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GOING DIGITAL IS HARD FOR OIL AND GAS COMPANIES— BUT THE PAYOFF IS WORTH IT

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BUSINESS LEADERS EVERYWHERE ARE becoming digital converts, inspired by the transformations that big data, advanced analytics, and machine learning can bring. The oil and gas sector is no exception. Over the past two years, spurred by resurgent oil prices, digital pilots have flourished across the value chain, promising an exciting future. But while all this activity is encouraging, many companies struggle to make a tangible impact at scale.

This is certainly not because there is insufficient value at stake. For oil and gas companies that successfully introduce digital across their businesses rather than in single-use cases, there are considerable benefits. (See Exhibit 1.)
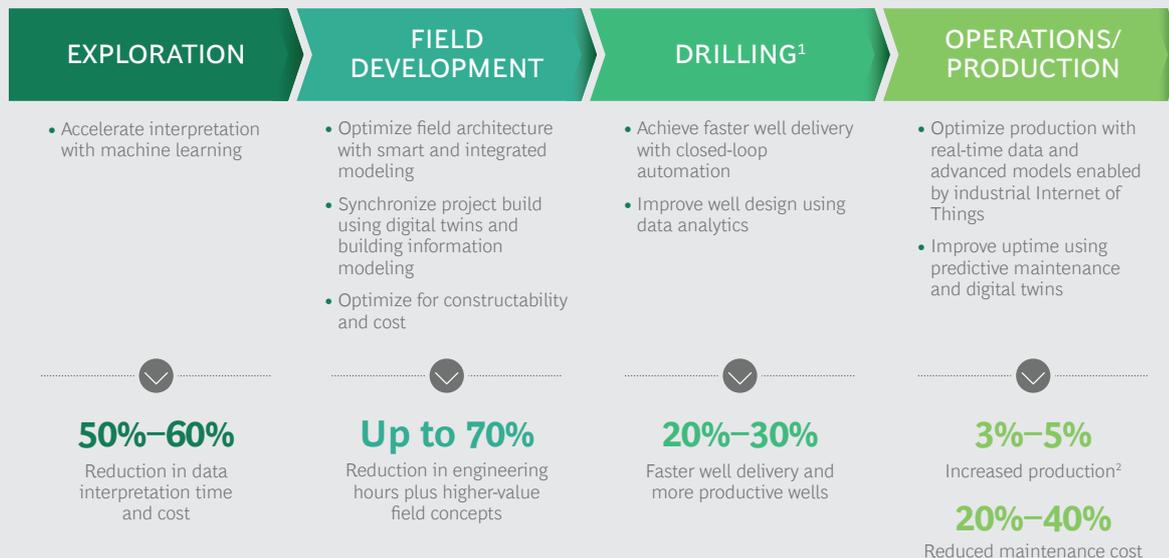
From our work with leading companies, we've found that organizations that overcome obstacles to digitization follow seven imperatives. In doing so, they are able to resolve industry-specific challenges, tap the full potential of data-driven technologies, and gain a significant competitive advantage.

Digitization Poses Unique Challenges for the Industry

The oil and gas industry is not an easy place to go digital. Companies are project-focused and safety conscious, and they value execution excellence and predictability. Executives struggle to integrate agile management techniques, such as the "right to fail," within their company's culture. And because the industry has used automation and data processing for decades, many believe they are already up to speed with digital technologies and almost consider themselves digital natives. Consequently, the sector has been slower than others, such as consumer goods and finance, to innovate with transformative data-driven solutions.

The industry's structure also creates challenges. Oil companies rely on oilfield services companies and engineering, procurement, and construction firms to carry out key activities. This creates mutual interdependencies and makes it difficult to forge a consensus for change. In addition, decentralization and mergers and acquisitions

Exhibit 1 | Digital Can Unlock Significant Value in Upstream Activities

EXPLORATION	FIELD DEVELOPMENT	DRILLING[1]	OPERATIONS/ PRODUCTION
• Accelerate interpretation with machine learning	• Optimize field architecture with smart and integrated modeling • Synchronize project build using digital twins and building information modeling • Optimize for constructability and cost	• Achieve faster well delivery with closed-loop automation • Improve well design using data analytics	• Optimize production with real-time data and advanced models enabled by industrial Internet of Things • Improve uptime using predictive maintenance and digital twins
50%–60% Reduction in data interpretation time and cost	**Up to 70%** Reduction in engineering hours plus higher-value field concepts	**20%–30%** Faster well delivery and more productive wells	**3%–5%** Increased production[2] **20%–40%** Reduced maintenance cost

Source: BCG project experience and analysis.
[1]Drilling covers exploration and appraisal and development/infill drilling.
[2]Assuming marginal value of $50 per additional barrel.

between operators have resulted in siloed localized management structures and diverse legacy systems, making the transition to digital solutions more challenging.

But companies can achieve success if they treat digitization like any other fundamental business transformation. By adopting all seven imperatives outlined below, they can surmount the challenges and capture the full value potential of digital technologies. (See Exhibit 2.)

1. Create a Bold Digital Vision Led from the Top

For the company's ambition to permeate throughout the organization and inspire staff, the leadership team will need to articulate and own its digital vision of the future. Explaining how technologies are embedded in day-to-day operations isn't going to cut it. An effective vision must describe how digital solutions will enable the company to meet its high-level strategic objectives (such as reduced accident rates, faster time to first oil, or increased profitability). It will require significant involvement from executives across the business to ensure that the vision is achievable. But the vision should also be bold enough to establish a

"true north" and guide subsequent investment decisions.

Red flag: Without adequate sponsorship from senior leaders, digitization risks being just another initiative on a long list of R&D projects.

2. Build a Balanced Digital Roadmap Owned by the Business

Once the digital vision has been established, companies will need to develop a roadmap of distinct use cases, or pilots, to guide them. Using a roadmap brings greater focus to any digital transformation. We find that many businesses execute far too many initiatives at once. This dilutes management attention and the efforts of the organization, undermining its ability to create impact.

Use cases will need to tackle real business issues that confront staff in their daily activities. They must be initiatives that have been identified by the business as delivering value. When considering potential use cases, start by defining the value opportunity—such as increased revenue or operational efficiency—and the decisions that affect it. Then consider what data-driven

Exhibit 2 | Seven Imperatives to Succeed with Digital at Scale

1 **Create a bold digital vision led from the top**
Explain how digital solutions will help you meet your strategic goals, but also ensure executive ownership

2 **Build a balanced digital roadmap owned by the business**
Prioritize and sequence use cases, balancing big-value initiatives with quick wins

3 **Take a holistic, pragmatic approach to data and IT**
Resist the urge to build the perfect data platform before you utilize your data

4 **Adjust your business processes to capture digital value**
You'll need to spend 70% of your effort on change management to succeed

5 **Digital requires a different culture and ways of working**
Foster an agile culture, quick decision making, and a "fail fast" mentality

6 **Develop digital capabilities and an ecosystem for the future**
Build a critical mass of in-house digital capabilities and avoid overreliance on third parties

7 **Maintain a relentless focus on value creation and strong governance**
Kill use cases that fail and strengthen those that succeed

Source: BCG.

insights could improve those decisions and how digital tools might provide them.

The roadmap will have to balance quick wins that require less effort and deliver benefits quickly with more ambitious, big-value use cases. Clearly, it is important to identify meaningful use cases, but companies also need to get started: managers shouldn't overthink initiatives and end up with analysis paralysis. The roadmap ought to include some flagship initiatives that can be implemented early and generate momentum. These projects should meet three criteria: delivering significant potential value, having a high chance of success, and being easy to communicate internally and externally. They should be the top priority on your roadmap.

The implementation plans of one large international oil company were stalling because of too many small initiatives spread across different business lines and functions without proper coordination. To fix the problem, the company developed a roadmap owned by individual business areas and turned the functions into a resource to support use case execution. A member of the senior management team was tasked with prioritizing key use cases based on digital themes, getting buy-in from business areas on common development principles, and deciding which asset would be the site for large-scale deployment. The result was a portfolio of fewer, more impactful use cases that were better

aligned with the business strategy, used resources more efficiently, and maximized value creation.

Red flag: Chasing too many use cases (pilots) simultaneously jeopardizes companies' ability to create real digital value.

3. Take a Holistic but Pragmatic Approach to Data Governance and IT Architecture

Capturing data effectively is essential if companies are to leverage new digital technologies. For the oil and gas sector, this poses particular problems. First, the volume and diversity of the data are typically huge, thus requiring a lot of cleaning, enhancement, and contextualization before it can be exploited. Second, the vast number of legacy systems makes integration more complicated. Third, data governance is often inadequate or nonexistent, resulting in poor data quality.

The key to overcoming these pitfalls is to build a bespoke data architecture and develop data governance through your use cases. Clearly, you will need to make some strategic choices early on about your data platform, including whether to make or buy the main technological building blocks. However, you should resist the urge to build the perfect data lake before you start utilizing data in use cases. Aiming for perfection will significantly delay time to value and increase the likelihood of poor

technology decisions, since the implications of the decisions you make can be fully understood only when you tackle concrete challenges thrown up by real use cases. What's more, making your data architecture flexible and able to be broken down easily into separate components will give you greater freedom and speed with use case development. At the same time, plan to rationalize and simplify it in the future.

While you will need to define your data families, data policies, and data organization principles upfront, start by keeping your data organization small and leverage each use case so that you implement your data management principles with each one. This will enable you to progress more quickly and establish sound data foundations that can then be replicated.

Close collaboration between the IT department, digital developers, and the business is essential for an effective data platform. Traditional models, where IT works in isolation to meet requirements defined by the business, have several shortcomings, especially early on. Lead times become too long. In addition, inadequate understanding of the data and its potential uses means it can be difficult for IT professionals to make the right technology choices. Instead, traditional IT capabilities must be combined with new digital capabilities and the on-the-ground expertise of the business to determine the way forward. This can be achieved by creating multidisciplinary use case development teams.

The approach taken by a leading offshore oil exploration company is a good example of effective cooperation between IT experts and the business. The company partnered with an industrial data platform provider and together they created a list of concrete use cases to help define its technology requirements. They developed a digital value chain that mapped a virtual digital world onto the physical world. The goal was to identify digital models that could help the company tackle inefficiencies in its physical operations. In parallel, the company was able to identify underlying technologies capable of capturing value

along the value chain rather than in just one area of the business.

Red flag: The IT department makes endless efforts to clean up and integrate data from the business; as a result, the moment when the business can really start leveraging the data to create value keeps being postponed.

4. Adjust Your Business Processes to Capture Digital Value

Digitization brings new and powerful insights that can radically improve decision making. To fully capture the value of those insights, companies will need to redesign their core processes. As a rule of thumb, we find that in successful digital transformations, companies devote 10% of their efforts to developing algorithms, 20% to building a data platform, and 70% to change management.

This process redesign should be an integral part of use case development. End users—including geoscientists, project developers, well designers, subsea engineers, drillers, and field operators—must be involved from the outset. That way, they can ensure that the planned digital solutions are user friendly and deliver new insights, while also helping to define how the new tools can be used to radically improve their work practices and deliver more value with less effort. Development teams should plan for changes to decision rights, decision-making forums, and job responsibilities. The key actors in these new processes must be identified early. Proper training can then ensure that the organization is ready to capture the value of the new digital tools from day one.

Although many companies undervalue the importance of change management, some get the emphasis right and have seen significant value creation. For example, BCG recently worked with a leading international oil company to develop a digital solution to improve the monitoring, visualization, and management of external contractors on a site with over 1,000 contractors on

any given day. After defining the value creation strategy for the new tool, the team mapped the underlying processes that would need changing. It recognized that some activities and behaviors of both the company's employees and the external contractors would have to be adjusted. Consequently, it developed and executed a stakeholder management and training plan, ensuring that training took place in parallel with the development of the digital tool. A full-time employee was brought in to manage implementation of the tool, which was successfully rolled out to all contractor managers and contracting firms, demonstrating clear value within six months of initiation.

Red flag: The digital app or tool is not used and, consequently, the status quo remains unchanged.

5. Digital Requires a Different Culture and Way of Working

A thriving digital culture encourages information sharing and collaboration with customers and partners, delegated decision making, and boldness and action over cautious planning. To oil executives, many of these may seem like anathema. But by introducing attributes of digital culture, companies can reap significant benefits. A recent BCG study of 40 digital transformations found that the proportion of companies reporting breakthrough or strong financial performance was five times greater (90%) among those that focused on culture than among those that neglected it (17%). (See "It's Not a Digital Transformation Without a Digital Culture," BCG article, April 2018.)

For oil and gas players, traditional values will still be important in order to ensure proper risk management and good operational safety. But at the same time, they need to create areas where they can foster effective behaviors such as speed, agility, and a digital mindset.

The best way to change the business's culture is to introduce new working methods alongside digital pilots. These should in-

clude faster decision making, agile methods, and a "fail fast" mentality; autonomous teams combining digital and traditional expertise; product iterations in collaboration with the end customer; use of light-touch communication and management tools; and new roles and responsibilities, such as business unit managers who are digital-product owners. (See "Taking Agile Way Beyond Software," BCG article, July 2017.) As with any culture shift, new behaviors should be incentivized and supported by up-to-date KPIs, a management team committed to different ways of working, and company-wide training and communication programs to help embed the new culture.

A leading drilling contractor chose agile principles when developing a new human-machine rig interface. It assembled a multidisciplinary team combining in-house designers and engineers with experts from an external IT vendor. The team, which had full decision rights, visited several rigs to understand end user needs. A product prototype was tested repeatedly in the field over eight months, with improvements made each time. The approach resulted in a 40% improvement in user acceptance, higher operating margins, lower training costs, and fewer incidents of operator error.

Red flag: Digital initiatives are poorly executed and revert to a traditional "waterfall" development approach, losing the benefits of a fast feedback loop.

6. Develop Digital Capabilities and an Ecosystem for the Future

To achieve digital transformation, companies require new capabilities. Leaders and employees will be needed who understand the value of digital and can adapt to new ways of working. The IT function will rely more on software development and data management capabilities and less on traditional service, maintenance, and support. Companies must acquire capabilities in data science, advanced analytics, and artificial intelligence so that use cases can be developed. Graduates with these skills are in high demand, however.

The oil and gas industry is facing a double challenge. It has an aging workforce, and because the industry is considered environmentally unfriendly and conservative, companies are in danger of losing fresh digital talent to other sectors. Despite this, many companies don't acknowledge the difficulty of the task and struggle to build digital capabilities.

By creating a capability strategy, companies can identify where gaps lie in their flagship initiatives and plan recruitment and training accordingly. A key decision is the extent to which the company should develop digital capabilities in-house rather than relying on an ecosystem of suppliers and partners. For each digital capability and use case, control and agility will need to be weighed against the availability, speed, and scale benefits of acquiring capabilities externally. For example, a company may outsource predictive-maintenance analytics for specific equipment to a supplier but keep the system optimization capability in-house in order to retain overall control and leverage its end-to-end process understanding.

Red flags: Digital teams are made up of members who only have experience in the oil and gas industry. Companies assume that by recruiting staff externally they can create a digital culture, so they ignore in-house training. They miss out on digital talent by failing to segment recruitment methods. They overrely on suppliers for all aspects of their digital strategy, or they depend on off-the-shelf digital solutions that don't meet specific operational needs.

7. Maintain a Relentless Focus on Value Creation and Strong Governance

Even after digital pilots are up and running, a relentless approach is necessary to weed out initiatives that aren't demonstrating added value. Companies will need to introduce KPIs in order to measure the contribution of use cases to business performance, and they will need to communicate those benefits in order to build momentum. However, they may have to act pragmatically, as it can be difficult to distinguish the effect of digital solutions from those of other initiatives designed to improve performance. Overly cumbersome governance procedures that hamper an agile "fail fast" mindset should be avoided.

Strong and effective oversight of the digital roadmap is essential to a balanced portfolio of use cases. Good, active governance by senior management will ensure that the roadmap deploys scarce resources efficiently, prioritizes value over volume, delivers bespoke projects as well as initiatives that can be replicated elsewhere, and remodels the role of the IT function for a more digitally driven organization.

Red flags: Weak projects never get killed, preventing resources from being redirected to new use cases. Digitization fails to create significant value for the business and gradually loses momentum.

STARTING ON YOUR digital journey can be daunting. You are confronted, on the one hand, by the excitement of new, digitally enabled opportunities and, on the other, by the challenge of cultural inertia, the potential for misunderstanding between the IT function and the business, and uncertainty about whether your digital pilots will deliver. But, as the saying goes, keep calm and carry on. By following these seven imperatives, you will smooth your way to significant business impact. Remember that business transformations are fundamentally about people. By staffing digital projects with rising talent, you can let future leaders shine and increase your prospects of success.

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