

energistics™
The Energy Standards Resource Centre

<WITSML/>™
energistics standards

<PRODML/>™
energistics standards

<RESQML/>™
energistics standards

Ways to improve production

Technical sessions at the SPE Intelligent Energy conference in the Netherlands covered a range of ways to improve production, on complex fields, old fields, across Africa, with thermal EOR and with fibre optics

Keat-Choon Goh, principal optimisation engineer with Shell, talked about his company's systems to try to optimise the complex Sarawak gas gathering system in the South China Sea.

The paper was SPE 150109, "*Successful Real-time Optimisation of a Highly Complex, Integrated Gas System: Intelligent Energy in the Real World*," by employees of Shell and IPCOS, an optimisation solutions company based in Belgium.

The Sarawak gas gathering system has over 100 wells, 40 platforms, and 3 LNG plants.

Sometimes platforms are shut down, which involves complex synchronisation; some production lines have carbon dioxide and hydrogen sulphide; there is effort to maximise condensate production.

"We want to meet gas demand, and keep CO2 content at its allowable maximum," he said.

To make things more complex, "the first batch of wells and platforms have different contracts to the 2nd batch and 3rd batch," he said.

Shell has to optimise on a well, field and asset level. "There's a replication of structure of what we are looking at," he said. "All the way from multilateral wells to an asset wide basis, like a fern."

The optimisation also happens at different time scales, he said. "It's complex on multiple levels. This is a large scale optimisation problem."

"Optimisation can be tried using Excel files, but its generally not very convincing," he said. "We want a fit for purpose optimisation system, to continually optimise production."

Shell is now using optimisation software, supplied by an (undisclosed) software company.

It works out the optimum set-up so you can get the most condensate, keep within carbon dioxide rules, provide enough gas to meet demand, and maximise revenue.

Running the optimizer takes 3-4 minutes on a 4 year old laptop, he said.

The tool was not developed specifically for Shell, which should make it easier to make sure someone is around to upgrade it when it needs to be upgraded. "We believe software sustainability is a major concern," he said.

One audience member from Saudi Aramco said that his company is engaged in similar projects, aiming to maintain levels of gas production during optimisation, and a certain condensate to gas ratio, and optimising because different contracts are demanding maximum delivery of different substances.

Onshore 4D seismic – for thermal EOR

Kees Hornman, geophysicist at Shell based in The Hague, talked about how Shell is monitoring steam enhanced oil recovery at its Schoonebeek heavy oil field in the Netherlands, using seismic.

The paper was SPE-150215, "*Continuous Monitoring of Thermal EOR at Schoonebeek for Intelligent Reservoir Management*" written by employees of Shell and NAM.

The field is monitored using time-lapse (or "4D") seismic (doing seismic surveys at regular intervals to try to work out what has changed).

The time-lapse seismic surveys could help show pressure and temperature variations in the reservoir and quantify them, and use the data together with well data.

Time-lapse seismic is much harder to do onshore than offshore, because there are more factors which can change from one survey to another, such as traffic or machinery noise. But Shell aimed to overcome these problems with a variety of different "appropriate measures".

The time lapse seismic has only been used over a portion of the field so far as part of a pilot project, but now Shell will use it over a larger area of the field.

The field was first discovered in 1943, produced until 1996 and then abandoned. It was re-started in 2009, to take advantage of recent advances in heavy oil technology, including horizontal wells, high capacity pumping units and steam injection technology, and is expected to produce a further 100 to 120m barrels by 2035.

The remaining oil is very viscous so needs steam to produce. However the oil layer is 20m thick and the reservoir has excellent porosity and permeability, he said.

Reservoir engineers want to get an understanding of how the steam 'chest' is progressing through the reservoir.

Ideally, "steam propagates symmetrically," he said. "But a fault, even if only a few metres, can stop the steam layer for a few years."

There are many changes which take place in the reservoir during steam injection, for example increasing pressure in the reservoir, seismic velocity changes due to increasing pressure, gas coming out of solution, the rock (reservoir matrix) expanding, heat in the rock above changing the seismic velocity. "Pressure is propagated quickly, steam and heat are propagated slowly," he said.

The geophysics models need to take these changes into account. "You learn, update your models and react," he said.

Shell is applying the same intelligent reservoir management systems it developed for the Amal West field in Oman, Carmen Creek in Canada.

Fibre optics for strain sensing

Shell is developing technology to monitor the strain which well tubulars are under using fibre optics, said Vianney Koelman, chief Scientist Petrophysics at Shell.

His paper was SPE 150203 "*Optical Fibers: The Neurons for Future Intelligent Wells*," written by 3 Shell employees.

"I'm enthusiastic in general about this technology," he said. "We have tens of people in Shell developing this."

Fibre optics were first used for temperature sensing, and acquired the acronym DTS (distributed temperature sensing).

Now Shell uses the acronym DxS, where the x indicates that you can sense all kinds of things with it. "There's a whole group of sensing technologies, broadening at a very fast rate," he said.

You can use fibre optics to measure strain by wrapping the fibres around the tubular, and measuring how much strain the fibre optic cables are under, he said. You can measure this because the passage of light through them is different if they are stretched.

If a tubular is under strain, this can be a useful early indication of a well integrity problem.

In one example, 4 fibres were wrapped around a well tubular, enabling detection of exactly how the tubular was being strained. This typically gives a resolution of 1m (you can pinpoint a strain problem to a certain metre length of tubular), he said.

Fibre optic cables can also measure other parameters.

You can record seismic data downhole (using them as microphones), to get a better understanding of the subsurface between the

well and a seismic source on the surface.

The signal to noise ratio on fibre optic acoustic sensing is "not as good as state of the art geophones," he said. "But really what we want is a system which is less costly to deploy."

You can analyse fluid flow around the well, by detecting how fast seismic waves go through the surrounding fluids.

Another technology under development is to use them for chemical sensing, where you coat the fibre in a special material which swells in the presence of certain chemicals. If the material swells, you can detect it in the light patterns through the fibre. "Distributed chemical sensing is the least mature. We work with TNO in the Netherlands [to develop it]. We haven't put this in wells yet," he said.

The fibres could also be used to monitor injection wells (in enhanced oil recovery), and monitor production of hydrogen sulphide.

The real potential is when you have all of these readings together, and have figured out a way to use all the data. "Business integration is a term which comes back again and again," he said. "How to turn fibre optic sensing into value."

Fibre optic cables can deliver data for every 6 centimetres along the cable, and it can all add up to terabytes per day.

This compares to kilobytes per day from permanent downhole gauges installed in the 1980s, or megabytes per day from distributed temperature sensors in the 1990s.

"We see an explosion in data rates - but is also a challenge to get information out of that huge pile of data," he said.

You don't necessarily need terabytes. "If we have pressure at 10 or 15 points in a well, for 99 per cent that's enough," he said.

But still, the first stage is to actually gather the data. "The real bottleneck is measurements," he said. "Petroleum engineers normally admit to that and say 'I'm always eager to get more data.'"

"The promise is that we don't get a snap shot picture, we get continuous data."

The cable survives for long periods and older cables can still provide data which can be used for high-tech data processing methods. "We've got an old cable, come along with our light boxes, and it works," he said.

"Does it have a promise for many tens of years? We don't know yet. It is a glass hair in the well."

Shell works together with a number of technology providers under joint development agreements, he said.

Optimising old Texas field

Bill Taylor, Technical Team Leader at Chevron based in Texas, talked about how is company is optimising the McElroy Field in the Permian Basin, West Texas, which has 600 producing wells and 490 injection wells. A further 50-75 wells are drilled every year.

His paper was SPE-149668, "*Chevron's Digital Oilfields Solutions and Base Business Processes Maximise Value at McElroy Field, West Texas*".

The McElroy Field was first discovered in 1926, and water flooding started in 1948. The field has a variety of artificial lift systems and injection systems.

Today, total oil production is 9,500 bopd, with around 350,000 barrels of water per day production.

"We are moving a lot of fluid around the field," he said. "It is challenging to manage the fluid. There's a lot of complexity to what we're trying to do. "The reservoir is more complex than you might think."

Chevron implemented its Integrated Production System Optimisation (IPSO) program, part of Chevron's "i-field" program.

The project aimed to put together workflows to manage the waterflood, gather the necessary data, apply filters, and present the results for review.

As a result, the number of injection wells within 10% of their target rate increased from 185 to 275 wells within 8 weeks, he said.

It also led to a reduction in annual decline in production from 13 per cent to 9 per cent, he said.

ISPO guides operators to come up with a plan for how much fluid they want to inject or product in the various wells, and try to see how closely they are following it.

There is a "well event surveillance tool" runs every night, to analyse the data and identify wells which are worthy of a closer look, perhaps 3 wells out of the 1090 in the field. Then a meeting is held on Monday and Wednesday to look at them in more detail.

The software produces a map showing which injection wells are above or below target, with different colours. "I said, it has to be very visual, I want things that stand out so I can tell what the problem is."

"The goal was to pull all that information into a tool and manage the results," he said.

Using statistical analysis, you can work out which wells are most critical to overall performance. "We said, you don't have to look at all the wells, look at these 10 injectors and 4 producers."

Once an action plan has been decided on, it goes into an 'action register', to plan the well work.

The field team also implemented Chevron's program Integrated Production System Optimisation (IPSO) process to gather data and look for bottlenecks in the flow.

There is another tool monitoring every piece of equipment in the field.

Managing African production data

David M Smith, Solutions Manager at Schlumberger Information Solutions in the UK and Ireland, talked about the project he has done with Tullow Oil to help Tullow get better production data for its non-operated wells in Africa.

His paper was SPE-149641, "*Enhancing Production, Reservoir Monitoring, and Joint Venture Development Decisions with a Production Data Center Solution*," written jointly with Tullow Oil.

The aim was to get production data into a common data format, so it could be more easily analysed at Tullow's production data centre in South Africa, to monitor production.

Tullow has non-operated assets in equatorial Guinea, Gabon, Conga, Ivory coast, altogether 500 wells with 7 different operators, he said.

There is a production and reservoir engineering team in Cape Town, where engineers monitor 5 reservoirs each, with between 7 and 200 wells.

Each field typically sends data weekly, in pdf, excel or Microsoft Access database format.

Tullow was missing opportunities to optimise (or suggest means to optimise) production because it could not see all of the production data in a common format, he said.

It could also not assess if wells were interfering with each other.

"They couldn't challenge the operators or suggest production enhancement improvements," he said.

New wells were being added or changing their designation around ten times a month, adding to the complexity, he said.

It was very difficult to track which wells were providing the production.

There was often a problem of data being incomplete or incorrectly loaded, he said. "Far too much engineering time was being spent on data management, leaving less time for value-added work."

A drilling infill program was increasing the number of wells being managed, adding to the complexity.

Tullow and Schlumberger decided to work together to try to work out the best way to work with the data.

They did reviews of the documentation

available. They defined what was currently available and where they wanted to get to with it ('as is' and 'to be').

Tullow wanted "easy access to validated, trusted data, automated data loading, and a standard template," he said. "Efficient data transfer to reservoir models, consolidated reporting on the intranet, the ability to run daily allocations."

The final solution, "Production Data Centre", extracts data from the various file formats supplied by operators, including pdf files and excel files, and inputs it into the central system.

Pdfs need to be supplied in the same format week after week for the extraction system to work. "Pdf is the least preferred method," he said.

"It took 4 months to develop", he said.

The software runs on a small single server system. "It is quick and easy to install and scalable," he said.

As a result, "we got validated and trusted data, more efficient data flow and improved data ownership," he said.

"Sometimes Tullow can alert operators [about a problem] before operators themselves are aware. Tullow can challenge the operator if necessary."

"A second set of eyes on partner data has led to increased production, enhanced reservoir monitoring, and better joint venture investment decisions."

A second production data management project was deployed in London covering European and North Africa fields, gathering together data from 25 different daily and monthly reports.

The system developed by Schlumberger builds on its Finder* data management system.

Improving IT reliability

Schlumberger has been engaged in a project to improve the reliability of its real time data systems, said Sebastien Lehnherr, real-time technology product manager at Schlumberger based in Paris.

His paper was SPE 150095 "*Transforming IT to Sustain and Support Real-time Operations Globally*" written by Schlumberger employees.

Schlumberger needed to translate its business need for more reliable IT infrastructure into steps that IT managers around the world could follow.

All IT managers are provided with a checklist to follow that will help maintain uptime, with questions such as, does the network cabling have a label, is there a generator (back-up power), is there a secondary WAN connection, are UPS generator tests done twice a year, does the GeoMarket (regional) IT manager attend GeoMarket operations meetings.

There are specifications for minimum hardware standards.

It included a target for the data communications level which would be expected at all well sites.

"We have a clear standard, very robust," he said.

Schlumberger monitors communications standards on all the rigs where the company operates, looking for factors such as average uptime and data latency.

"We are using this dashboard on a daily basis," he said. "People get alerted as soon as we have problems."

Since bringing in the system, "there's been an increase of 35 to 95 per cent of rigs that are reaching the standard," he said.

The results show that the company has had "zero catastrophic events since 2009," he said.

"All the key stakeholders get data about performance," he said. "We can keep the eye on the ball. It's made a really big difference."

When Schlumberger staff are working on rigs operated by other drilling companies, Schlumberger people will typically bring their own communications equipment with them, rather than rely on the system that is installed on the drilling rig, he said.

One of the biggest helpers when rolling out the system was "senior management," he said. "I don't think we could have got there without them."

Rush to the cloud

The movement to cloud computing, sometimes used together with mobile devices, is happening faster than anyone predicted, according to a recent Accenture / Microsoft survey

In a 2012 survey of 200 oil and gas engineers, managers and IT managers, conducted by Microsoft and Accenture, 23 per cent said they were "currently using private cloud services," and 9 per cent said they were "currently using public cloud service," and 36 per cent said "there are plans to use cloud services in the future."

The move towards cloud services in the oil and gas industry seems to be moving faster than most people predicted.

Only 17 per cent said "Cloud Services are not applicable to my role" and 16 per cent said "There are no plans to use Cloud Services in the future."

Ali Ferling, worldwide managing director of oil and gas with Microsoft, said "We see more and more of our industry partners coming up with cloud solutions, as well as also customers in the oil and gas industry starting to discuss this solution."

"I think the industry is figuring out where we get the biggest benefit from using cloud services, [and how to get over] drawbacks some people have, such as security questions and legal restrictions to use cloud services, for example, if it is required to keep certain data in the same country."

"It is our duty to find out what is the best usage, what are the best scenarios for cloud services," he said.

There is also a growing interest in providing information from cloud type servers to mobile devices.

45 per cent of respondents said they thought key production indicators and common information should be made available to all users on a mobile device (tablet or smart phone).

27 per cent said it should be available to engineers and operators only, 20 per cent to management only, and only 1 per cent said that they would not like to provide data to anybody via a mobile device.

Benefits of cloud

There are plenty of hard commercial benefits to cloud computing. Microsoft has a case study with Baker Hughes using cloud services for high performance computing, where they found a simulation that previously took 9 months could be run on Microsoft WindowsAzure cloud platform in under 1 month, he said.

Cloud is not new, in that cloud e-mail (such as Hotmail) has been around for many years, but perhaps what has changed is the existence of mega data centres with tens of thousands of servers, which for example, bring down the cost of storing large amounts of data at low cost, Mr Ferling said.

Part of this cost reduction is achieved through new server technologies which use less electricity to operate and cool. "That's a huge amount of operational expense on top of the hardware," he said.

People are also getting much more ac-

"I think the industry is figuring out where we get the biggest benefit from using cloud services" - Ali Ferling, worldwide managing director of oil and gas, Microsoft

customed to getting data from online services from their personal activities, he said.

Public and private

As soon as a discussion starts about cloud, the next question is usually whether you want to host the data on your own servers or public ones (such as the Microsoft ones).

The main difference between the two is the cost, Mr Ferling said – it is more expensive to host the data yourself.

"You can rent times in these data centres. You can run huge simulations and just pay for the time you use," Mr Ferling said.

Building blocks

Microsoft sees its role as providing a range of tools or platforms which other companies can build services on top of. For every dollar Microsoft earns, Microsoft partners make eight, Mr Ferling said. "We are a very partner-centric organisation in terms of delivering industry solutions and services to our customers."

Microsoft is continuing with its "Microsoft Upstream Reference Architecture" project to engage its customers and partners in discussions and agreement about, how to best use the Microsoft stack in an Upstream Oil & Gas connect, or – to mention a concrete example, what is the best architecture related to specific business scenarios, such as data architecture, streaming data etc.. All this is based on, but not limited to, Microsoft products as the building blocks.

In the meantime, there are 39 Industry partners involved in MURA and holding monthly meetings, on topics such as big data and security, cloud, and how to fit mobile phones and slates into the business environment.

Other survey responses

Also in the survey, 74.5 percent of respondents said they spent as much or more 'focus and investment' on IT in 2011 as they did in 2010.

Nearly half (43 percent) said they also anticipate lower costs due to streamlined operational workflows.

Almost 75 percent of survey respondents agreed that the need for improved incident response has created the need for greater IT integration in the upstream environment. However, 60.5 percent of respondents said that, as a result of those same regulations, they are experiencing slower business processes.

Regional results reveal that additional regulations were slowing business processes for close to half (46.3 percent) of North American survey respondents, followed by respondents in Asia-Pacific (12.4 percent) and Africa (7.4 percent).

There's not much improvement in the biggest problem people have, finding information. That was the biggest difficulty in both the 2010 and 2012 surveys, in particular retrieving information from another department of the company.

When asked "What are your concerns regarding the use of Cloud Services", 45 per cent said security, 26 per cent said loss of control, 22 per cent said standards, 5 per cent said none.

Apps not data

Dean Forrester, senior director at Accenture's Energy industry group, said that he is surprised how fast the industry's interest in cloud has developed from seeing it as a place to store data to seeing it as a place to run applications from.

"It's not a big hard drive in the sky; people are moving services out to the cloud," he said.

There are many vendors developing cloud workflows, for example for gas lift optimisation or well test optimisation, he said.

A lot of these applications are also running on mobile devices.

There are 2 ways mobile computing is used in the oil and gas industry – the 'Starbucks' case, where an employee wants to get the same data on his iPad in a coffee shop as she can in the office, and the field usage, where staff at field sites find tablet computers much more convenient than laptops.

Accenture has been running workshops with a number of oil majors and service provides in Houston, to talk about what kind of data tools their staff might need on their mobile devices, eg to monitor downhole pumps or field equipment.

Accenture has already built a range of experimental mobile phone apps, for example one for monitoring a field, including a map, which shows you where you are in the field, and gives you alarms from the equipment.

Accenture has 5,000 staff members with skills to build mobile phone apps and the infrastructure behind it, Mr Forrester said.

It is becoming a challenge filtering out which mobile phone apps you are actually going to build. "Everybody has a great mobility (mobile phone app) idea," he said. "How do you identify what are the key trees you want to jump on?"

IT departments "need someone in charge of mobility," and "you need business people involved in the prioritisation of which apps do we build," he said.

But it is possible to build up tablet apps as quickly as 4-6 weeks "from something on a post-it note to something that you can look at and touch," he said.

Mobile devices are unlikely to replace the desktop or laptop computer, but they are more useful if someone wants to look something up quickly or post some data.

"The minute you put something on an ipad or iPhone, there's an expectation that it will be pretty, easy to use, you can just tap on it and something useful will happen," he said.

"Start to finish, to produce a really high demo content, took 4 – 6 weeks – it's as good as anything you'll see on the app store," he said.

Don't assume everybody has fast wireless bandwidth available – many oilfields are in remote areas where there aren't even mobile phone masts. "That's part of the design principles that you have to consider with mobility."You also need to make sure that the app keeps running fine if the data communications is lost. "The application has to keep working – stacking up stuff ahead of time," he said.

Making apps for different devices is not so difficult, the user interface is usually about 10 per cent of the work, 90 per cent of the work is the data plumbing behind it.

"If you have to build more than one front end, that's a drop in the ocean compared to the back end – getting the data right, getting the data architecture right, getting the appropriate data to the appropriate people."

Making contract management systems popular

Formal contract management systems are often not very popular with site-based project personnel. Richie Anderson of 8 over 8 explains how to get them involved

Richie Anderson

Resistance to adopting a contract management system is often significant from site-based project personnel.

The most commonly cited reason is that a contract management system will slow down decision-making on fast moving projects, and also inflict unnecessary bureaucracy on project staff who continue to invest in the paradigm that says "managing capital projects is more art than science."

However, one does not have to ask too many contract engineers to hear numerous stories of sleepless nights over how to reimburse a contractor for work performed after a rushed hand-written site instruction was issued by a field engineer without any follow up notification to the contract management team; the first they heard about it was when the invoice was received!

Management by exception

The truth of the matter is that to successfully manage modern, complex projects with compressed schedules in a changing geopolitical climate, and with the lean management teams commonly used these days, the project and associated risks must be managed by exception.

International oil companies are increasingly realizing that using a contract management system designed for major capital projects, integrated with their ERP system, dramatically reduces the effort required to fully manage and monitor everyday communications, activities, contractual obligations and contract spend, and does so in a transparent, repeatable manner.

This frees up valuable expertise to deal with the unexpected, i.e. the exceptions.

A contract management system for capital contracts provides complete transparency and advance notice of site instructions to all that require visibility, whilst providing the flexibility and speed required by field engineers to deal with minor, unplanned changes to work that pop up on site. A proper contract management system manages the communication between responsible parties, captures and logs potential risks while doing so, ensuring that nothing escapes visibility, and that all contractual obligations have been met.

Overruns

Given the many years experience of National Oil Companies (NOCs) and International Oil Companies (IOCs) of investing heavily in the delivery of such major capital projects, it comes as a surprise to many outside the energy sector that the average cost overrun on major capital projects between 2005 and 2009 was 15 per cent, and that nearly 40 per cent of mega projects (>$1bn) exceed budget and cycle time by 10 per cent.

While such overruns can be quantified, and greatly minimized using a variety of best practice processes and early warning systems, the consequential effects of these overruns can be felt by the party managing the project long after the project is complete and the asset goes into operation.

Major capital projects are more complicated than ever before, on a number of levels. They are larger in scale, require extensive financing, work to compressed project timelines, are technically more challenging, involve more stakeholders and are often managed by a collection of teams based in different locations.

In addition, the geopolitical climate has changed: there is an increased regulatory burden in terms of local/social content and environmental responsibilities, and some US IOCs are reporting that influence of US foreign policy has to be classed as a potential risk for some of their major capital projects.

In this changing landscape the super majors are more proactive than ever in protecting their capital investment in order to gain maximum return on investment and secure a competitive advantage that largely hinges on the success, and output, of those capital projects. Their publicly-announced strategies for 2009-2011 are very specific about focusing on major projects, and the need to address cost overruns.

Causes of overruns

Cost and schedule overruns can be attributed to a variety of causes; not all are within the control of the project stakeholders, for example an unstable geopolitical situation or natural disasters.

However, overruns that result from the following list are very much risks that can be identified, managed and mitigated by project stakeholders: incomplete design, a poorly defined or inappropriate contracting strategy, and inadequate contract execution.

An example of inappropriate contracting strategy includes selecting an EPC contract as a vehicle to transfer risk from project stakeholders to the EPC contractor without due consideration of the risks that this contracting strategy, in itself, poses.

If an EPC contractor has won the contract on the basis that completion risk would be addressed by binding the contractor to a schedule to completion (secured by liquidated damages for delay), and cost secured by receiving a fixed lump sum price, then it comes as no surprise that the EPC contractor, who may have bid low to get the work but knows that they are more likely to overrun a lump sum bid than under-run, has more to gain than lose by submitting as many claims and variation requests as possible.

Other factors contributing to schedule delay and cost overrun relate to materials and equipment, lack of EPC contractor's experience, late approvals due to poor coordination and communication between project stakeholders, poor communications between project management team, contractor and suppliers, and unrealistic project scheduling.

Another prime example of poor contract execution is not having appropriate, joined-up tools and mechanisms to provide continual oversight and governance of risks that may negatively impact completing the project to schedule and on budget.

Early warning, and continual monitoring, of risks is critical to project success. The days of managing and monitoring risk with a collection of disparate spreadsheets stored over multiple laptops and shared storage drives are long gone; they are simply not fit for purpose in this era of the complex megaprojects.

This is not a reflection of the quality of the contract management team, it is simply a realization across the industry that tracking vast quantities of data, contractual communications, contractual obligations, and potential financial commitment vs. budget vs. actual commitment vs. expenditure is something that requires a comprehensive contract

management system, not a spreadsheet.

Effects

It is worth taking a moment to reflect on other effects of overruns, apart from the obvious metrics of spending more than was budgeted for an asset that was delivered later than planned.Overruns affect standing with lenders and access to future capital: this results from delayed income from Production Sharing Agreements, and also from cost recovery issues with host governments [capex/opex/first oil diagram]

Reputation as being a project partner that does not deliver or monitor its commitments; this affects access to new opportunities and gives advantage to competitors.

Harder to recruit the quality project and contract professionals required to replace the aging population of capital project experts and practitioners.

These issues are of vital importance to the future of IOCs in a global, commercial environment where only 7% of the world's reserves are now fully accessible by IOCs and there is a notable increase in worldwide competition from NOCs expanding outside their host countries. In addition, the price environment for oil and gas is uncertain with refining margins also being squeezed.

Adopting a contract management system that provides complete visibility into potential and actual risks, as well as a set of standardized processes and templates that ease contract management tasks in a cohesive, repeatable manner has proven to be a winning formula around the world.

8over8's contract lifecycle solution ProCon is a formidable defense system which puts owners in control of the shared communication channel, thus mitigating the risk of contract overruns and poor cost recovery. Forward-thinking IOCs who have implemented such a system have successfully delivered major capital projects on budget and on time, and enhanced their reputation as world class project partners.

digital energy journal

Oil major moves financial planning off Excel

UK business intelligence company Altius helped an oil major move its year end financial planning system from Excel onto an online system the whole company can work with.

UK business intelligence company Altius reports that it recently helped "one of the world's largest oil and gas exploration businesses" to move its year end financial planning from spreadsheets onto a database software tool.

The oil major needed to provide its financial analysts in its exploration and production department with a more effective Group Financial Outlook (GFO) process.

The GFO process enables the business to anticipate any changes to the plan which might occur, before they actually happen.

The company's existing GFO process was previously very spreadsheet-dependent and labour-intensive to prepare each month.

The company needed to turn around information in a few hours rather than days. So it decided to invest in a Microsoft technology-based GFO solution and selected Altius Consulting to implement it.

Altius worked closely with the oil major's E&P senior financial analysts to replace the existing system with Microsoft SQL Server for relational data storage and Microsoft Analysis Services for multi-dimensional analysis.

Together, these provide the necessary relational and Online Analytical Processing (OLAP) components for a fully integrated Business Intelligence (BI) solution accessible by E&P's analysts worldwide.

The project has been so successful that the SQL Server and Analysis Services implementation has been adopted by the client's joint venture company and is proving equally successful, Altius says.

The oil major's E&P Senior Financial Analyst said, "We [previously] built a systems infrastructure around an existing OLAP (Online Analytical Processing) product for a local audience."

"Initially, all users were in the same building".

"But within twelve months from implementation we needed to extend the system to a broader audience and distribute it through the intranet."

"Unfortunately, our existing product did not give us a robust or scalable enterprise solution."

The client wanted to provide up-to-date data to its Hong Kong, Houston, Buenos Aires, Aberdeen and London offices to ensure that analysts could access information at the same time.

The new system

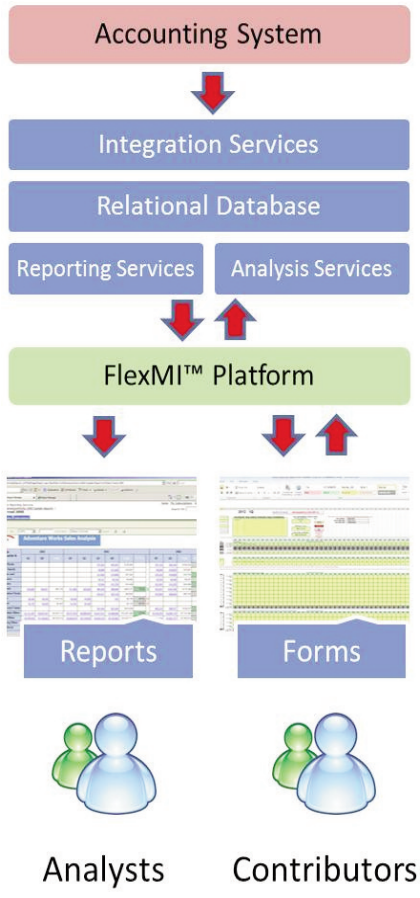
The system Altius implemented was based on the Microsoft Business Intelligence platform using Microsoft SQL Server and Microsoft Analysis Services as the data storage and analysis engines.

It also uses Reporting Services as a Web-based reporting and analysis tool. SQL Server Reporting Services provides users with a user-friendly way to navigate around their business information environment and to gain a solid understanding of where their business is doing well and could do better.

Features such as drill-down and up, traffic lighting and graphs make it a very intuitive environment for the client's analysts to work in.

For ad hoc reporting and analysis, Microsoft Office Excel Add-in was recommended, enabling users to create reports 'on the fly' utilizing the power and functionality of Excel and Analysis services.

A key ingredient in this transformation is that Microsoft has changed the price profile for OLAP technologies. Companies can now gain access to OLAP and relational data-



base technologies for a fraction of the cost of just a couple of years ago.

Since Microsoft Analysis Services is totally integrated with Microsoft SQL Server, these products have combined for a fully integrated BI solution. Reporting Services produces reports and graphics that easily export to Microsoft Office products; the tool is extremely easy to use.

The company's senior financial analyst said, "Reporting Services is a very robust enterprise application which fits well with our intranet. We particularly like the tight integration with Microsoft Office for our monthly financial reports to the E&P Management Team. "

"Previously, we had to print off tabs in 65 Excel workbooks. Now the information can be viewed online, automatically distributed via e-mail as a PDF or exported to excel for further ad hoc analysis."

Financial analysts in the company's E&P segment now have online reports produced in minutes, which previously took half a day to prepare and distribute in hard copy format. The client previously would have distributed all the reports between 12:00 and 1:45, and they now manage this by 9:30 a.m.

What would have taken six elapsed months with older generation BI (business intelligence) technologies now takes less than three elapsed months to deliver.

The Reporting Services Report Builder and the Excel Add-in both enable users to develop their own reports without needing programming skills.

On the expenditure side, cost per user is significantly lower than the previous solution and Microsoft product implementation has saved around $100,000 in annual maintenance costs.

By standardizing on SQL Server and Analysis Services, the oil major's E&P department now finds it much easier to choose from a range of compatible third-party tools, because of the ease of integration with Microsoft technology.

Various solution-specific applications will likely be developed using the Microsoft .NET Framework; the .NET Framework is an integral component of Microsoft Windows operating system which provides a programming model and runtime for smart client application. The client is now in a position to leverage these leading technology developments going forward.

Also, using SQL Server and Analysis Services has enabled the client to build a system which is much less vulnerable to hardware failure. "While we had a form of disaster recovery before," said the oil majors' analyst, "the Microsoft solution allows us to use SQL Server replication procedures to back up the server and provide a more robust disaster recovery system."

By choosing SQL Server as its relational database engine, the oil major's E&P department has improved the control and ease of auditing its data. With the combination of SQL Server and Analysis Services they can now do things with business processes that had not been possible.

Ninety percent of the data captured is presented in Excel workbooks. It has automated load routines, so you can track who loaded it and when. The ability to create a comprehensive audit trail provides additional transparency and security around the critical forecasting processes.

Honeywell – plant data on the intranet

Honeywell has launched "Intuition Executive", a software tool to work with all the data in your plant to help make confident decisions and manage actions

Automation giant Honeywell has launched "Intuition Executive", an online tool to manage and work with all of your plant data.

It extends Microsoft SharePoint, taking data from plant in the OPC standard and other formats, and making use of Microsoft data analysis tools such as StreamInsight.

This is not the first time that OPC plant data has been available on SharePoint, but what is new is a platform to enable everyone in the company to see all of the plant data on one screen, keep the data safe, and work with the data with specially built modules and workflows, adding new components as required.

In the past, Honeywell had a range of tools for doing specific tasks for different siloed groups, such as reservoirs and planning. Now it has all been brought together, along with more sophisticated database and data analytics tools.

This is about "taking a bunch of cogs and turning it into a well oiled gearbox," says Andy Coward, director for portfolio innovation at Honeywell Process Solutions, regarding the launch of Intuition Executive.

"We're enabling customers to create that single collaboration environment encapsulating all the functionality," he says.

"We're providing both an infrastructure and information that drives their workflow," he says.

The system is also designed to work with very large data volumes, which can easily be handed on SQL Server and analysed using StreamInsight, and allows the data to remain in the original source system.

It builds on the strength of Matrikon, a company acquired by Honeywell in June 2010 for Canadian $145m (USD $146m), which makes software for industrial performance monitoring, including it's MatrikonOPC division which makes OPC Servers that allow for vendor neutral data communications between devices, applications, and control systems regardless of their native protocols.

So this means that data streams from any automation equipment, including from Honeywell's competitors, using a range of automation protocols such as Fieldbus and HART, can be accessed by the system.

Because OPC is an open standard there is no bias towards automation equipment from Honeywell over other companies.

You can also incorporate XML data streams, including PRODML and WITSML, and MIMOSA standards for operations and maintenance data, as well as standard relational databases.

The system is already being used by two oil and gas companies in Europe, one major oil company in the Middle East, 1 major refiner in Asia and two major gas in the Pacific, he says. These companies have been working on the trials and the pre-releases and testing various components.

Honeywell has been working on Intuition Executive for 2 years. "It's a significant technology investment for us - which we believe takes the offering to the next level," he says.

Honeywell believes that systems like this can help facilities push production forward by a few percent. "That has a major impact," Mr Coward says.

Working with it

Honeywell provides a range of components for Intuition Executive to perform specific tasks.

You can display plant data however you want to, to meet the needs of different people. Some people might want a dashboard on certain data, others might want to see it in more depth.

You can display graphics, trends, tree maps, and lists. You can host discussions online next to the data dashboards, and distribute notices.

You can use the system to keep track of static information, such as the boundary conditions for equipment. "A significant portion of equipment failures are because equipment is operating outside of their bounds," Mr Coward. "Those operating bounds are rarely shown to the operator or maintenance people."

The service can form a basis for training programs and monitoring programs, bringing in remote experts, documenting best practise, monitoring current activities, decision making, making production reports and comparing different pieces of plant.

You can also connect to other software systems which can integrate with SharePoint, such as SAP.

You could have tools for well monitoring or well performance monitoring. "You develop a template and then roll it out across the wells," he says. "You can identify issues with stability of production, or when there's issues with gas lift."

View plant data on your company intranet, together with other company data

Risk based maintenance - better results for less effort

Having a "risk based" maintenance plan can give you better equipment performance than a "proactive" maintenance strategy, but with less cost and effort, says Andy Scott, global business director for RMBI (reliability-based mechanical integrity) at Lloyd's Register.

"Risk based" maintenance could be better understood as a "right maintenance right time" maintenance, where you use the best knowledge available, including expert advice and data analytics, to work out the best time to do a certain task, said Andy Scott, global business director for RMBI (reliability-based mechanical integrity) at Lloyd's Register.

"Proactive" maintenance is usually understood to mean maintenance using reliability centred maintenance and condition based monitoring tools, to assess the condition of equipment using a range of factors, such as vibration and noise.

The company believes that a good risk based maintenance plan can help reduce the number of inspections you need to make by 50 per cent, and improve reliability by up to 80 per cent.

A risk based maintenance approach can be a great help in reducing non productive time for drilling rigs, he said. "We believe 60 per cent of NPT can be related to maintenance, and we can save 50 per cent of it," he said.

"What we try to achieve is informed decision making, balancing the right level of risk against, asset performance," said Mr Scott. "We build dynamic risk profiles for each asset based on a wide range of criteria including integrity and business drivers"

Lloyd's Register has gathered 15 years of data about the performance of different pieces of equipment, which is important when calculating risk.

The problem with proactive / condition based monitoring is that systems to monitor equipment can be costly and highly complex. "Are the crew and maintenance team up to the task of keeping them current? History shows that perhaps they're not," he said.

Mr Scott classifies maintenance in 4 groups - reactive (fix it when it breaks), preventative (replace items according to a schedule hopefully before they break), proactive (try to monitor the condition of items to see when they are going to break) and risk based (when you try to manage how much risk you are taking).

It is still common for maintenance plans to be time based (replacing certain items after a certain number of hours). This can be nonsense when you consider that one rig might trip (raise and lower drill pipe) millions of feet more than another, and they both replace parts at the same time intervals, Mr Scott said.

Software

The company has developed its own software, called "Capstone RBMI", to help operators of heavy equipment put together a risk based maintenance plan.

Risk based inspection software has been around for many years for fixed equipment, but it has not been made available for rotating equipment before, he said.

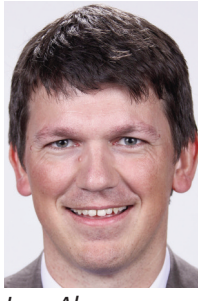
Rotating equipment has more complicated components and more varied damage mechanisms than fixed equipment, he says.

Capstone RBMI runs a screening process across all pieces of equipment in the plant. It works out which assets are most critical (ie cause the most problems if they fail), and prioritises maintenance tasks accordingly.

digital energy journal

Assessing the risk of a blow out preventer

Lloyd's Register is developing a software tool, "BOP Risk Model", to monitor the risk performance of blow out preventers (BOPs) at any time.



Inge Alme

The tool is being built by two Lloyd's Register companies, Scandpower and ModuSpec. ModuSpec is one of the world's leading drilling rig inspection companies and Scandpower isa global provider of risk management services.

The software tool uses Scandpower's "RiskSpectrum" software as a foundation, which is being used in half of the world's nuclear power plants, and incorporates the company's experience in helping manage nuclear power safety.

ModuSpec's Well Control Centre of Excellence based in Houston has recommended to continue operations 29 times when otherwise the regulator would have forced the operator to pull their BOPs to the surface. This has saved operators $200+ million in lost revenue by preventing non-productive time (i.e., 29 BOP stacks remaining in operation X an average of $1.2 million per day X 7 days minimum non-productive time).

"When you detect a failure (in a BOP component) it is very important to judge the criticality of it," said Inge Alme, technical director of Lloyd's Register Scandpower. "BOPs have many components and the judgement is not straight forward."

"Today when people (onboard) detect a failure they do an adhoc risk assessment, all this has to be done with the pressure of being onboard," he said.

And when it comes to recording how decisions were made, "the traceability might not be as good as it should be," he said.

There are also a range of opinions in the industry about what to do in certain circumstances, and the software can help resolve the argument.

For example, some people in the industry believe that a loss of hydraulic fluid from a blow out preventer means that it should be considered failed and drilling needs to stop. However some people believe it is safe to continue drilling after a loss of hydraulic fluid.ModuSpec is developing tools which can get a deeper understanding of how serious a hydraulic leak is.

Skills

ModuSpec also notes that if the well control equipment supervisor has all of the necessary skills to manage a blow out preventer, the amount of non productive time can be much less.

There are 6 basic skills to manage a blow out preventer - electrical, electronics, hydraulics, pneumatics, technology integration and asset management.

The company has developed software tools to assess well control equipment supervisors, so they can be trained in their weaker areas.

digital energy journal

Should we re-invent business IT?

What about re-inventing the connection between IT and the business? What are some considerations and potential actions that could be taken? By Dutch Holland

Today's new executive standard is "to run the business well all the time and change the business well every time." Both sides of the standard will be impossible to meet without business-IT alignment.

Many IT departments need to aggressively re-invent themselves along process management lines or they will not fit with their operational customers who are beginning to use process thinking.

What are IT processes? Opinions vary as would be expected, but the following figure (below) shows how IT processes can be defined and organized around the "run the business, change the business" paradigm.

Run-the-Business Processes are necessary to carry on the day-to-day business of operating applications and serving users. Failure to have run-the-business processes in place and used on a day-to-day basis will result in overall poor service to the business organization.

Run-the-Business processes are composed of IT operating processes, along with the methods and steps used by an organization to run and maintain systems/applications on a daily basis. Also included are Customer Support Processes and Quality Management processes that ensure the overall methods used to create deliverables sufficiently meet requirements

Change-the-Business processes enable the IT organization to put in place those new capabilities and functionalities to support changing business needs and/or to systematically change the way the IT organization operates.

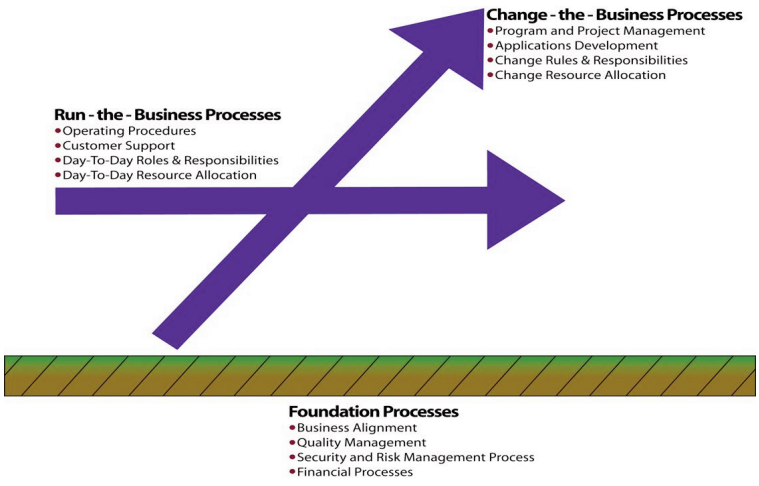
Many would say that the heart of Change the Business processes would be Application Deployment processes, the methods and steps used to manage the selection or development, installation and implementation of new applications for the business or for IT.

Change-the-Business processes depend on Program and Project Management, the methods and steps used to align people, projects, costs and organizational priorities to meet new and changing business goals. Supporting Program and Project Management are Business Analysis Processes, the methods and steps used to fully "understand the business."

Foundation Processes allow discernment of business needs and alignment of IT processes with the business, including steps taken to understand the business organization's direction and to establish IT goals, strategy, resources, technology, and competencies.

Security and Risk Management processes include the methods and steps to reduce the probability of loss or damage to existing or future information assets.

Rounding out foundation processes are resource management processes for day-to-day operations and financial management processes used to account for the cost and/or revenues of the IT organization, to determine accurate costs for IT's key activities/products/services, to make financial projects, to monitor IT performance in financial terms including costs and return on investment.



Organisational risk

Business-IT must step up to its corporate responsibility for risk management, a responsibility that must extend far beyond IT's typical role as managers of technical risks only.

While the benefits to big IT systems have proven to be positive for many companies, implementation of such a system continues to be a risky proposition with three categories of risk, technical risk, organisational risk and business risk.

Technical risk involves the chances that an IT solution may not work as needed or as advertised. IT functions and technical vendors have been doing high quality risk management for a couple of decades.

However, most risks that have been managed are called the technical risks. For really big, technical systems, the two most critical risks can be called organizational and business risks.

The point of reinvention for business-IT is for the IT function to reach across traditional organizational lines to manage both organizational and business risk. (See diagram on following page)

Organisational risk involves the chances that an operating organization will not use the technical system as a part of improving performance. Organizational risk will always be high if the operations organization, directly supported by the IT function, has not specifically prepared its users with aligned processes, workable systems, training on both the system and operational processes using the system, and positive consequences for system usage.

Business Risk involves the chances that an operating organization is actually using the technical system as a part of improving performance but the improved performance is not forthcoming.

More than one system implementation has gone well until it was time to see business returns that suggested the wrong technical system had been chosen at the beginning.

Operations integration

The single most important aspect of Business-IT that is in need of reinvention is what might be called Operations Integration.

No system can have real business value without being used to enable work processes, and the more utilization the better.

Operations Integration is the process of fully and comprehensively preparing the business or operating organization for the use of a new IT system in day-to-day operations.

For years the assignment to prepare business users has suffered from a lack of accountability. While preparing a technical system for organizational use is clearly the responsibility of the head of IT, no such clear accountability is found on the operations side.

Many on the operations side have the impression that IT will automatically arrange preparing a technical system for organizational use (they won't) or that the technical system itself will be so marvelous that its competent use will be intuitively obvious (it won't be).

The Bottom Line: All Three Risks Must be Mitigated for Full Value Realization!

IT must once again step across the chasm between IT and operations to directly participate or even lead a project designed to ensure the organization is ready to use the system being technically prepared.

Why bother?

Why should IT put in extra energy and take the risks associated with working across organizational lines?

First, if the implemented system does not produce business value because of a lack of preparation on the operations side, IT will likely be blamed.

Second, the business' operations side already has "a day job" of operating the company. They will have little time to think through how they might go about getting their users ready. And preparation of users to make money with the system is not a competence of the operations side; operations will need help to get themselves ready to "go to work at go live."

In short, IT has the responsibility to prepare information systems for the organization, and, in today's world, also the responsibility to prepare the users, and take the system "all the way to the bank."

Conclusion

One might make a case today that the changing practices of business require IT to "reinvent" itself for business-IT alignment. Reinvention is not a simple linear operation; reinvention must happen on multiple fronts or dimensions. It may not be fair, it may not be easy, but alignment is there to get done. "Lead, follow, or get out of the way."

About the Author: Dutch Holland, PhD, is a multi-decade veteran of the business wars. He has been in the trenches long enough to know that the real excitement is to take the high ground to see today's big picture and to envision tomorrow's "Upstream Business of the Future." Dutch can be reached through his web site at http://www.hollandmanagementcoaching.com/digitaloilfield/.

Criticality analysis, stocking, sourcing, returns and integration

The foundation elements for an efficient international supply chain are analysing criticality of goods, stocking strategy, sourcing / expediting, managing returns, and integrated systems, says Don Valentine, operation director of Absoft


Don Valentine

Supply chain is a service function and in order to be effective it must have some means to understand which goods and services are important (critical) to its customers.

The supply chain function cannot make that priority/criticality call on its own.

It is the customer's equipments and activities which are safety critical, production critical, time critical and defining that criticality is a pre-requisite to determining the related criticality of the goods and services that support those equipments and activities.

As an example, take a fire pump on a remote offshore site. The maintenance and operations discipline determine the criticality of that equipment as "high" because of its significance to safety.

The designation of the equipment as critical in turn will typically invoke definitions of allowable downtime for that equipment, e.g. "maximum allowable downtime - 24 hours" or "work until fixed".

The implication of this designation are that any materials implicated in the maintenance or repair of the fire pump must be held offshore, because shipping the materials from a local or regional warehouse will break the allowable downtime rules. They should also be included in the most rigorous inventory management regime available (stock counting, replenishment parameters).

There are some key analytics/reporting which can provide you with a health check for this foundation element: number of equipments with criticality assessment performed; number of critical equipments with bill of materials/spares list defined, number of materials associated with critical equipments by the physical inventory regime; number of materials associated with critical equipments flagged as critical spares; stock holdings of materials associated with critical equipments.

Stocking Strategy

There are also proactive measures which the supply chain function can undertake for it-

self based on current inventory data to help it to formulate a view on which materials are critical and therefore which should be stocked where and with what stocking parameters.

Let us presume that your inventory data captures the numbers of goods issues from stock for use by maintenance or projects, and let us also presume that you have captured a unit price for each material.

You then have the parameters that allow you to calculate "Demand Value", the result of multiplying the number of issues from stock for an item over a period of time multiplied by the average unit price of that material.

Calculating that demand value figure for each of your locations can lead to some very illuminating results. A not atypical outcome is that you find that 5-10% of your stock materials catalogue accounts for 80% of the aggregate demand value across the location inventory!

Related actions to such an analysis would be to compare the results with pre-existing stock classifications (ABCD classification) to ensure that stock count behaviours and stocking parameters are appropriate for each material.

For example, for items associated with classification A (critical), a stock count may be performed four times a year, while replenishment parameters may be reviewed once a year.

Items designated as C might be counted once a year, and their replenishment parameters reviewed every two years and some items may be considered for movement from offshore to a local warehouse or from the local warehouse to the regional warehouse.

One very important caution with regard to the exercise described above is to stress that maintenance and operations, and projects, must be involved in this exercise in order to highlight exceptions where inventory data may not tell the whole story, e.g. irrespective of whether a material was issued in a year, if an item is a critical spare or an item required to maintain a critical equipment – it should be classified as A.

Some key analytics/reporting can provide you with a health check for this foundation element: demand value analysis; physical inventories by material class; stock parameters by material class.

Sourcing/Expediting Strategy

The complexities of doing business in Brazil, West Africa and the other oil and gas provinces are well documented and the challenges involved in local procurement, inventory management and logistics in these locales are seldom overstated.

There are some basic principles that apply irrespective of location and which tie into the previous two sections of this article. These basic principles relate to the third foundation element – sourcing/expediting strategy.

Having defined the criticality of goods and the related inventory parameters, (note – non-stock is a valid inventory designation for a material), you have also defined what goods need to be procured and held where.

This information can help you to identify the global suppliers who can cover your needs for specific categories of materials/services at regional, local and remote site levels and highlight situations where you will have to make exceptions and source to specific local vendors.

Critical goods and services should be established on formal sourcing constructs – contracts, framework agreements or blanket orders and should be supported by Service Level Agreements (SLAs) that relate to delivery performance that respects material criticality.

Expediting strategy should be driven by the same thinking. Not all delivery due dates are equally important. By definition, delivery due dates related to items supporting critical activities tend to be more important than those for rope, soap and dope.

It is recommended that expediting is executed within the context of the priority of the activity that requested the goods or services. Traffic light reporting of late (red), amber (at risk) and green (on track) should be available and these analytics/reports must highlight priority 1, 2 and 3 – and promote expediting priority 1 activities first.

In addition to the expediting analytics described in the previous paragraph there are some key analytics/reporting that can provide you with a health check for this foundation element including: contract coverage by material class; material/service spend by category, by vendor, by location; vendor performance by delivery due date or by material class.

Returns Strategy

Unsurprisingly, there is great emphasis placed on the supply chain function in oil and gas getting the right goods and services, to the right place, at the right time. This outbound orientation ensures that goods and services are available at the remote site to perform work.

However, in recent years there has been a growing recognition that the inbound domain of material returns is also a very important area of the supply chain to manage.

The war stories will be familiar to most supply chain professionals: growing stock holdings, no deck/storage space at remote sites, surplus materials not being re-used, no visibility or management of company materials held at third party sites, scrapping of usable items, the list goes on.

Often subsumed under an overarching investment recovery policy, the processes and procedures which ensure that goods returns are handled efficiently require the definition of:

i) The scenarios that returns processes must cover (repairs, rentals return, return for reintegration into stock , scrapping, return to vendor, return for holding etc.)

ii) The steps that comprise each of those scenarios and who is accountable for each step.

A major facilitator for effective execution of returns processes is a returns workbench. Such a workbench tracks and reports each material return by its related returns scenario and for each step of the scenario.

This supports multiple departments/functions in identifying and executing their specific steps in the returns process and also provides visibility of where blockages and delays are occurring.

For example, Finance will use such a workbench to search for materials which are at the stage of a scrapping scenario where financial approval is required. The warehouse manager may use the same workbench to identify and deal with returns which have materials awaiting approval for reintegration into operational stock.

Without such a workbench, tracking and progressing returns scenarios which typically involve multiple steps and multiple stakeholders – procurement, inventory management, suppliers, and finance – can become a nightmare.

Integrated Systems Strategy

Enterprise Resource Planning (ERP) systems, such as SAP, in which the Computerised Maintenance Management module, the Capital Projects module, the Finance module and the Supply Chain module are integrated and all share data, are powerful process engines and datapools which support the workbenches and analytics which are the core of this article.

ERP systems offer workbench/analytic capabilities to support operational, tactical and strategic analytics with strong process support and also critical insights into current and potential future performance.

Watch a video of Don Valentine's talk at our Finding Petroleum Stavanger supply chains forum at www.findingpetroleum.com/video/342.aspx

Managing real time data - a tutorial

Mark Reynolds, staff drilling data analyst with Southwestern Energy (Houston), explains how to work with real time data

Mark Reynolds

Real-time physical data represents a unique challenge for the data engineer.

Unlike financial and accounting data, which must be 100 per cent accurate and can be audited back to the source, real-time data in the physical world suffers from sampling errors, missing data, and diminishing temporal significance.

Real-time operational data is a representation of reality, with assumptions and reductions; oversampled, filtered and patterned.

Data engineering in an operations-centric environment concerns the five segments of a real-time data system: electro-mechanics of data acquisition; data pre-processing, cleansing, and validation; data transmission and retention; on-line and on-time visualization and reaction; post-process portals, forensics and data mining.

Additionally, predictive analytics becomes a concern at each stage when closed loop automation and interactive control is introduced.

Data Acquisition

The physical data acquisition represents the grit-and-grime of the data engineering problem.

The range of measurement possibilities in the physical world is daunting. Solutions to measurement include voltage differential based load sensor (i.e. hook load), magnetic pulse detection (i.e. rotational speeds), quadrature encoders (i.e. linear travel).

Down hole sensor data may be transmitted top-side via mud pulse, requiring its own detection equipment.

Finally, some data may arrive via manually entered parameters.

Although systems data sampling may be occurring simultaneously, data preparation, transmittal, and integration is asynchronous and the time differences must be accounted downstream, therefore time-tagging mechanisms are required.

Data quality and accuracy must begin at the source and must address noise, continuity, and sampling rates.

Noise sources such as electronic noise are best resolved with noise cancelling techniques – differential analog, shielding, sensor proximity, and careful attention to grounding (a skillset more acquired than learned).

Vibration and other mechanical noise sources may be addressed with sensor placement, alignment, or analog filtering.

Signal continuity is normally resolved through redundancy, physical routing, and failure mode analysis. Finally, basic signal conditioning is commonly applied to raw analog signals (voltage and current) consisting (commonly) of a simple RC low-pass circuit.

Sampling rates are a balance between transmission rates, computational horsepower, and underlying system requirements. Sampling rates must be carefully considered as requirements for subsequent filtering and subsequent operational resolution.

Whether the data acquisition is performed on a drilling platform, midstream pressure and flow system, or medical EKG devices, the principles are the same – noise elimination, sampling rates, continuity of service, and basic signal conditioning.

Data pre-processing

Regardless of the mechanics of the original data source, data will arrive in digital form with null values, spurious values, and insignificant sampling points. This is all common and all must be addressed.

Data collected before or after the operation may be discarded, provided actual operational data is not lost.

For example, data streaming immediately prior to beginning a 'trip-in' is irrelevant to the drilling operation (except, of course, certain diagnostic processes). Similarly, pipe inspection equipment may disregard data collected prior to engaging the pipe. But the event tagging required to properly identify the start / end event may be difficult to properly isolate. In these cases, too much collected data is preferable to too little. Other processing operations should resolve and discard the irrelevant data.

Physical data is, preferably, over sampled – and oversampled at greater than the Nyquist theorem would indicate. Nyquist would dictate 2x sampling rate but this only applies to steady-state data streams, not streams with spurious events and unpredictable shape.

Experience has shown greater performance and reliability of measurements where 5x to 10x sampling rates are beneficial; generally 3-5 samples taken from a single, spurious, sinusoidal impulse is the practical target sampling rate.

After data stream endpoints are established and sampling rates defined, proper data cleansing and validation is required. Cleansing and validation involves several aspects: elimination of null, spurious, and duplicate values, data stream filtering (low pass, high pass, band pass, and stop band), and all of this is dynamically altered due to modal changes (rotational drilling, slide drilling, circulating, etc.)

It can be amazing that 16-24 bit analog-to-digital binary data must be handled as double precision through the cleansing, reduction, and analysis phase or otherwise data quality will suffer.

Null values may be identified with a data validity flag associated with the data. More often, the null data is identified by specific out of range condition. Examples include readings representing the maximum or minimum range of the acquisition system, or readings that are arbitrarily set to known invalid values (i.e. using 9999.25 as an invalid data flag.)

Spurious readings will normally fall well outside the anticipated signal range (such as max reading on an analog-to-digital converter). Other spurious readings may result from transient and overwhelming noise pollution.

Although a little more difficult to identify and remove, long duration unpatterned noise is usually not replicated. Careful distinction must be made between data that is atypical but relevant vs. data that is external and irrelevant. But when identified early and removed from the system, the entire system performs better.

Duplicate values, often resulting from stale readings, will misrepresent reality and can skew processing results by falsely disguising malfunctions and lost signal, by artificially weighting trending algorithms with false samples, or polluting a database with excess records. Generally, time tagging the sample permits downstream cleanup. But when possible, the duplicate values should be removed earlier rather than later. (WITSML data transmission makes duplicate cleansing easier; WITS data, however, is often a transmission of everything known, not just new values.)

After all signal-specific data cleansing has been accomplished, especially the mechanical and electrical design, the data may be passed through a digital filter to smooth

out the residual rough edges.

Digital filtering is a technology requiring specific design processes by is always better than brute force signal averaging because digital filtering reduces latency and specifically identifies specific signal characteristics to be corrected.

Data Transmission and Retention

Management of real-time data mandates end-to-end data flow analysis – precision (and dropped precision), temporal relevance, and automated analysis.

As data advances through a system, it is transformed, represented, grouped, reduced, and pushed.

For example, data originating downhole may be transmitted via .5bps mud-pulse, decoded and transmitted topside via Ethernet to a workstation, analyzed and processed, pushed out via WITS (Wellsite Information Transfer Specification) to a rig-site operations and control system, converted to WITSML (Wellsite Information Transfer Standard Markup Language), compressed, encrypted, and bounced off the satellite, and then routed into the data center via fiber optic.

Each phase has requisite standards that equipment from disparate vendors will abide. But each data format carries differences in precision and may produce inadvertent rounding.

Although there are data repositories along the path, all data must eventually arrive at a central or enterprise-wide data schema – usually within a single database on a single server.

Streaming data creates data server loads that must be carefully structured. Single tables opened for long periods, accepting millions of rows over time are unstable if not carefully implemented. Data servers optimized for streaming data are not often optimized for data mining.

Holistic data processing and analysis must address the simultaneous and de-synchronized data, perform tasks necessary for real-time representation, analysis, and alerting.

Traditional data flow dictates data to be received, stored to the repository, re-queried from the repository, processed and then presented. New techniques of in-line and real-time data analysis, including Complex Event Processing (CEP) technologies permit streaming data to be synchronized and holistically analyzed prior to the final repository.

Such in-line processing enables new opportunities in exception-based data spooling where minimal data is recorded until a significant event triggers, retroactively, maximum data resolution and retention. Data architecture increases incrementally while quantity and quality of relevant data retention is radically increased.

Data Visualization and Reaction

Data management is not data acquisition, nor transport, nor storage. It is the larger goal of providing real-time data, information, and knowledge to the user, operator, or systems.

When data transforms into information and knowledge data management has been achieved. Information is the real-time visualization; knowledge (and wisdom) comes from post-event analysis, mining, and forensics.

Real-time visualization and reaction include human machine interface (HMI) streaming data strip-charts, over-under alarms, three dimensional data channel cross-plots, consolidated operations summaries, and real-time closed-loop system feedback. Operations centers are becoming utilized as the norm, not the exception.

As the process of energy gathering becomes more complex, the opportunities for proper data visualization increase, and a highly skilled team of professionals is required.

Modern drilling operations require teams of geo-steering, trajectory control, wellbore stability experts; completions teams require area-wide situational awareness; and production teams require ever more granular analysis of well production, byproducts, and situational awareness. Live data streaming and management dashboards are becoming more and more critical to overall success.

Tolerances in the oilfield are growing tighter and tighter. Wells are drilled in a seemingly spaghetti mash pattern, mandating near real-time trajectory analysis and prediction; and production systems require near real-time capacity control to maximize transfer and capacity efficiencies. Volume demands may fluctuate daily or faster as inventories are minimized and closely aligned with market and transport demands. Closed-loop architectures require a new level of quality, resiliency, and reverse-flow data to the wellsite.

Data Portals, Forensics and Mining

Streaming displays, situational awareness, and management dashboards improve the oilfield, but are not the step-improvement in system capabilities that most companies desire. Visualization of the current status of systems is integral to a real-time operation, but equally as important and often improperly implemented are the analytics and analysis required to anticipate and prepare for impending project or future project events.

Data is informative in the temporal visualization, but data becomes knowledge and understanding when it is used proactively. Proactive uses of drilling data include borehole integrity analysis, down-hole drill bit performance, and geologic prediction.

Data portals require ad hoc drill-down tools that allow not only filtration, but insight to excluded data. Many current Business Intelligence (BI) tools provide this information, but the back-end data store must lend itself to the ad hoc queries imposed by the BI tools. Operational forensics require much less BI drill down, but do require variable cross-plot tools to compare potential ad hoc relationships found in a single project (or well). And data mining will require very complex multi-variable analysis between wells (drilled days or years apart), well depth (both pay zone depth and actual bit depth), and disparate data sources (PVI, trajectory, curve).

Data portals, forensics, and mining represent the leading edge of current E&P data projects.

Conclusion

Real-time data management grows more complex every day. The data collected and data sampling rates are creating data repository issues unimagined a few years ago. And the operational functionality and utilization is still evolving. Data and real-time operations require a systematic and visionary understanding of the challenges. Real-time data management encompasses knowledge in electrical and mechanical apparatus, communications protocols and systems, and streaming data technologies.

Mark Reynolds is currently at Southwestern Energy (Houston), where he works in the Fayetteville Shale Drilling group as a Staff Drilling Data Analyst. In this position, he pulls his experiences in data processing, data analysis, and data presentation to improve Southwestern Energy's work in the natural gas production and mid-stream market.

Mark began developing military avionics systems for General Dynamics and Sikorsky Aircraft. Since 1990, he has been developing Systems and Applications for the Energy Industry including integrated information systems, systems analytics, real-time processing, and operations management.

Any opinions expressed in this article are personal opinions of Mark Reynolds, and are not related to any business activities of Southwestern Energy

Need help picking the right projects?

EPC Offshore of Aberdeen helps offshore oil and gas companies choose the right projects – including analysing opportunities, and selecting and defining the right development concept. COO Peter Kirkbride explains how it works

The first step of an oil and gas project is deciding whether or not you have a reservoir worth going after.

"Adequate work must be performed during the opportunity identification phase in order to understand the impact issues such as fluid viscosity and corrosivity, scouring and scaling propensity, pressures and temperatures can have on the facilities and the resulting cost," says Peter Kirkbride, chief operations officer of EPC Offshore of Aberdeen.

"For more challenging opportunities, it may be necessary to investigate a number of options before feasibility can be demonstrated or the project rejected.

The technical definition work required at this stage is commensurate with the required level of accuracy of the cost estimate.

"In addition to reservoir and subsurface uncertainty and risk, technical and project execution uncertainty and risk should also be established. The emphasis should be on identification of risk and understanding the potential impact that this could have on the project rather than mitigation actions to close out the risk," he says.

"Economic assessment of the opportunity can then be performed to establish if the operator wants to progress further, at which point a plan is prepared to take the work up to project sanction.

"An agreed plan and scope of work can then be established which sets out what activities should be undertaken, a timeline with dates for key milestone decisions and any intermediate decision points between the various gates.

"This also identifies who will manage the opportunity and how the quality of the process will be assured including a review and audit schedule, dialogue and feedback from the client and technical authority approval."

Concept selection

This second phase must answer the question "Have we looked wide enough and selected the optimal alternative?"

EPC has recently finished concept selection for Penguins Field redevelopment, and is currently assisting Ithaca Energy with the Stella Area Development in the North Sea.

"All practical options have to be considered to optimise the concept selection. Reservoir performance is probably the most important factor in optimal concept selection and it will be defined by the subsurface team. However, as the subsurface work progresses it is important that the interface with the facilities is also developed," said Mr Kirkbride.

"The subsurface modelling work must proceed to a stage where sufficient data is available to perform the facilities concept selection so it is important to establish the basis for this by looking at things like PVT data, hydrocarbon characterisation and GOR, in place and recoverable reserves, and pressure support, artificial lift or chemical injection requirements.

"Once you have established reservoir performance the next step is to identify all possible development and export options."

The fundamental selection criterion is likely to be the Net Present Value (NPV) of the development. The main factors underpinning development value are reservoir performance and resulting oil sales revenue; development CAPEX, OPEX and tariff; and the development schedule.

"Concept engineering must be adequate to understand and compare the NPV of each of the concepts on a level playing field and it is important that the risks associated with each option are understood along with the potential impact of the risks on the value.

"Selection must demonstrate that the safety impact is as low as reasonably practical and take into account environmental impact, operability and flow assurance risks, commercial agreement comparative complexity, upside and downside flexibility and so on.

"At this stage the required level of accuracy of cost estimates to support concept selection economics should be reduced to +25% to -15% with the schedule identifying all long lead procurement items that need to be purchased before full project sanction.

"This means that going into the second gate we have enough information to ensure we have selected the best possible option and have a realistic budget, schedule and execution plan for the final stage of work."

Concept definition

EPC Offshore approaches facilities concept definition with effort focused in three key areas: technical definition, budget and schedule; and project execution. This approach resulted in the successful sanction of the Endeavour Rochelle project.

"Our approach is entirely focused on producing the deliverables to support project sanction," said Kirkbride.

HAZID and HAZOP studies are conducted, safety critical elements are identified and environmental and design notifications focused on providing the foundation for legislative compliance.

"The schedule implications of legislative compliance are often critical path activities so it is important that supporting work is performed as early as practical. The Environmental Statement requires wide ranging consultation that can take up to six months for approval so this is given high priority within the definition phase.

"It is likely that reservoir modelling will continue in parallel with this stage of the project however production chemistry, process and flow assurance work is completed to an extent to confirm production profiles, pipeline sizing, insulation requirements, operating strategy and so on.

"By this stage we can include full details of engineering and functional requirements, schedules and strategies as well as a budget accurate to within +10%. We also manage the interface with the Government agencies including DECC and HSE for all permits, licenses, authorisations, notifications and consents."

It is considered vital to project success that a risk management process is adopted.

"In order to establish the probability distribution and certainty of schedule end dates and cost estimates, statistical analysis is performed. The process provides a data set of the risks that the project faces and the potential impact, allowing the team to develop a risk management plan which shows how this will be mitigated throughout the execution phase."

As the preliminary stages draw to a close, organisations should have a fully defined project plan to take them through to sanction.

"All uncertainties should by this stage be reduced to levels which ensure there is minimal chance of the project failing," says Mr Kirkbride.

"There should be no doubt the project meets or exceeds corporate investment guidelines, the risks are fully understood and mitigation plans in place and there should be a sound project execution plan in place.

"This project focused approach pre-sanction provides the foundation for post-sanction project success.

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