



BESTEM
Method and Technology Adoption

Bestem Network Report

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4th Industrial Revolution – How are you responding.
Is the Oil and Gas industry adapting fast enough and what can we learn
from other industries?



The 4th Industrial Revolution is driven by:

deployment of new, general technologies;
nationalism and changing trade patterns;
capital allocation & wealth distribution;
reaction to climate change; and
political influence from younger people.



Summary of the evening's discussions

We broadly agreed that public opinion, and political posturing, supports tackling climate change. There is a widely held public belief that energy transition is underway. There was debate about: what the “truth” behind this was; what the speed of it could be; and to what degree there was a split between liberal “western” countries and the rest of the world.

We reached consensus that new technologies were important, were having an impact in operations and were becoming an expectation for supporting new ways-of-working. Some of us pointed out that there may be less impact on capital expenditure decisions and hence technology may not be a determinant of ultimate value for asset owners.

We also noted that there was a commonly held view that it was difficult attracting today's youth to work in our industry, but there were plenty of counter arguments to this position with examples of workers from other countries, and engineers from China, India and beyond still keen to enter the business.

Overall there was a lively debate about what to do about the above with no clear consensus emerging by the end of the evening.

“[our] industry has lost confidence somewhat. [This is] no surprise given what we have been through the last few years. We need to find that sense of common purpose again we've had it before but it was lost in amongst rebuilding our industry to deal with \$60 oil.”



The Change Agenda

Whether right or wrong from a scientific point of view, there is a public consensus that it is important to limit global warming to 1.5% and that de-carbonisation is a key element to this. In my view, if the political will has shifted and is supported by public opinion, then the primary business goal will change from profit maximisation under current rules. There is some evidence that a more socially inclusive and environmentally focussed agenda is in the air (<https://www.nytimes.com/2019/08/19/business/business-roundtable-ceos-corporations.html>)

We may shift towards profit maximisation under a different set of rules and boundaries. These may include “market distortions” such as taxes, subsidies, carbon-pricing etc. This will require changes in public policy. This is a global-scale problem and global-scale market interventions are difficult to achieve.

There are problems with energy transition currently. Renewables only make up 4% of the energy mix. Solar is already the lowest cost source of generation but, along with other methods, is intermittent and the electricity storage problem remains largely unsolved. In my view electricity provides a pathway to reducing carbon and there is rapid innovation being made with large profit available to those solving problems associated with distribution, consumption, generation, charging and storage – not to mention addressing the embedded carbon within the products sold to consumers. It is a growing market with over 90% of it served by “old fashioned” methods deemed unattractive.

The electrification of energy seems likely to continue but energy for applications such as shipping and aviation still require liquid-forms (which have the benefit of being very energy dense for their weight and getting lighter as they are consumed). Distribution of electrical energy remains a challenge in parts of the world where a decentralised and self-organising liquid fuel distribution systems already function. Perhaps micro-grids will help the 1.1Billion people who have no access to electricity (<https://www.iea.org/energyaccess/database/>), but financing projects to provide this remains a challenge.

Hydrocarbons as a feedstock to pharmaceuticals, fertilizers, plastics and general chemicals will not be replaced by electricity. There are nascent technologies that can harvest feedstock from contaminated plastic waste, biotechnologies creating crops that need less fertiliser, micro-scale pharma plants, microbial digesters with enzymes that produce feed-stocks and advances in material sciences. All of these may come into play on the demand side, but none yet appears poised to disrupt current supply chains.

In the eyes of many people – some young, some western and some not –oil is classed with tobacco, arms and other sin industries. We are not often perceived as a force for good, and some people are unwilling to led their hearts and minds to further the industry.



The Change Agenda: Quotes from our guests

“UK emissions are now the same as they were in 1888 but this is only achieved by exporting our emissions overseas. Time to start thinking beyond borders.”

“The O&G industry is facing a barrage of demonization in light of the ‘green movement’ - a movement (government led policy towards school kids) which hasn’t really changed human activity, rather it has just put off graduates to the industry that are vital to solving the very problems campaigned against.”

“I must admit to being struck by the strength of dismissive feeling [by some] towards climate activists, Greta Thunberg in particular. They are frightened and, in my opinion, rightly so”

“How do we get people in general, not just ‘the youth’, to understand what it takes to get their favourite products into their hands (especially in terms of oil), the impacts of these journeys, as well as the seemingly invisible impacts of their digital activity (e.g. much of Iceland’s growth in energy demand is to support server farms and cryptocurrency mining!)”

“The O&G industry could do far more to explain the vital role that we will have to play in the UK energy market, accepting that coal is on the way out, oil should follow but gas is here to stay for the foreseeable future. Might big data help us to achieve this? we need to inform and be a more visual part of the green revolution.”

“Stopping the oil industry means killing people, for almost a billion people apart from wood, hydrocarbons are their only source of portable energy, and their only hope of treating disease, trading with markets, gaining an education and developing in the most basic of ways.”

“What is the optimal mix of future fuel supply sources to preserve the environment whilst maintaining security of supply?

What is the future of companies whose core business is supplying hydrocarbons?

How successful (in terms of protecting the environment) are these companies in diversifying their businesses away from hydrocarbon production?

How successful is the oil and gas industry in attracting new or recent graduates?

From which countries should the main contribution to future reduction of CO2 emissions come?

What needs to be done, if anything, to improve the image of the oil and gas industry?”



Going Digital

The collection and analysis of large amounts of data and the process of making big-decisions in the presence of uncertainty is not new to the Oil and Gas industry. Analysis of the subsurface and simulation of reservoir performance has been pushing the boundaries of computing and data-science since the 1980's. This work is all focused on reducing uncertainty.

The incorporation of digital information has transformed the risk profile of exploration and development decisions in the past 40 years, and continues to do so. These decisions have been CAPEX focussed. Increases in availability of data, decreases in cost of processing and wider access to information has led to more access to capital for smaller players dulling the advantage that private decision processes and strong balance sheets used to give only to super-majors.

Digitalisation of operations provides only minor financial gains in comparison to deployment of capital. When expected project-returns can be in the 30-80% range and weighted capital costs are (for example) Premier 8.4% and BP is 3.3% it is no surprise that focus is on managing risk and deploying capital. As one member of the network informed me about one of his platforms – digitalisation will disrupt my entire operation, will cost me £2m and take 2 years, I am not sure if, how or when it will pay back. I can, however, drill a well for £1m, we know how to do it, nothing changes in my team and it will pay back in under 4 months.

The digitalisation talked about today refers mainly to: improving operations, enhancing ways-of-working; and management efficiency. These are determining factors of success in, for example, a wind-power project where risk is well known before starting. These are therefore easier to finance. Competition drives returns down to the industry-average cost of capital so profits go to those with scale that can reduce cost of capital and companies that can earn excess returns through more efficient operations. The latter group embrace any edge they can get from data and modern working practices.

While there are gains to be had in operations, the priority for doing so in traditional oil and gas is less. A 10% improvement in operating costs is less impactful than drilling a new gusher. Such natural biases may explain the relative lack of management skills (and reward given) in upstream oil and gas for activities focussed on marginal gains in operations. The deal-making-like nature of management culture may explain a keenness to avoid “event” losses such as equipment failures and the focus on individuals doing analysis and trying to predict failures and maintenance requirements.

Biases and deal-priorities were evident in our discussion and expressed through the frame of CAPEX vs. OPEX, a common truth of upstream projects is that they are rarely marginal bets – commercially, they fail or they work **really** well. In the latter case the improvement in outcome by efficient operations is of secondary importance to companies that can develop an asset. They may become more important as fields go into final end-of-life and into decommissioning, but only to companies with the skills to safely understand risk and optimise cost under operational uncertainty.

Where technology may hold a key to value to upstream companies is in negotiating access to resources with host governments. Companies that can demonstrate leadership in certain aspects of development and operation can become a preferred partner by promising to develop assets in better ways and training local workers. Being able to demonstrate that by working with a company the local population will gain skills and knowledge in areas such as AI and data science (which are useful in the broader economy) may provide a competitive advantage.



Going Digital: Quotes from Guests

*“Digital must improve a decision (better and/or faster) – if it doesn’t then it will not have improved anything
The supermajors are on a different level when it comes to Economics”*

“The data centric rigour of oil and gas is echoed in the digital agenda in healthcare...one of the consequences of this data driven approach to therapeutic interventions is that bespoke pathways are doable; certified sharing of best practice becomes virtual and leverages genuine centres of global excellence; and the definitions of treatable conditions become more specific and differentiated. I wondered whether this insight might have implications for other sectors.”

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“How effective is the analysis of big data / AI in increasing technological advantage and cutting costs?”

“Do we already have enough data to make significant improvements in operational efficiency? ”

“should advances in efficiency generated by Industry 4.0 be targeted at reductions in capex or in opex?”



The North Sea Challenge: Quotes From Guests

“The North Sea has a big challenge ahead of it to attract the investment and innovation it needs”

“I found the discussion about the image of the industry in general and towards young people interesting. The day after the dinner we signed a the largest cash transaction ever on the Norwegian Continental Shelf. The transaction was led by two of my colleagues, both partners just turned 30 – and creates a company of scale in North West Europe. The acquiring company attracted 2000 applications for 24 professional job openings recently, so there are still hope.”

“The management focus on cost-efficiency clashes with operational perception of approaches to safety. I have had technical authorities leave because they feel their professional integrity is compromised by the financial requests to cut maintenance, competencies and reduce inspections. There is little faith that these cost decisions are based in sound analysis or dynamically managed in an evolving risk profile. The role of the regulator and the legislative framework will need to strengthen, or we will see a race to the bottom.”

“I find it interesting that all this PE money is funding purchase of late-life assets from big-oil. Who do they think they will exit to? No oil operator that I know will buy back into these assets, so will these owners need be in this for the long-haul, beyond the life of their fund? Or are we going to see secondary buy-outs? How’s that going to work?”



Electricity – sparks from the outer edge

The day after our event, I was lucky to be invited to a London Business School event focussed on the renewables sector. I thought I'd bring some of my notes from the discussion to the network for your information. Of course, renewable energy mostly means electricity. Discussion focussed on ways to generate it, distribute it and the problem of balancing the consumption needs with available power in each moment. Overlaid on this discussion were the crinkles of financing projects and the challenges posed by different political, regulation and geographical issues.

BP (Beyond Petroleum) was quick off the mark into solar almost 20 years ago. Investors did not think this a good idea at the time and BP ultimately divested the majority of their renewable portfolio. These tides have turned. Today solar power has become the cheapest form of generation. Most of the accelerating falls in price didn't start until 10 years ago. One person explained that projects he financed had fallen in price from £6M / MW in 2007 to £220K / MW in 2017. There are technologies being developed now that promise a 10X improvement in solar yields. This is a cost-curve that is hard to ignore. The only place where solar is not already the least-cost is in parts of Indonesia, but that's to do with the (unsafe and inhumane) way coal is mined there. There was talk in our group about how oil and gas production may move to countries with lower cost of production and more available labour. We might want to consider coal production as a warning of what could happen.

Nuclear which can be seen as a suitable base-load supplier has issues with project overrun and long-term liabilities. Current rates are being guaranteed to EDF at 9p/KWh whereas offshore wind is already contracting at below 4p/KWh and is only likely to fall further. In 2017 demand for electricity in the UK fell by 7% as energy efficiency initiatives showed progress in reducing consumption and private generation increased.

Central generation and distribution systems in some political environments have not traditionally demonstrated good practice in forward planning and execution of projects. This leads to a "panic" situation requiring quick uplifts in generation capacity which is can mean diesel gensets from companies such as Aggreko. This leads to unnecessary increases in carbon production.

Some larger companies have decided to contract privately to create their own power and disconnect from the grid. Usually this is a combination of renewables (Solar/wind) with combined cycle gas generation, and diesel standby. These projects are simple to finance as the counter party in the transaction is the company itself. In less developed countries private mini/micro grids are springing up, though these are harder to finance. One emerging consequence of this is that nation-scale generation and distribution equipment relate to the high fixed costs which are spread across all connected parties. In this scenario industrial companies often subsidise domestic consumers. As industry disconnects and generates privately, there is less base to spread the cost causing financial distress. Raising prices just encourages more to go off grid. The industry is already seeing companies like ESCOM in south Africa and the generator in Queensland potentially entering death spirals. The response of some countries, such as Spain, is to charge a tax to all properties not connected to the grid. We may also see arguments emerge for nationalisation and government subsidy of public distribution.

Returns from offshore wind are running at about 8% which reflects the lower risk nature of the projects compared to oil, they are relatively easy to finance. Less equity in capital mix means returns can be high and small gains in operational efficiency make significant boosts to share holders. This in part explains the relatively higher interest in digitalisation and AI/ML in applications around operations, distribution (smart-grids) and in load-management. Some oil companies are looking to pursue more technically risky offshore wind projects in deeper water where they can benefit from scale, their balance sheet for financing and their ability to assess technical risk. They believe that there are large parts of the world which are not close to shallow water therefore floating offshore wind provides opportunities well suited to their core operational capabilities. Equinor have committed £9Bln to a 3.6GW project on Dogger bank which has a theoretical limit production (at 100% efficiency and 100% uptime) of 30tWh per year, the UK currently consumes about 350tWh per year.





More information



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