Using Analytics to Improve Production, Aberdeen - Sept 29th 2015

Data, Workflows, Models and Change Management: Towards improved operational performance

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The E&P Space

Prospecting/Exploration | Development | Production
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• Where to explore? | • Which discoveries to develop? | • Real-time execution and control
• Which prospects to investigate? | • What are the reserves? | • Asset model driven performance
• Where to invest? | • What are the fluid volumes?
The Quest for Operational Efficiency

Over the past few years, value in upstream operations has shifted from gaining access to new fields and delivering development projects to delivering best-in-class operational performance. Today’s challenging economic environment for oil and gas operators means that better operational performance—both in costs and production volumes—will play a significant role in delivering positive returns over the coming years.

When the going gets tough, the tough gets going


- Improvement in all these areas could result in up to 30% higher net present value (NPV).
- World-class performance on one dimension typically goes hand-in-hand with world-class performance on all dimensions.
But… where can we look for more Operational Efficiency

- ASSET POTENTIAL
- FIELD DEVELOPMENT PLANNING & OPTIMIZATION
- INSTALLED POTENTIAL
- MAINTENANCE & RELIABILITY OPTIMIZATION
- OPERATING POTENTIAL
- PRODUCTION OPERATIONS OPTIMIZATION
- ACTUAL PRODUCTION

- KNOWLEDGE MANAGEMENT
- OPERATIONS AND ASSET INTEGRITY
- REGULATORY COMPLIANCE WORK PROCESSES – HSE, SOX, OSHA
Refinery Capacity Utilization in the US (1990 to 2000)

Evolution of refining capacity vs. utilization in the US (1990 to 2000)

Millions Of Barrels Per Day

Utilisation Rate

- Capacity
- Utilisation
What is DOF anyway?

**Digital oil field** is the umbrella term for technology-centric solutions that allow companies to leverage limited resources. For instance, such technology can help employees more quickly and accurately analyze the growing volumes of data generated by increasingly sophisticated engineering technologies, such as down-hole multiphase sensors, measurement-while-drilling (MWD) applications, multilateral completions, and down-hole separation.

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.

http://www.strategyand.pwc.com/global/home/what-we-think/reports-white-papers/article-display/unleashing-productivity-digital-field-advantage

The concept strives to enhance quality and speed of decision making and execution. This is achieved by integrating people, process and technology supported by access to (real-time) data, information, use of simulation models and other analytical tools. This enables the asset team to monitor the performance of wells and facilities against target in order to realize the differences and detect anomalies at an early stage.

http://www.adco.ae/En/Technology/Pages/AutomationSmartFields.aspx
Components of the DOF

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, downhole 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.

http://www.strategyand.pwc.com/global/home/what-we-think/reports-white-papers/article-display/unleashing-productivity-digital-field-advantage
The OLF Model for Integrated Operations

To look is one thing, to see what you look at is another, to understand what you see is a third, to learn what you understand is still something else, to act on what you learn is all that really matters.

W. Churchill
Shemwell, Murphy, Strategic Decision Sciences, Houston

Article available online:

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Some industry analysis suggests improved net present value of up to approximately 25 percent from digital oil field–related implementation; from a human capital perspective, digital oil field technologies can allow companies to operate with significantly fewer resources and scale the existing resources more effectively by capturing and displaying relevant conditions more quickly and to a wider collaborative environment. For instance, one oil and gas company has quantified its productivity-based gain from introducing select digital oil field technologies at US$20 million annually. It identified opportunities for direct deferment; by automating data updates and reports across a standardized master production data-store, the company removed the responsibility for routine data collection and analysis requirements from its scarce engineering talent.

http://www.strategyand.pwc.com/global/home/what-we-think/reports-white-papers/article-display/unleashing-productivity-digital-field-advantage
The People-Process-Technology Paradigm
The People-Process-Technology Paradigm

- People
- Process
- Technology

- Change Mmt.
- Workflows
- Data
- Models
The Need for Data

- Are I covering the right ranges of “time”, “space” and “type”?
- How am I validating the data?
  - Simple statistics?
  - Data Reconcile?
  - Model-based?
- Do I have clear guidelines about who “owns” each piece of data?
- Do I have the data available when I need it?
  - Right time
Data Management – Architectural Models

Data Federation
- Uses information from its source
- No duplication
- Performance?
- Business rules may interfere
- Cost

Operational Data Store
- Collects information into an ODS
- Duplication
- Performance
- Different business rules for original than for copy
- Cost
The Need for Predictive Models

We are drowning in information but starved for knowledge.

John Naisbitt

If you can't model your process, you don't understand it. If you don't understand it, you can't improve it. And, if you can't improve it, you won't be competitive in the 21st century.

James Trainham, Former CTO Invista
The Need for Workflows

The "big crew change" or large turnover of retiring industry personnel to a younger workforce is currently happening.

Graph displays the percentage of E&P personnel per age category on a global basis. The retirement rate is at 20% for 55–59 year-olds, 90% for 60–64 year-olds, and 100% for 65+ year-olds.

The attrition rate is at 1.4% and is defined as the people leaving the E&P industry.

*SOURCE: 2010 SBC O&G HR BENCHMARK*
Industry studies show that it takes between 7 and 11 years for new explorationists to make independent innovative decisions
Considerations for Workflow Design: Proper Division of Labor

Humans
- Strategy
- Designs and choices
- Constraints & objectives
- Decisions

Machines
- Repetitive tasks
- Running models
- Optimizing
- Monitoring, trending & alarming
Workflows in E&P Operations

- Well Integrity Management
- Steam Flood Optimization
- Artificial Lift Optimization
- Smart Production Surveillance
- Production Losses/Recovery Reports
- Well Performance Assurance
- KPI Monitoring
- Well Test Validation
- Facility Monitoring
- Reservoir Visualization & Analysis
- Oil Hauling & Tank Management
- History Matching
- Operational Target Setting
- Reporting & Distribution
- Water Flood Optimization
- Field Development Planning
- Reservoir Visualization & Analysis
Workflows in E&P Operations

Well Integrity Management

Understand Production History

Real-time Monitoring

Warning area

Predict Optimize

Understand Analytical Tools

Monitoring Alarming & Visualization Tools

Recommend Predictive Analytics Optimization

Past

Present

Future

Past

Future

Understand Production History

Real-time Monitoring

Warning area

Predict Optimize

Understand Analytical Tools

Monitoring Alarming & Visualization Tools

Recommend Predictive Analytics Optimization

Past

Present

Future

SPE 163812 • New Generation of Petroleum Workflow Automation…• Al-Jasmi & J. Rodriguez
More high impact workflows are **possible and affordable** than ever before.

- **Virtual metering**
- **Well test validation**
- **Facility monitoring**
- **Real time production estimation**
- **KPI monitoring**
- **PVT correction**
- **Performance curves generation**
- **Production loss analysis**
- **Well performance evaluation**
- **Artificial lift optimization**
- **Multi well allocation**
- **Reservoir simulation**
- **Field development planning**
- **Integrated production optimization**
- **Smart waterflood optimization**
- **Smart model update and ranking**
- **Dynamic well surveillance**

**Foundational**
- **Well Centric**
- **Field Centric**

**Expert**
- **Foundational Expert**
- **Field Centric**
- **Well Centric**

**Sophistication Level**
- **Workflow Scope**
Old habits die hard

Humans are allergic to change. They love to say, "We've always done it this way." I try to fight that. That's why I have a clock on my wall that runs counter-clockwise.

The most dangerous phrase in the language is, "We've always done it this way."
The Need for Change Management

Aligning the Organization
The ability of a company, a business unit, or a team to execute a strategy is not something that can be mandated by fiat. It is inherent in the organization’s DNA and expressed in the hundreds of decisions and actions that collectively constitute and define performance. Would-be digital oil field operators can, however, attempt to align the building blocks of a company’s DNA—decision rights, information flows, organizational structure, and motivators—to better capture the digital oil field’s benefits. In order to realize the full potential of digital oil field technologies, organizations must be aligned and interrelationships established—for instance, between engineering functions, assets, and functional reporting relationships through an integrated set of key performance indicators (KPIs) (see Exhibit 8).

A significant part of organizational alignment will involve creating new roles, redesigning existing processes, and aligning performance measures to support and execute collaborative working conditions.

http://www.strategyand.pwc.com/media/file/UnleashingProductivity.pdf
The Risk of Organizational Fatigue

The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency.

Bill Gates

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.

http://www.strategyand.pwc.com/global/home/what-we-think/reports-white-papers/article-display/unleashing-productivity-digital-field-advantage
Lessons Learned (SPE 115367)

1. Start planning early, synchronize with overall project plan and ensure alignment and upper management support.

2. Focus on business process delivery, quantify and demonstrate value to the asset team members. IT is a means, not an end. Improved efficiency is the end.

3. Ensure constant engagement with ALL the stakeholders.

4. Carry out Proof-of Concept (PoC) for feasibility/scoping prior to committing to an overall project scope.

5. Ensure an Integrated System to be developed and deployed is based on modular solution (to allow for plug and play).

6. Use relevant subject matter experts (SMEs).

7. Implement project in stages to ensure maximum value is captured, prioritize workflows and focus on the “quick hits” first.
The Need for a Platform

Production Applications and Plug-ins

Production Monitoring
Production Allocation
Production Surveillance
Well Integrity Management
Economics
Production Analytics
Production Plug-ins

Integration Server
- Business Process Management
- Data Integration
- Web framework
- Search

Data Quality
- Data Validation & Reconciliation

Analytics
- KPI & Dashboards
- Reporting
- Business Intelligence

RealTime Analytics
- Alarms
- Data Driven Models
- RT Computation

Engineering Tools
- Process Modelling and Simulation
- Model Management & Catalog
- Real Time Production Management
- Petro-technical Application Orchestration

Information Sources
- Corporate Databases
- 3rd Party Databases
- Semi Structured data
- Unstructured Data
- Real-time

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Conclusions

To look is one thing, to see what you look at is another, to understand what you see is a third, to learn what you understand is still something else, to act on what you learn is all that really matters.

W. Churchill

- Begin with the end in mind (Covey)
- You’ll need data, IT infrastructure
- But always think first what you are trying to accomplish
- Data requirements comes after you decide what data you need for your workflows
- Performance!
- Who owns what (data, models, workflows,…)
- Build a business case (e.g. Uptime)
- Consider starting with Regulatory Compliance
  - Production Accounting
  - Well Integrity
- Iterative approach (complete system, a few workflows)
- Assess performance early on
- Build on “stay on business” regulatory compliance and pursue operational efficiency
- Align with corporate priorities and standards
- Don’t let silos get in the way (sub-surface, surface, facilities)
- If you don’t manage change, it won’t happen (or won’t happen as you thought it would!)
- Think of a platform to tie all this together (multiple data sources, multiple applications)