SPE 99829

The Challenges of Implementing at Scale: Field of the Future—Technologies in the North Sea

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This paper was prepared for presentation at the 2006 SPE Intelligent Energy Conference and Exhibition held in Amsterdam, The Netherlands, 11–13 April 2006.

Abstract

For BP the North Sea is an important mature basin which produces around 15% of the company's total global production of around 4000 mboed. However, like many mature basins sustaining a profitable and competitive future is challenged by the overall decline in oil and gas production rates, increasing trend in unit operating costs, the integrity and operability of the ageing infrastructure and the changing demographics of the work force. In this perspective, North Sea has become a key exemplar that illustrates how BP's FIELD OF THE FUTURE programme can help to meet numerous challenges in the management of mature areas.

To help manage and reduce the negative impact of these business challenges BP is implementing a North Sea regional FIELD OF THE FUTURE Technology programme. The vision over the next 5 years is to deploy FIELD OF THE FUTURE technologies at scale across most BP operated fields with the aspiration to improve overall production by 5% and reduce operating cost by 10%.

For the North Sea mature assets the main focus is around four technical projects: Advanced Collaborative Environments (ACE); Real time data monitoring and surveillance; Advanced control and optimization; Automation and remote control. From the outset BP has discovered many challenges in deploying and implementing at scale across a region. This paper will share some of the key challenges and insights involved in implementing at scale the technical projects through the appropriate process, organisation capability and technology across the region.

Introduction

The North Sea is a mature province which has been producing oil and gas since 1965, today the North Sea in the UK, Norway and the Netherlands sectors produce around 9.2 million barrels of oil equivalent with the forecast decline rate of around 7 % over the next 10 years [1]. Compound the decline in production rates with increasing trends of unit operating cost from today's average of around $8/bbbl to around $12/bbl in 2015 makes for a tough challenge in the future. In order to sustain a profitable and competitive future it is imperative that new improved processes and technology are put in place over the next few years that directly improve the overall plant operability and efficiency and at the same time reduce the cost of operations and maintenance. In the North Sea BP produces around 550 mboed and operates some 20 fields and 3 terminals; all fields and infrastructure are in decline accept for the recently developed Clair Field. In order for the North Sea to sustain its profitability and maximize the value from its infrastructure investment and resources BP have developed five key strategic technology themes. Advanced reservoir imaging, Pushing Reservoir limits, Subsea Developments, Low cost reservoir access and FIELD OF THE FUTURE. For operational improvements BP recognized the importance of taking a new approach to the way it operates its fields through the FIELD OF THE FUTURE Theme. It is through the combination of applying the right technology, improving processes and integrating organizational capability and skills that improvements in operation efficiencies and costs will be realized.

FIELD OF THE FUTURE

FIELD OF THE FUTURE is a global BP technology programme.

By enabling faster and better decisions, it intends to create a step change in the operating, capital and cost efficiencies with which BP manages its resources. This will be achieved through the application of digital technologies and BP will be able to operate its assets safely at the technical limit of efficiency, recovery and margins.

In an ideal world a FIELD OF THE FUTURE will be able to fully optimise resource extraction, processing and export on a continuous basis. It will monitor and manage fluids, reservoirs, wells and facilities in real time. Reservoir options generation will be automated and data and tasks will be moved to where they can be most effectively worked. A FIELD OF THE FUTURE will be able to connect to global know-how and expertise around the clock. It will free people to use their intellect and creativity by automating the routine activity and it will keep people out of harm's way.

FIELD OF THE FUTURE is applicable to North Sea mature assets, and brown field projects (e.g. Valhall re-development) but is also very important to the new green-field projects (e.g. Clair Phase 2 and Skarv developments). This paper addresses the approach taken and experience acquired as the North Sea region has risen to the challenge of implementing the FIELD OF THE FUTURE concept in its own business environment.

North Sea Vision

FIELD OF THE FUTURE implementation is a complicated journey, and it has been important that before embarking on such an endeavour, a vision for the future and road map to get there is established. For the North Sea, the next ten years is about operating in a world of real time decision making and operational control that enables full integration of the activity from the reservoir, wells, facilities and ultimately through to export and market place. In place would be an operating model that spans the entire value chain. In the reservoir it would mean being able to have real-time automated reservoir management capability with selective application of permanent seismic available on demand through seabed seismic sources on high value fields. In the wells there would be high utilization of intelligent flow control and on line surveillance monitoring. On the facilities it would mean wide spread utilization of advance control and optimization technologies, intelligent integrity monitoring with all fields being linked by high speed communication networks to remote onshore monitoring centres. Finally the work environment would be fully collaborative between offshore and onshore and also globally between centres of expertise.

Technology

Regionally within the North Sea we have been focusing on driving four key technological areas that are aligned to the delivery of the vision articulated above:

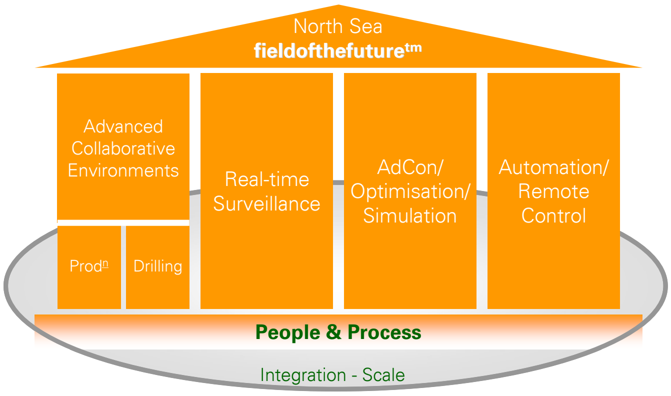

Figure1: North Sea regional FIELD OF THE FUTURE technology projects

The four technological projects (Figure 1) have wide spread application across most North Sea assets and align strongly with the ability to improve operational performance. Other more selective technology capabilities within the global FIELD OF THE FUTURE progamme are being pursed at an asset level of implementation e.g. Life of Field seismic [2].

- **Real-time surveillance data:** Delivery and real-time processing of operational surveillance data to BP's onshore and offshore communities and its vendors and suppliers. This requires connectivity from the point of data collection through plant control systems, onshore and offshore data historians and processing and viewing applications. It also requires a robust Information Technology (IT) networking capability based around fibre and terrestrial communications systems to overcome the latency weakness of satellites systems based communication and demands a security architecture to protect offshore control systems while allowing maximum visibility of diagnostic data to BP and third parties,

- **Advanced collaborative environments [3]:** Working environments where access to people and information does not determine where the job is done, rather it is whether access to the physical plant is needed. The focus for FIELD OF THE FUTURE is on operational rooms where decisions are taken around real-time dynamic data for both plant and drilling operations. This is facilitated by audio-visual communications between offshore and onshore and by access to real time operations support applications, analyzing real time process and plant data.

- **Advanced control and optimisation:** Ensuring the plant we have is operating at maximum efficiency. This includes assessing on a field by field basis opportunities for retro-fitting advanced controllers and optimizers to maximize plant profitability. Advanced control elsewhere in the business stream has clearly added 4% to production by allowing the facilities to be confidently driven closer to its constraints. Where it is complex to determine which constraints should be challenged, and where this optimum can change, then off-line or on-line model based optimizers can be used to work along side advanced control to select the most valuable operating strategy. Optimisers determine the best operating strategy; Advanced control supports the operator in implementing it.

- **Automation and remote control**: Assessing how much we can avoid putting people in harm's way at our offshore plant. Driving forward with plant automation where possible and where this is not establishing remote control of systems (if possible and safe so to do). The degree of retro-fit and plant complexity means this has to be assessed on a field by field basis.

Approach

The approach adopted recognizes the need for more than simple technology deployment. The value of FIELD OF THE FUTURE lies in enabling better and faster decision making through the use of digital information technology. The implementation of FIELD OF THE FUTURE technology changes the way individuals in the organization will do their business [4] and has the potential to accelerate high performance.

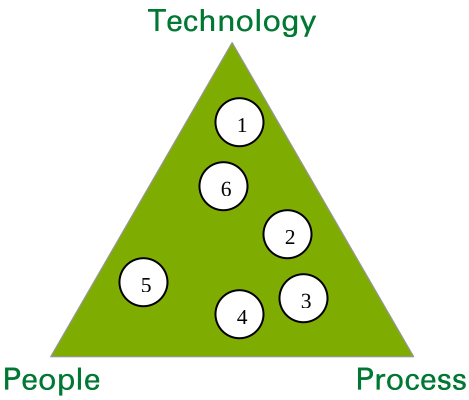

Figure 2 Implementation ternary diagram.
1=Automation, 2=LoFS, 3=Adcon, 4=Optimization, 5=ACE, 6= ISIS.

In summary, it is necessary to address all three aspects of the implementation model; People, Process and Technology. The current implementation status can be illustrated by the position on the ternary diagram. For successful implementation and adaptation of technology the ideal balance is to be somewhere in the centre of the diagram. Figure 2 reflects the current status and focus of the North Sea projects.

Furthermore, the sustainable uptake of the new technology is dependant on supporting an adaptive change programme with users and practitioners of the new technology.

Before individuals in the assets can make "Better Decisions, Faster", the asset teams have to be able to articulate where processes and behaviours could change, which will improve business delivery and individual fulfillment. This engagement process with the business is seen as critical to the success of the programme.

While deployment of the technology can be viewed as a linear delivery process; the adaptive change required by asset team members is not so. It is more akin to setting-out on a journey to a defined vision and supporting a change in team behaviours and culture such that the technology can be sustainably embraced. This will involve team members experimenting, exploring and innovating within the capability of the new toolkit. This implies flexibility in the technical solution.

The BP North Sea portfolio comprises some 20 operated and producing assets. Our challenge is to deploy FIELD OF THE FUTURE in an appropriate and sustainable manner across the portfolio. However, one size will not fit all and both the technological and engagement solutions need to be flexible and modular. For example we use the metaphor of a "Lego set" where modules are standardized and can be configured for individual needs.

Experience to date

The following examples are not exhaustive, but illustrate some of the experiences, challenges and success over the last few years during the period of implementation pilot stage.

Schiehallion Integrated Subsurface Information System (ISIS) and Date to Desk (D2D); transforming data to Information: Typical of similar assets on Schiehallion, over 20,000 process tags (temps, pressures, flows etc.) are updated in the on-shore historian showing a picture of what is happening on the asset. It is clearly impossible for an engineer to take account of a fraction of these. If it is done correctly, reconciling the data, processing it through models and flagging up apparent anomalies, can reduce this huge cascade of data to a digestible quantity of information. For instance; ISIS [5] translates the temperatures and pressures around a well into Gas Oil and water flows in real time, allowing immediate quantitative analysis of the effect of interventions. Similarly D2D (Data to Desktop) looks at top sides equipment such as heat exchangers and compressors and monitors key performance indicator's (KPI's), to give an early indication of performance drift. Both these technologies have helped the Schiehallion team react quicker and smarter to operational threats and opportunities.

A key lesson learnt is that if the engineer is to take action on the basis of data which he or she has not processed and interpreted themselves they must be sure the data processing is logical and delivering a credible solution. One way to do this is to enable them to climb inside the models and understand precisely how the data are being processed. This can certainly speed up the process of turning processed information to decisions. These engineering decisions must also be transferred into action and transparency is also required to provide sufficient context to rationally support the decision to act.

Valhall production Optimization

It is often possible and profitable to take the application of on-line models one step further than data processing and to run them in such a way as to feed an optimization engine consistent with determining, a more, or the most profitable operating point given current constraints and equipment/ well availability. Successful applications in this area, such as the Valhall production optimizer, tune themselves against conditioned live data sets to first give the user confidence that the model is representative. This model is then run in optimization mode which determines the optimal operating point to deliver e.g. the most production which respecting integrity, reservoir and equipment constraints. The many spin offs from such models such as limitless virtual metering, full field data reconciliation, compositional machinery monitoring are just starting to be explored. An optimizer translates reservoir, well, topsides and equipment threats and opportunities into a common language, e.g. profit, and in doing so serves as a key collaboration enabler, helping to further break down traditional divides between these discipline teams. Another example of a successful application in this genre is the Schiehallion water injection optimizer.

Ula Advanced Control: A Tool to Improved Oil Production. In 1999 the BP Ula Field in the Norwegian Continental shelf became, as far as we know, the first platform in the world to introduce advanced multivariable predictive control (MPC) of their production process.

The use of this technology led to a 2% increase in Ula's production and a reduction in CO2 tax [6]. From this early beginning the model was re-designed and improved over the years to reflect the changing production profiles and production fluids entering Ula, for example, resulting from the tieback of a new satellite field called Tambar.

Although MPC was a well-established technology in BP's downstream business, the application to the upstream operation was a completely novel approach. Advanced MPC utilises powerful mathematical models of process dynamics to predict future process behaviour and produce appropriate control responses, making it possible to operate nearer to the operational limits and thereby improving production efficiency. MPC's capability of handling many variables simultaneously enables it to consistently perform tasks beyond the capability of the human operator.

Since the introduction of advanced control to Ula, BP extended its use to other fields elsewhere with similar success such as Marlin Field in the Gulf of Mexico [7]. This proved that this technology is directly transferable to the upstream business and is now being implemented in other North Sea fields.

The Ula Integrated Operating Environment (IOE):

A wide bandwidth low latency fibre optical communications system was commissioned in 1999 linking BP Norway's offshore installations with the companies onshore support base in Stavanger. Initially the fibre link was utilised to improve communications by providing near broadcast quality video conference facilities between meeting rooms on and offshore shore. Data equipment that had low safety impact but high offshore maintenance requirements, such as data servers, was also moved to shore. Gradually the team saw the opportunity to provide greater levels of remote monitoring. Remote operator stations were established for each of the fields and a master historian data base was established for gathering real time production and maintenance data from the control systems. Vibration and corrosion data monitoring systems were also linked to shore. Although the above developments gave incremental improvements they had little impact on the way work was organised and performed. In 2003 a major re-basing of the field support organisation was instigated. As part of this a new support concept was developed which became known as the Ula Integrated Operation Environment (IOE).

The main objective being to improve business results by introducing new ways of working making optimal use of the new technological opportunities the fibre cable had provided. Improved collaboration between onshore and offshore was identified as an area with high potential for business improvement. This was based on better use of technology investments already made, together with the focused introduction of new technologies, such as Visiwaer, a mobile intrinsically safe wearable computer based camera system, where this could deliver added value. The project made use of human factors based design tools in the early phases of the project to ensure optimal Human Technology Organisational (HTO) integration. Employee input and buy in was assured through face to face interviews and workshops involving both on and offshore staff.

A key success factor was seen as the physical working environment which needed careful design to promote open information flow and behaviours that would lead to improved operational and production efficiency. An important aspect was to facilitate ease of co-operation between groups onshore and offshore. To gain increased transfer of experiences and changes in work processes, it was seen as important that the main IOE rooms functioned as the normal working areas for staff and not just as a meeting room to be used occasionally. This meant careful selection of the personnel needed to have a permanent seat in the main IOE.

The final solution consisted of two rooms onshore linked by high quality video conference facilities with offshore offices:

The main IOE room houses front line discipline support engineers, field planning and maintenance functions together with an offshore operations coordinator (who is an offshore employee who rotates shifts onshore IOE). The room is provided with direct video links to the Offshore Production and Maintenance Team leaders. The room is equipped with large video/data screens to enhance communication with the production and the maintenance offices offshore that have similar equipment. Extensive data to desk top and planning tools are also provided.

The Production Optimisation Room (POR) has the primary function to promote collaboration with the offshore Central Control Room in order to optimize production. This room is co-located with the main IOE room and is the permanent working place for the onshore Process Engineer but with sufficient space to allow other staff such as: wells, automation and metering and allocations engineers to use the room on a part time basis. The room is equipped with video conference facilities for communicating with the Ula CCR, Production Supervisor, and the remote support facilities at BP's UK engineering base at Sunbury. The room is equipped with operator stations to allow the engineers to see the same information as the CCR, remote monitoring of the advanced control and fiscal metering systems, together with access to all the other data through extensive data to desktop (D2D) applications.

The IOE has been in operations for nearly a year and a half and significant benefits have been achieved. A much tighter integration between offshore and land has given substantial improvements in work planning and execution, fast and effective decision making, based on the right information being available to all parties. Considerable benefits in terms of production up time and throughput have been achieved; Ula in fact has one of the highest plant availabilities in BP despite having only a single production train. Tight following up of production opportunities has also given significant improvements, for example, cooperation between offshore-onshore-model vendor to optimise the use of the advanced control slug reduction model alone has given an extra 1000 barrels oil per day.

Andrew Onshore Operations Centre (OOC): Andrew is a CRINE (Cost Reduction in the New Era) platform and bed space is severely restricted. As the platform ages, more maintenance work is required to assure safety, integrity and production up time. Therefore infill drilling and platform activity must be carefully balanced. For the two wells planned on Andrew in 2005, drilling could only be achieved with a 10% reduction in drilling personnel numbers.

The team took up the challenge to appraise work practices and technology options that could transfer traditional offshore services, to onshore. As a result of this, the new fibre optic link was utilized to build an operations centre for real time and reliable remote data transfer from Andrew Platform to the BP office in Aberdeen.

The projects objectives included; Increase Safety (fewer people exposed to offshore hazards); Sustain platform integrity/maintenance during drilling; Deliver directional, MWD and mud logging services from the onshore office in Aberdeen; Provide access to onshore expertise to support critical well operations; Create alignment with FIELD OF THE FUTURE programme; Enable two low cost wells to be delivered [8] within the restricted time window to sustain field production.

The team conceptualized, designed and commissioned BP's first fibre connected OOC in the UKCS on 15th February 2005.

The vendor's equipment was installed offshore in exactly the same configuration as for a normal crewed operation. A duplicate system was built in the OOC with software capabilities to interrogate the offshore databases and reproduce the interactive offshore displays, onshore. The link carried data, telecoms, video and intercom between the two systems.

This enabled manipulation of mudlogging alarm settings, the downlinking to the MWD/LWD tools of log and survey data and the setting and resetting of tool parameters. A real time data feed for populating BP's subsurface and drilling databases were made via the vendor's Houston open Wire centre, enabling additional 3D visualization capability. Views from platform cameras on the rig floor, previously installed during platform emplacement, were fed back to the OOC to provide the OOC personnel with a window into the offshore environment.

To ensure a smooth transition to this new way of working, considerable effort was made to involve the wider team onshore and offshore, including formal consultations to identify and work any concerns they had. Changes to roles and responsibilities were documented and agreed with onshore, offshore and OOC personnel. A code of conduct was created that articulated expectations and ensured focus on good behaviours to facilitate open and honest communication throughout.

Three positions: Mud Logger, MWD Engineer and Directional Driller were transferred from offshore to onshore. The OOC successfully delivered the required 10% reduction of offshore drilling personnel, enabling the drilling programme to proceed and production to be maintained. Performance has exceeded all expectations.

Valhall Life of Field Seismic (LoFS)

During the summer of 2003, a hundred and twenty km of seismic cables and 20 km of associated control and power lines were trenched into the seafloor at the Valhall Field, Norway [9]. A total of 10,000 sensors are employed in recording the seismic waves from seismic surveys, acquired using the field's standby vessel towing a high end seismic source [10]. Since start-up six surveys have been acquired, and 4D seismic images have been constructed capturing the response of production and injection over periods of two to six months. Valhall field is the first global scaled application of permanent sea bed seismic arrays to be installed for the purpose of reservoir monitoring. The application of LoFS is considered as an integral part of the Valhall reservoir management and FIELD OF THE FUTURE strategy.

The 4D seismic images offer the framework for optimal reservoir management, and are used to define infill well opportunities, validate the reservoir flow model and to supervise well performance and well work/intervention opportunities [11]. The LoFS converted wave data (which still needs additional quality improvements) is contributing to a significantly improved structural definition under the gas obscured region at the crest of the field, resulting in new well targets. Since its introduction the LoFS data has been a key data set in planning numerous well targets and well interventions. In addition the insights of LoFS data are having a profound effect on our understanding of drainage in the field and enhancing our ability to predict and integrate with the reservoir model. Work flows for quantitative history matching of the fields flow simulator using the 4D seismic images have been established [12]. The seismic data provides needed dynamic information between wells; significantly reduce uncertainty in the reservoir modelling resulting in an improved prediction capability.

The frequent repeat surveys at Valhall have forced a number of significantly improved work processes in order to reduce the cycle time between acquisition and field management decisions. Seismic processing turnaround has been reduced to as little as 5 days, data management routines have been improved to effectively handle the more than 50 seismic volumes generated from each survey, new automated data analysis and display schemes have been developed to facilitate integration and utilization.

The 4D response at Vallhall is due to the fluid changes and changes in stress/strain (compaction) associated with injection or production in a well. While the wells' performance might be monitored by running a dedicated production logging tool, or by means of permanently installed distributed temperature sensors (DTS), seismic is the main tool for monitoring the changes taking place away from the well bore.

At Valhall, 4D effects around individual well perforations can be observed and is used to manage the reservoir performance. The resolution of the 4D effect has helped predict when perforation become blocked, or when near well bore drainage changes take place by capturing an image of the inflow and the propagation of the injected water or gas away from the injector well. In the ultimate case it has been possible to visualize the distribution of the inflow along the well by individual perforations. All these examples have lead to well intervention activities which in turn have resulted in improved production.

The 4D seismic images are also providing detailed insights into the depletion mechanism and provide vital information to help predict the pressure and porosity changes. In many cases the 4D seismic images are providing information of changes outside the reservoirs in both the over burden and deeper strata due to induced dynamic geomechanical changes [13]. This information has been used to help mitigate potential integrity issues related to drilling of the new wells through the compacting overburden.

Challenges and lessons

People: Our aspiration with FIELD OF THE FUTURE is to transform the business. Engaging all the stakeholders and in particular the business leadership has been an important and necessary part of the programme. Not only do we have to maintain credibility with the technical teams and practitioners, but also establish firm sponsorship and vision from the business leadership.

This activity is beyond the scope of most asset teams and certainly in the early stages of engagement additional effort was needed from a central team to establish the business case for such a transformational move.

FIELD OF THE FUTURE also challenges the boundaries between disciplines. For example, optimizing production is a deeply cross discipline endeavour and is one of the main business levers that FIELD OF THE FUTURE expects to drive. In developing solutions for this type of opportunity we have to find ways of bridging the language, behavioural and cultural gaps between disciplines, e.g. engineers and subsurface. The challenge proves a greater threat the more transformational the aspiration. For the future it will become more important to develop new integrated skills and competence both in internally and externally to manage the more complex discipline interfaces.

Process: If practitioners and potential users of FIELD OF THE FUTURE technology and can see how it might improve their ability to do business, demand for the technology is usually very high. Equally, it is usually seen as enabling current processes to be executed more efficiently. It can be looked upon as incremental improvement.

On the other hand, if it is believed the new technology can enable profound change in which processes are done and how they are carried out, the conversation with the potential users is more difficult and needs more support. In this transformational world there are more stakeholders from more diverse positions in the company.

Ultimately, for the FIELD OF THE FUTURE to be effective at improving the work flows, data management and the process of doing business has to be simple and linked by a common approach to avoid business or functional silos.

Technology: It is important to understand the current technical limit of the technology and the ability to develop or improve new capabilities that enhances productivity and creates a believable business case. A lot of the technology needed for the FIELD OF THE FUTURE already exists; the main challenge has been configuration and connectivity of multiple systems. For example, providing real-time surveillance data to the beach has involved connecting and configuring control systems with data historians and data viewers. This has included defining IT systems and security architecture. The building blocks have all existed; it is connecting them up in standardized way that has taken the effort.

Alignment and transparency between the engineering community and the IT community has also been an area of focus. The ability to provide sustainable and supported IT solutions requires full alignment to the corporate IT standards guidelines and appropriate supply chain management strategy in place. Many of the tools that are used within FIELD OF THE FUTURE can easily be seen as relatively small scale, job specific solutions that engineers want to own, configure and use. This is workable until that individual moves on and no-one knows how to do what he was doing.

Finally it is important to consider the challenges to implementation against the degree to which it impacts the near term tactical delivery, the long term strategic direction and the external environment. Table 1 summaries some of the main challenges against the type of impact. Our observation is that all three elements need to be managed to ensure effective technology implementation at scale.

	Technology	People	Process
Tactical	1. Develop the business case 2.Providing a sustainable support 3.Configuratio n of Multiple systems	1. Stakeholder engagement. 2.Cross discipline integration 3. Adopt new skills and competency	1. Simplify the work flow and managing the data volumes 2.Enable new process to work 3. Share best practice
Strategic	1. Define the long term IT standard 2.Allow innovation space to experiment and progress 3. Focus on a few high value areas of scale	1.Create a vision 2.Senior mgmt sponsorship 3. Behavior and cultural transformation.	1. Realize the full business benefit 2. Develop Common process strategy that technology underpins and enables.
External	1.Balance competition with collaboration 2. Develop a robust SCM strategy	1.Contractor and partner alignment and commitment 2. Access the right skills and know how.	1. Engage wider industry experience. 2.Stake holder complexity

Table 1: Summary of key challenges to implement technology at scale.

The future

The North Sea FIELD OF THE FUTURE programme is at the beginning of its lifecycle. Clarity of vision and purpose is established and provides important direction as we develop and execute the programme for the North Sea. The next few years will see a consistent approach to deploying at scale a number of information technologies that will enable our business to be executed in a very different standardized manner. The layout of BP's new Aberdeen head quarters will be designed and equipped to implement FIELD OF THE FUTURE applications and standards across the portfolio, creating an "office of the future" environment.

This standardized approach will enable staff to transfer their skills to any operating asset, potentially changing the organizational structure, to a more functional delivery model with shared central resources, reducing the operating cost for the region, while maintaining the competence and capability to operate safely.

Many of our global common process that impact our operational business delivery such as Integrated Field planning, Base Management Excellence and Beyond the Best drilling are being developed to fully embrace the benefits of FIELD OF THE FUTURE technologies.

The distinction between onshore and offshore will be blurred and increasingly data and video communications will allow information to be delivered to the individual rather than have to move the individual to the plant. Increasing automation and remote control ability will result in fewer people needing to be exposed to potentially harmful environments further driving down the additional cost burden offshore based activity currently presents. Standards for information and surveillance systems across the globe will mean support will be truly global on a continuous basis, offering the potential to provide multiple operating points around the globe to provide "Follow the Sun" approach to operations support.

For the North Sea, FIELD OF THE FUTURE has the potential to materially impact the economic longevity of our assets and sustain the business well into the 21st century.

Acknowledgements
The authors would like to thank BP management for allowing this work to be published.

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