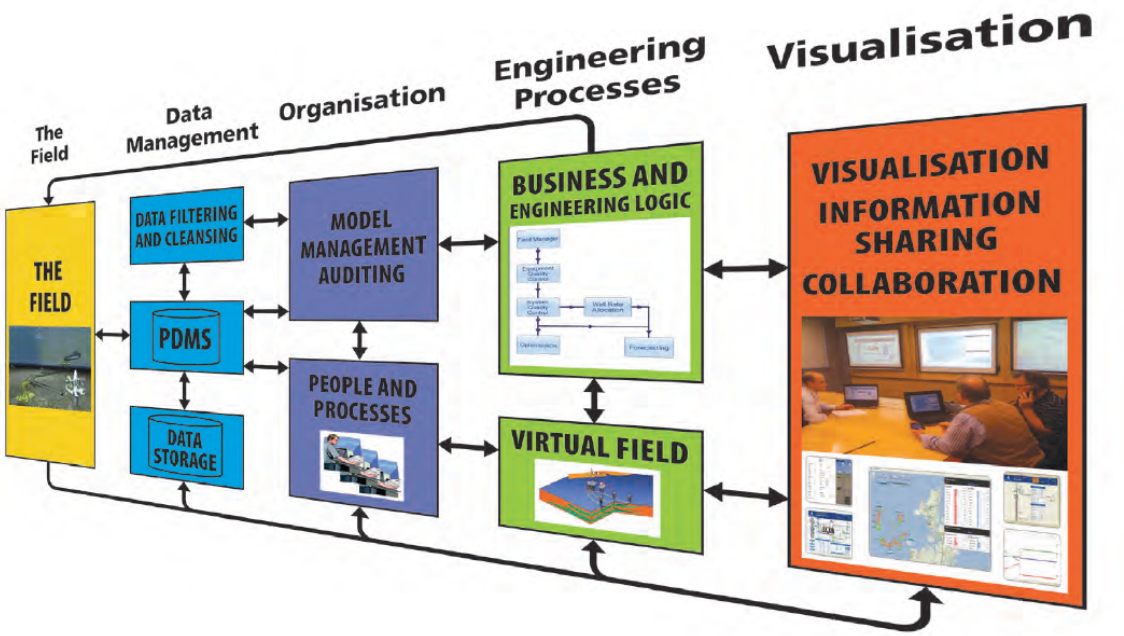
Progress Report on Significance of Real Time data management in Digital Oilfields: Data collection, analysis and visualization to Business Intelligence Systems.

The purpose of the digital oilfield is to maximize oilfield recovery, eliminate non-productive time, and increase profitability through the design and deployment of integrated workflows. Digital oilfield workflows combine business process management with advanced information technology and engineering expertise to streamline and, in many cases, automate the execution of tasks performed by cross-functional teams.

The Structure of the Digital Oil Field



Historically, Petroleum Experts pioneered integrated production modelling and management. Today, Petroleum Experts continues to lead the way in integrating these models into a digital oil field system. Diagnosis, validation, and - most importantly - optimisation of the field production are done *automatically* using real-time data.

This concept has been developed as a product as opposed to a project. This approach facilitates very short deployment times (weeks instead of months or years), upgrades, as well as an inherent capability to scale the system up. Automatic data model management, auditing of models, and intelligent data gathering allow the engineers to focus on higher added-value activities. The system also supports the distribution of best practices across the enterprise through the use of workflows.

The real time data collected from Digital oilfields helps petroleum expert with following elements.

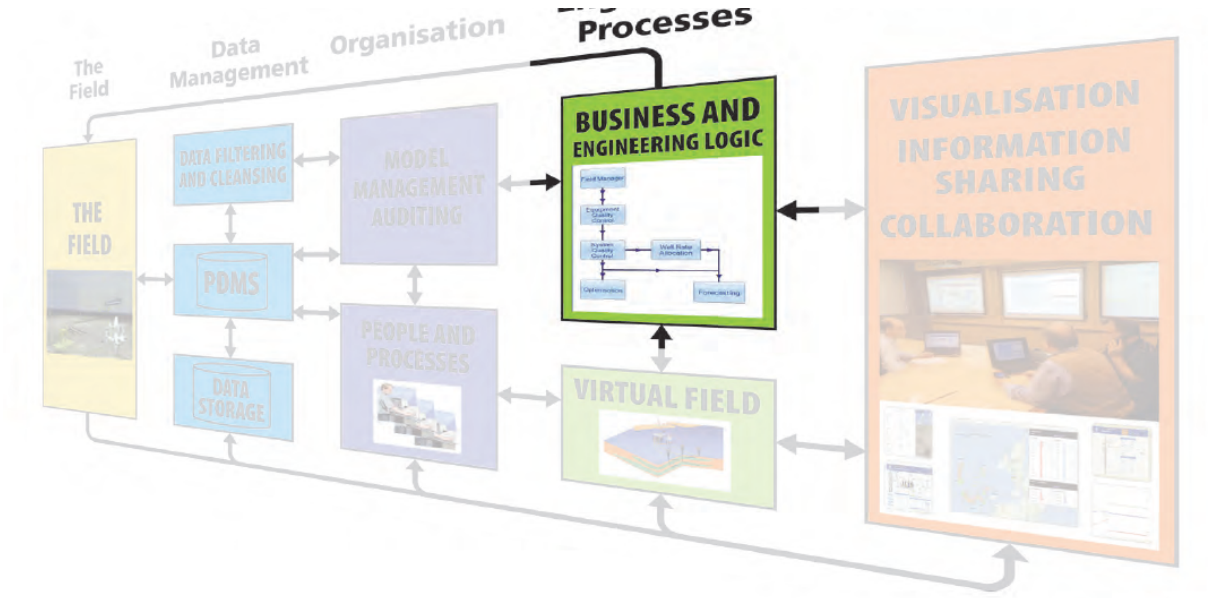
Visualization - Provides a coherent view of an oil field. Data sets are integrated, including the engineering models and production and economics information with visualization capability in an organized way. The power of a single asset and data model permit, with a push of a button, the visual screens to be upgraded and extended automatically as the oil field develops.

Data Management - Today, the instrumented fields have a huge volume of measurements coming from wells and equipment sensors – often millions of data points per minute from a single field. Making the relevant measurement and data (validated measurements) available at the frequency required necessitates sophisticated data storage, management, cleansing, and filtering of the data. In order to be suitable for the required tasks, a scalable, upgradable, and extensible data technology has to be at the heart of effective long-term data management. Therefore, productising of the data management through a single-asset data model is fundamental to any successful Digital Oil Field implementation. Otherwise, the implementations become highly customized, lengthy, very expensive, and, oftentimes unsustainable.

The Virtual Field - This is a physical representation of the field through a set of models, i.e. mathematical representations of each component of the field. In the virtual field, reservoir, production, injection network, wells, process, economics, and planning tools are each integrated with one another. These multi-vendor sets of steady and transient models are dynamically linked as an Integrated Production Model to represent and capture the current field response, as well as to optimize field production and run forecasts.

Engineering and Business Management Logic - The tasks and procedures, i.e. workflows, that the teams carry out to monitor, operate, optimize, and develop the field are automated through a layer of logic, business, and engineering workflows. This layer establishes common best practices across the global organization using standard workflows that are out-of-the-box best-practice procedures for field surveillance, optimization, diagnostics, allocation, and forecasting. Custom workflows can be easily added to the logic layer by the user. The automation of standard tasks frees the engineering and management teams to concentrate on much higher added-value activities.

Organization and Auditing - Alignment of the teams, processes, and the technology is core to any successful digital oil field implementation. A single repository of the models, data, and information for a field allows the organization to develop a consistent and coherent view of their asset. This common official field representation, the virtual field, records an auditable history of the field over its life. The use of a centralized model and data catalogue can help reduce the “soloed” view of single technical disciplines. Moreover, storing the field events and recording the decisions associated with those events become the foundation for engineering knowledge capture required for an “expert” system.



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Tools required for acquiring Real time data in digital oilfields

Generally, the digital oil field encompasses both the tools and the processes surrounding data and information management across the entire suite of upstream activities. More specifically, digital oil field technologies allow companies to capture more data, with greater frequency, from all parts of the oil and gas value chain and analyze it in real or near-real time, thus optimizing reservoir, well, and facility performance. These engineering-based and information-based technologies can have a profound positive or negative impact on human capital efficiency depending on how they are introduced and embedded into the organization. A sample set of technologies that are receiving universal industry acceptance includes the following

: • Remote Real-Time Facility Monitoring and Control The off-site control of facility process systems through the networking of SCADA (systems control and data analysis) and its transfer to onshore control rooms, enabling field data capture, set point control, and valve/pump manipulation.

• Real-Time Drilling The collection and integration of real-time drilling data such as RPM, circulation solids, down hole pressures captured through MWD, and

remotely steerable down-hole tools.

• Real-Time Production Surveillance The utilization of advanced alarm systems to trigger analysis of important production integrity trends to help optimize and maintain installed capacity levels.

• Intelligent Wells Surface-controlled, down-hole equipment, enabled by fiber-optic sensors, allows for continuous monitoring of conditions and response.

• 4-D Visualization and Modeling Successive 3-D seismic surveys track fluid movements, allowing for additional insight into production enhancement and redirecting enhanced recovery mechanisms.

• Remote Communications Technology Off-site facilities with real-time visual, voice, and data communication with the field allow more rapid, analytical responses by a mix of off-site and on-site staff.

• Integrated Asset Models Applications that model complete production system performance from the producing horizon, through the well-bore, through the production facility, and onto the export/sales point across disparate data sources and multisite work teams. • Workflow and Knowledge Management Systems Robust historical data and document-management solutions that allow assets and functions to quickly execute workflows and routines by calling up complete historical analyses quickly and accurately. • Production Volume Management Systems Standardized production data and production allocations, allowing more efficient real-time production decisions that result in reduced deferment and improved operational integrity

Nowadays Hadoop is also being used to store and analyze real time data in digital oilfields

Operating Model Enabled by the Digital Oil Field to use real time data.

Digital oil field technologies such as fiber-optic pressure and temperature gauges allow for sustained down-hole profiling, which offers managers more robust information and thus more comprehensive asset awareness. As information flow is directed from the field to the most relevant party off-site, this complete sense of asset awareness translates directly into asset optimization, as managers can make more informed portfolio decisions in terms of resource and capital allocation. This portfolio perspective allows the best deployment of available staff and therefore has a positive impact on the industry’s most pressing issues, offering benefits such

as a reduction in production deferment due to unplanned shutdowns, higher uptime across the production system, and a reduction in health, safety, and environmental incidents.

By enhancing collaboration across facilities, geographic locations, and functions, global majors have strengthened lines of communication and interrelationships between the field and office and redefined the field operating model. New collaboration technologies—such as high-density video; reliable video, audio, and data transmission through fiber optics; and multidimensional presentation technologies (e.g., video cube walls)— have transformed companies' ability Booz & Company 08 to stay globally connected 24/7 and have aligned onshore support centers, offshore facilities and operations, vendors, partners, and non-field professionals into a collective operating unit. These collaborative environments are increasingly equipped with smarter surveillance and diagnostic tools to pinpoint relevant conditions by passing real-time data through advanced multivariable models that can be scaled across multiple assets and facilities. For instance, one super major has deployed a new operating model that ties together remote monitoring; real-time surveillance; and reservoir, well, and facility optimization, field planning; and work activity execution into an integrated production management center (see Exhibit 4). Although early in its deployment, the operating model's business objectives are to pay for itself and create the productivity equivalent of 19 additional engineers. To do so, it would need to reduce production deferment by a mere 0.04 percent.

The key advantages of the integrated operating model are access to distributed expertise from remote locations and reduced decision time despite geographical boundaries. Other benefits include the ability to leverage lessons learned on previous projects, as knowledge management systems become more robust and historical well and facility performance profiles are generated over longer periods. Access to this information enables companies to identify the right personnel to engage for faster problem resolution. Holistically, document management databases can serve as a clearinghouse for issue status information that may affect operations and a conduit for on-demand operations optimization.

Booz & Company Booz & Company Static Feeds 09 Continuous monitoring or advanced surveillance activities stored in integrated knowledge repositories (e.g., databases, wikis, or analysis applications) that catalog asset and equipment history, well-test histories, decline curves, and previous optimization decision routines allow managers to maximize field value through advanced system-wide modeling and simulation analysis. However, none of this can happen without high-quality data in a consistent format. Performance dashboards and enhanced reporting capabilities permit transparency and cross-organizational knowledge transfer from the field to the management and executive layers. Collecting performance statistics through a centralized, accessible data warehouse can enable dynamic reporting of performance to partners, regulatory bodies, and executive management.

For instance, static reports produced for one offshore asset at a global super major include alarm trends, well performance, topside performance, downtime, equipment availability, and bad actor reporting. Executives can parlay this type of asset transparency to manage performance across a wider portfolio of assets: Using integrated asset models that predict how changing one part of the system will affect the overall portfolio, executives can more effectively allocate resources and make

decisions that maximize value.

The overarching benefit of an operating model that makes the best possible use of digital oil field technologies is clear. It solves the information dilemma by knowing what field data to capture and how to interpret that data, resulting in field optimization, improved safety, cost reduction, and production enhancement. Better yet, it does so while enabling automated operations, carried out without any compromise of health, safety, environmental standards, or asset-realization results.