

Dual Transformation and the Digital Oilfield

The digital oilfield is bringing about the next major realignment in oil and gas. Exploration & Production companies and those serving them must transform to take full advantage of the strategic shift.

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EXECUTIVE SUMMARY

Emerging digital technologies promise to transform the oil and gas sector. Technologies such as the Internet of Things (IoT) and predictive analytics, mobility and cloud computing, as well as artificial intelligence and augmented reality are enabling an era of substantial realignment around the opportunity known as the “digital oilfield.” While there have been a series of realignments in the oil sector over the past fifty years, the digital realignment is potentially the most transformational. As macro trends coincide with the development of these new technologies, exploration & production (E&P) companies and their oilfield service (OFS) company partners will need to innovate new business models.

To win in this new era will require two parallel efforts, what we call “dual transformation.” Transformation A in the core business will require converting previously unstructured data and expertise into proprietary insights that reduce costs or de-risk investments on behalf of customers, maximizing ROI. Transformation B is a parallel effort to launch new growth ventures enabled by new technologies that build new value over the long term in ways that might disrupt the core business. The E&P and OFS players that are best able to leverage their past capabilities to execute both types of efforts and deliver high-value, integrated solutions in this new realignment will be the winners.

OFS companies can prevail by morphing from traditional product or service-focused organizations into customer-focused solutions shops, finding ways to sell cost-effective solutions to the customer based on newly created value. Such fundamental value shifts are not simple for large organizations to execute. This will require a deliberate approach to innovation with a particular focus on mitigating the organizational friction that commonly kills new business models in their infancy.

The digital oilfield holds incredible promise. Combining new technologies like the Internet of Things (IoT), predictive analytics, mobility and cloud computing, oil companies up and down the value chain can capture more and better data, with greater frequency, and analyze insights more quickly to make better and faster decisions. The benefits include enhanced recovery, eliminating equipment downtime, and boosting profitability by streamlining and integrating workflows across teams.

Because digital oilfield technologies are complicated and expensive to implement, it is tempting to harness them mainly to further existing oil and gas company goals. In E&P companies' core business, for example, these technologies can help shift from a model of rationalization of current assets towards a model of optimizing the longevity and recovery from those assets. But focusing only on incremental improvements, without making bigger investments to generate new types of value, is a short-term solution at best.

To unlock the real potential of the digital oilfield, companies need to do both – optimize, adapt and evolve the core, while investing in new business models and growth ventures aimed at generating new revenue streams and fending off disruptive startups. This is what we call dual transformation – two parallel efforts managed on separate paths, along separate timelines, and with separate organizational structures. (Read more about the concept in the book, [Dual Transformation: How to Reposition Today's Business While Creating the Future](#)).

These two efforts are most effectively managed on separate paths, along separate timelines, and with separate organizational structures.

The digital oilfield realignment sets up both E&P companies and their OFS partners for independent but interrelated dual transformation. E&P companies must cost optimize their core “A” businesses while pursuing opportunities to reduce risk exposure with differently-structured “B” businesses. OFS companies must adapt to the needs created as E&P companies shift (“A”), but also must look for opportunities to provide new services (“B”) to disruptive oil companies, firms that will be smaller and in a certain way less sophisticated without the organizational heft to capitalize on data.

HOW REALIGNMENTS CHANGE THE GAME

Industry realignments are driven by both technology and macroeconomic forces, triggering major changes in the process of value creation.

Realignment = Macro-Economic Trends + Technological Shift + Business Model Shift

Two shifts in recent decades are especially illustrative of how early movers among E&P companies can become the biggest winners. Correspondingly, the service and equipment providers who are able to shift their business models also fare well.

The Shift to Deepwater

The events of the 1970s and 1980s pushed international E&P companies to find alternative provinces and basins. A subsequent run-up in oil prices – when the search proved difficult – created an environment in which there was tolerance for previously unfathomable drilling costs. Concurrently, advancements in the technology used for seismic acquisition and in the mechanical capability to drill and produce in deep water allowed the exploration and development of underwater basins all over the world. Large E&Ps shifted their business models to include long cycle, high capex offshore mega-projects¹.

Successful Deepwater Services Companies



Identifying and Fulfilling a New Niche

Oil States was founded in 1995 as a supplier of specialty piping for early offshore platforms and grew along with the deepwater boom, to IPO in 2001.

Targeted manufacturing capability led Oil States to become the leading supplier of capital equipment used on floating production platforms, subsea pipelines, floating drilling rigs and vessels.



Building Capability in a New Niche

Throughout the 1990’s Weatherford maintained an active M&A arm, grabbing innovative products and services and scaling their distribution through its local networks.

- Invested heavily in artificial lift technology, in which lower density fluids or downhole pumps are used to flow hydrocarbons
- Weatherford had patents covering all 5 known AL techniques, acquired through M&A

¹ Daniel Yergin “The Prize: The Epic Quest for Oil, Money & Power” Simon and Schuster, 2008 Edition.

Shale Gas and Light Tight Oil (LTO) Revolutions

The high price environment also encouraged companies to experiment with other technologies. Due to considerable US interest in energy independence, research funding was available for technologies needed to extract hydrocarbons from known oil bearing formations which had no permeable reservoir². Advancements in computer processing capacity combined with 3D seismic, hydraulic fracturing, and horizontal drilling used technology to create commercial reservoirs where none previously existed. These new reservoirs decline more quickly, so well performance must be optimized as quickly as possible and the queue of drilling projects must be constantly refilled.

Successful Shale-Era Service Companies

HALLIBURTON

Finding High-Value Customer Needs

Halliburton reorganized itself around drilling and related disciplines which enable good results, becoming an indispensable partner.

- Integrated all of its disparate drilling capabilities into one core unit so that end-to-end cost of drilling could be managed all at once
- Debuted a software suite designed to integrate geophysical and geological information directly into business decision-making



Maintaining Local Relationships

TechnipFMC built and then capitalized-on a local market approach which placed customer needs at the center of its business.

- Restructured customer-facing operations to a “Service Base” model with specifically-staffed offices
- Developed manufacturing capabilities in each location to help compliance with local content requirements
- Invested in capacity to build out shale equipment sooner than competitors because of presence on the ground from the start

ECONOMIC AND TECH DRIVERS OF THE DIGITAL OILFIELD REALIGNMENT

The economics of the next realignment point towards an environment of a range-bound price for oil, overlaid with several looming factors which could lead to downward price swings. Concurrently, many digital technologies that have already revolutionized other industries are finally being meaningfully applied in the oilfield.

² Daniel Yergin “The Quest: Energy Security and the Remaking of the Modern World” The Penguin Press, 2011.

Economic Drivers

Overall, continued demand growth coupled with projected stable supply suggest an intermediate and perhaps even long-term range-bound price for oil. Global demand is currently very strong with a projected annual increase in daily consumption of 1.7 million BPD projected for 2018, with total demand expected to reach 100 million BPD by early 2019. On the supply side, companies are approving investments in long cycle, large capex projects for the first time since 2014. However, this supply and demand equilibrium could be thrown off by three destabilizing factors:

Destabilizer 1: Technological Advancement Leads to New Supply Growth

Since the 1950s there have been two dominant objectives in the application of technology to achieve increased world oil supply. The first is an array of exploration technologies leading to the discovery of new hydrocarbon resources, typically with very large conventional reservoirs but in remote or harsh locations and requiring high cost, longer cycle projects. As these exploration projects are developed and produced, they set the marginal cost of extraction. When supply is taut, these new projects tend to set a high marginal oil price.

Destabilizer 2: Technological Advancement Leads to Existing Supply Growth

The second is a variety of technologies that have focused on increasing the percentage oil recovered from a known or existing reservoir. These enhanced recovery techniques (water flooding, CO2 flooding, steam injection, specialized surfactants, etc) have slowly brought recovery rates in oil reservoirs from 15% - 30%³ to 30% - 50%⁴.

As long-term trends towards ever higher fuel efficiency and auto electrification gain adoption, the growth in demand for liquid transportation fuels will decelerate.







The recent advent of LTO horizontal drilling and hydraulic fracturing technologies can be considered a variant of these older recovery enhancement technologies. Most of the world's known oil reservoirs have had a recovery rate of less than 40%, and in many instances, less than 20%. The effective application of LTO technologies in basins outside of North America (such as Argentina) or the advancement of enhanced recovery technologies could lead to a relatively sudden increase in deliverability of oil from known sources into existing infrastructure.

Destabilizer 3: Transportation Trends Decrease Demand

The use of petroleum liquids for transportation accounts for approximately 54% of current

3 Primary recovery
 4 Secondary and tertiary recovery

Key Digital Oilfield Technologies

TECHNOLOGY	DEFINITION	DIGITAL OILFIELD APPLICATION
Happening Now: Creating value by connecting existing assets in new ways		
 INTERNET OF THINGS	Parts and equipment enabled to sense and transmit changes in operating conditions to a common data repository	<ul style="list-style-type: none"> Monitoring and tracking in-field equipment Predictive maintenance In-situ monitoring of drilling performance Hyper-standardized processing outputs
 CLOUD COMPUTING	Storing and processing data over a network of remote servers rather than locally	<ul style="list-style-type: none"> Off-site data storage and processing Integration of data from disparate locations Closer links between field/platform, engineering, and accounting
 MOBILE CONNECTIVITY	Connections to remote equipment and its data through edge leading to availability of immediate and accurate measurement	<ul style="list-style-type: none"> Immediate and accurate measurement Real-time at-the-meter rate payments Decreased remote asset inspection frequency or personnel requirements
 AUGMENTED REALITY	Information systems which display information visually overlaid on top of actual asset or remote from the asset	<ul style="list-style-type: none"> 3D Seismic, mapping, and stimulation results for VR headset Real-time onsite asset information headset Remote VR asset visualization
Next-Generation: AI-powered analytics uncover unseen patterns in operational data		
 PRODUCTION OPTIMIZATION	Using artificial intelligence improve performance by uncovering patterns in newly-available operational data	<ul style="list-style-type: none"> Highlight changes in key asset performance indices between reviews Suggest changes in asset management strategy based on other assets
 DRILLING LOCATION OPTIMIZATION	Using artificial intelligence to improve performance by uncovering patterns in geographically similar assets	<ul style="list-style-type: none"> Reducing the use of sand in hydraulically fractured wells based on past data Optimizing the path of horizontally-drilled wells based on in-field data from other wells

consumption.⁵ As long-term trends towards ever higher fuel efficiency and auto electrification gain adoption, the growth in demand for liquid transportation fuels will decelerate. However, absolute declines in liquids demand for transportation are not forecast by the EIA through 2040. Reductions in OECD demand due to efficiency gains, as well as natural gas and electric substitution, are offset by very significant demand increases in non-OECD countries. In short, demand is not expected to fall in the short term but if the transition happens more quickly than expected, then prices will fall.

Technology Drivers

The internet age has brought a wave of advancement across many industries, but thus far the oilfield has been slower to adopt new technologies. The digital oilfield is really a range of technologies which have grown up from the digitization of other industries and is poised to transform the economics of both exploration and production.

HOW EXPLORATION & PRODUCTION FIRMS CAN CAPITALIZE ON THE SHIFT

In the economic and technological context delineated above, Transformation A largely revolves around using data analytics to optimize existing assets and reduce the cost basis to an absolute minimum, while Transformation B consists of building businesses which address price risk from an entirely different perspective based on the data. Early rumblings of the anticipated shifts have been seen in the LTO revolution, so it is useful to discuss those examples as early indicators of the implications of digital oilfield technologies while acknowledging that those implications will broaden to address new problems.

Dual Transformation in Action

Companies can address the same problem in different ways, depending on their capabilities and circumstances. In this example, the issue of sand usage in hydraulically fractured wells was addressed by using digital innovations for both the “A” business and the “B” business.

Transformation A: Occidental Petroleum – Using Data to Optimize Cost

In June of 2017, Occidental Petroleum credited reduced sand usage for helping it to achieve an industry-leading lifting cost. Occidental’s technical advances have used big data to analyze completion location and completion landing techniques, reducing the amount of sand and widening the set of useable sand options.



Transformation B: EOG Resources – Taking On New Challenges

In 2011, EOG announced that it had vertically integrated by opening a sand processing facility in Chippewa Falls, Wisconsin, which would ship approximately 200 train cars of sand to another processing facility in Refugio, Texas most of which would ultimately be used in its operations in Eagle Ford. The company used data to find vulnerabilities in its business, and built new capabilities to address them.



Transformation A: Using Digital to Achieve Cost Optimization

The most obvious response to a risky price environment is to create a cost-optimized business which is still profitable in the downside case. While the rationale is simple, the realities of creating a truly cost-optimized business are very difficult. Crucially, with digital oilfield technologies, the true value will be unlocked by reorganizing the company so that it is nimble enough to take advantage of the insights uncovered within the data.

For example, production company asset teams today are matrixed organizations in which engineers and operating disciplines work together as a team to operate a particular physical asset, but the reporting structure for individual engineers is discipline-based: Facility engineers (largely mechanical engineers by training) report to a facility engineering manager. Reservoir engineers (largely petroleum engineers by training) report to a reservoir engineering manager. Digital oilfield technologies for operations will upend this paradigm – the teams best able to capitalize on newly available insights from data will be those which are most closely-aligned on an asset basis.

Transformation B: Using Digital to Reduce Downward Price Shift Exposure

The other way to respond to price risk is to approach it from a systematically different perspective: offload non-price risk when possible and find ways to reduce or mitigate it when not. This imperative will lead E&P companies to share price risk with other members of the value chain and to create asset-light, flexible operating models which can be easily scaled down.

A 20ft difference in landing site location can change a well’s productivity 20%; lack of data presents a bigger risk than lack of geographic diversity.

For example, during the LTO revolution many companies became successful by creating a geographic concentration within their portfolios, in direct contrast with the thinking of an earlier era in which geographic diversification was sought. These astute companies

saw that in the digital era, a surfeit of local geological and petrophysical data enables much greater precision in well design. A 20ft difference in landing site location can change a well’s productivity by as much as 20%; lack of data presents a bigger risk than lack of geographic diversity.

HOW OILFIELD SERVICE COMPANIES CAN PROFIT

The winners in the service market will be those who support the E&P business model transitions required to maximize the returns of digital oilfield technologies. More simply, winning OFS companies will be the enablers of winning E&P companies.

Additionally, OFS companies now face a dual transformation opportunity of their own. The core “A” business must take the capabilities and services which E&P companies have historically needed and adapt them to the new priorities. A “B” opportunity is available to OFS companies able to look more deeply at the needs of national oil companies (NOCs) or small E&Ps to help them gain capabilities that larger competitors will keep in-house.

Transformation A: Adapting to E&P Priorities

New offerings in these areas should be designed with three principles in mind:

Climbing the Value Stack. In technology, value has accumulated to the companies which can enable the realization of the technology’s benefits. Value accumulates to Google and Amazon rather than the companies within their ecosystems. Therefore, OFS companies should look outside conventional boundaries to attack sub-optimized processes at the system level.

Service-Based Offerings. As particular components or systems become commoditized, companies can re-capture some of the value they create by redefining their role in the ecosystem. As servers became cheaper and less differentiated, IBM transitioned to a service model in which the offering became closer to the customer’s real need (data storage/ processing power) by offering platform-as-a-service (PaaS) solutions on more flexible payment terms. This model would allow OFS companies to monetize their offerings based on value to the customer rather than seeing margins drop with cost-per-hour or cost-plus models.

Modularization & Mass Customization. OFS players should look to find places where their current state-of-the-art models are overserving customer needs and transition highly customized service to mass-customized or modular solutions that provide similar value with superior economics.

Transformation B: Harnessing the Power of Data for Small-Scale E&P Companies

One big barrier standing between OFS companies and a successful digital oilfield transition is data ownership and data gathering. Big data analytics and its next generation, machine learning algorithms, require huge volumes of data to generate insights. Large E&P companies have been reluctant to share drilling or production data with OFS companies because of security concerns and protectiveness towards a key source of competitive advantage. OFS companies are threatened with marginalization and limited pricing leverage in their negotiations with major and mid-size E&Ps.

To address this threat, OFS companies can perform an end-run by partnering with national oil companies and smaller E&Ps. OFS companies have an opportunity to leverage their broad market presence to collect, aggregate and structure as much location-specific geological and geophysical data as possible. These treasure troves will help them to keep pace with advances made by larger firms working in-house, democratizing geographically-based data.

OFS companies have an opportunity to leverage their broad market presence to collect, aggregate and structure data.

Given the primacy of data in the digital oilfield, these ventures need to be established quickly and managed under a different set of norms and priorities than more traditional offerings.

THE STRATEGIC IMPERATIVES OF THE DIGITAL OILFIELD

The key to surviving a realignment is to develop a deep, customer-centric understanding of the evolving value system within which the customer competes. A well-tuned organization can identify, prioritize and coalesce key customer concerns on a continuous basis, updating as appropriate for the future vision.

Developing a vision for the future and a strategy for competing within that vision are only the first steps of a journey to robust innovation capabilities. Companies seeking to capitalize on a realignment must develop a critical set of new enabling capabilities, including solution design, solution delivery and value selling.

Solution design is the ability to create an offering for customers which encompasses a complete problem definition rooted in the progress customers are trying to make. It involves the ability to innovate on a system level rather than a product level and must be continuously performed to maintain relevance with the customer. Hilti tools is a canonical example of a company which has excelled in solution design. Faced with a commodifying market for construction tools, Hilti reimaged itself as a provider of the continuous construction job site operations, through a job site toolbox service. The solution provides sustained value by solving the consistent problem of inefficiency caused when broken tools lead to lost work time.

Solution delivery is related to how the customer obtains access to the solution. Companies cannot do whatever customers ask, they must find things to do which are scalable and repeatable, push themselves up a learning curve and establish a relationship with clients based on expertise. Depending on the solution to be offered, OFS companies should consider:

- **Professional Services Delivery** reimagines the sales force as specialized consultants who help an engineer choose and implement a particular product and related services.
- **Mass-Customization and Modularization** creates a consistent base product which can be readily assembled like Lego blocks to create the solution which end-users really need.
- **Ecosystem Manager Positioning** strategically positions a company as the manager of the ecosystem in which others' activities transpire.

The exact nature of the right solution delivery model for a given business varies and is likely a subset of the three.

Value Selling pertains to a company's ability to price and sell based on the value it creates for its clients. When creating truly customer-centric solutions in the B2B space, it is critical to have access to the problem owner rather than a procurement department. In the digital oilfield space, the rise of cheap sensors, monitoring technology and digital contracts mean that vendors selling products on the promise of reduced emissions or reduced downtime will be able to share client's risk by agreeing to payment terms related to those selling points. For

instance, if a company increases the uptime of a refinery by 1% then it is paid a certain amount, but if it is increased by 5% then it is paid substantially more.

Executing for Innovation and Growth

All of these changes in vision and capabilities have historically been quite difficult for established companies to accomplish. That's why they must look to the health of their core business, making changes and advancements necessary to optimize the foundation of their value, but also perform entirely different tasks according to an entirely different values system in new growth businesses.

The digital oilfield realignment will require companies to change deeply-seated norms. Companies that have traded on offering the best price or the best product must transition to offering the best total solution, while companies that have found success through centralized models and structured procedures risk stalling out without an empowered front line and a field-driven approach to decisions.

Solution innovation is an unfamiliar process that will have no natural institutional home in a traditional product and service company; solution selling is a completely different art from product and service sales, requiring higher level competencies that do not exist within most existing sales forces. All of these factors argue for insulating a nascent solutions business away from the traditional management and resource allocation systems of the existing core business so that it can pursue a learn, adapt and scale approach.

The economics of solutions businesses are driven by new high-margin solution revenue streams, but also by the increased pull-through of traditional products and services earned through the privileged position that a successful solutions provider establishes with the customer. The pull-through manifests first in superior customer retention, then in increased share of wallet as the broader range of opportunities becomes visible.

Over time, leaders who develop a differentiated solution capability will win customers from the competition. Ultimately, expert solutions providers will become partners with their customers in identifying and attacking new sources of value creation, cementing a new higher-value position within the ecosystem.

ABOUT INNOSIGHT

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