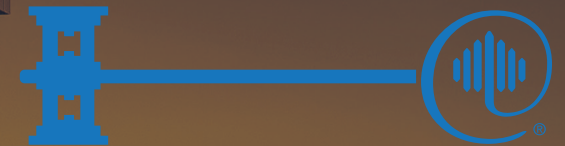




Five Keys to Agility and Resilience through Digitalization for Upstream Oil and Gas

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Executive Summary

Since mid-February 2020, the upstream oil and gas industry has been buffeted on a variety of fronts: historically low prices, plunging demand, challenges in ensuring safe working conditions at remote sites, continued pressures to decarbonize and a weakening of the oil and gas supply chain (with many upstream contractors forced to put experts out of work).

With crude oil prices hovering below \$20/barrel in February and March, and then recovering somewhat to between \$35-\$40/barrel in late May, many of the world's oil reserves are uneconomic at prices that low. The industry is counting on the delicate relationship between OPEC-plus and the supermajors to move oil prices to more sustainable levels (over \$40/barrel) for the remainder of 2020.

Changing this calculus, however, will not be easy. Innovation must happen rapidly and globally to make crude production sustainable at lower prices. With a persistent pandemic making the working conditions difficult for oil field crews on platforms, FPSOs and in other areas, the need to operate fields digitally and remotely is suddenly urgent. The good news is that setting up operations remotely, such as at onshore operations centers, aligns with the urgent need to lower costs.

Changes that were happening slowly now must accelerate rapidly. With capital funding sources – most notably the Blackstone Group, JPMorgan Chase and others – tying access to future capital to real sustainability progress, the ability to demonstrate decarbonization progress suddenly becomes existential. The Oil and

Gas Climate Initiative (OGCI), driven by the world's 12 largest energy players, recently stated a renewed and accelerated commitment to decarbonization in an open letter. They can afford the investment. But how will the remaining industry players keep up? Only by rapid commitment to organizational innovation and change.

What will these changes look like? Upstream players have had digitalization initiatives underway over the past year. Barclays Investment Bank called for more aggressive digitalization in oil and gas more than two years ago, contrasting the sector with other industry sectors. Most in the industry now realize two things:

- The pace of digital adoption has been too slow
- Companies were unprepared for the onset of the volatility partly triggered by COVID-19

Accelerated digitalization programs, particularly those that include digital twin technology, can provide agility, resilience and other benefits. Digitalization has been gaining momentum with several exploration and production players over the past three years, providing a signpost in a number of key areas where it has shown value.

This paper focuses on digital actions companies can take now to create short-term value and build resilience and agility to better handle future uncertainty and volatility in the global oil and gas market, with respect to pricing, demand for hydrocarbons and energy transition. It then addresses longer term, broader digital strategies for oil and gas operations, laying the foundation to help businesses gain competitive advantage.

The Business Challenge: An Uncertain, Volatile Path to Economic Recovery

Many economic forecasters, such as IHS CERA, believe oil and gas demand will not fully recover for a minimum of one to three years. Some industry observers feel that oil demand will never recover to pre-pandemic levels. The IEA's (International Energy Agency) Dr. Faith Birol, however, sees oil and gas prices and demand recovering to new levels within the next year.

Why the need for accelerated digital adoption?

Many industry watchers predict permanent changes in the roles of the oil and gas workforce as on-the-ground teams become increasingly virtual or remote.

Organizations are seriously considering how more work can be done remotely and with fewer crews in dangerous settings, in and around assets. Autonomous drilling and production are happening now as select companies are pushing their digitalization strategy. But what does that mean in the short and medium term to an upstream producer who may not be that far along with their own digitalization?

Companies are seeking an interim strategy to produce oil or gas with positive cash flow. Large oil- and gas-producing fields are being temporarily shut in, to contend with both employee safety and potential negative cash flows from operations. Technology can be a lifeline to manage fields and improve production with existing infrastructure, and in a much more remote and centralized manner. Technology can also help the upstream industry navigate structural capital and

operating expense reductions, adding resilience and agility to the development of assets.

In the current climate, upstream oil and gas companies need to move rapidly to 1) adapt to current economic conditions and 2) build resiliency and agility (which digitalization will play a strategic role in addressing). Short-term solutions can help answer a wide range of questions for businesses, including:

- What are the most advantageous CAPEX cuts that will both protect your financial position and keep the business agile and ready to take advantage of opportunities during the recovery? Or, to put it another way, what CAPEX cuts should be preserved — and how do you make these choices in a data-driven way?
- How quickly can you create digital twins to enable more remote work, promote agile decision-making, create immediate value and facilitate collaboration?
- What are the most effective strategies for decarbonization, and energy and water conservation?
- Where can you apply AI technology to create maximum short-term value across operations — and ultimately reduce production and maintenance costs, extend well lifetime and increase low assurance and uptime?
- Do you have enough of the right, relevant operating data to support meaningful digitalization and how do you know?
- How do you drive organizational change to create value from digitalization while sticking to your core competence areas?

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Driving Innovation and Digitalization Now

Has your organization embraced digitalization in a tactical way? One of the strongest aspects of today's digitalization technologies is the speed with which solutions can be implemented surgically to create meaningful, short-term business impact.

One of the areas where digitalization can have significant impact is production optimization. Another area is in remote operations, taking oilfield personnel out of logistically expensive places and enabling companies to manage operations "downtown" (e.g., Houston, Anchorage, Paris, Al Khobar, Kuala Lumpur and other places).



These are not “normal” times. Thinking outside-the-box and employing new technology can help keep upstream operations viable during volatile periods. You might have your own ideas. There are many ways in which digital technology can not only evolve businesses strategically, but also help them concretely and tactically in the near term.

First, a few driving principles:

- **Digitalization involves business realignment and organizational flattening,** not just technical solutions. Give your digitalization team high executive visibility and access for agile innovation and change. Make that shift quickly.
- **Pair your technology visionaries with domain experts.** An upstream company doesn't need to build separate teams of data scientists. Instead, it should be a much smaller, precise group of strategic catalysts paired with experienced reservoir and production engineers. Solutions themselves are being rapidly innovated by technology companies; building your own is rarely going to be a winning strategy in this race to change the face of an upstream company. AI will be a game changer in production optimization, but the competitive advantage will be in the intelligent adoption and application of solutions, not in the creation of bespoke ones.
- **Isolate digital twin opportunities into tactical, bite-sized, value-driven components.** Understand the range of possibilities — there are 13 fundamental categories of digital twins, each of which has upstream use cases that create value quickly (e.g., cost reduction, production increase, sustainability,

cash flow). They can merge together later and be orchestrated, but first they need to be simple to get online sooner for teams to adopt and create value.

- **Consider your OPEX and CAPEX decision-making a strategic driver supercharged by technology.** The financial considerations will be integrally tied into the impacts on a complex, interconnected value chain for producing hydrocarbons. Decisions and timing should be data and risk driven.

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Five Keys to Using Digital Now to Improve Your Upstream Competitiveness

Here are a few short-term ideas to get you thinking about digital solutions that can help upstream companies through the current oil price crisis — with immediate revenue and cash-flow impact. These actions can help position your company for more digitalization benefits down the road.



1 Optimize Performance, Reduce Costs.

Fast-to-implement, compact, online digital twin models have a two-fold impact:

- Increase productivity by pushing more yield through existing assets with zero capital investment
- Enable remote monitoring and decision-making to augment lean in-field staffs running operations

Oil and gas assets are operated traditionally by crews living and working near one another. In the new normal, the staffing of hydrocarbon assets and drilling sites must be redesigned. This calls for accelerated digitalization to support operations in a more distributed environment, with both operators and technical support staff located in disparate locations.

For example, a North Slope digital twin model was built and tested in less than three weeks enabling just one technician or a small team to perform essential work remotely. This model changed operating decisions on compressor and fin-fan air cooler trains, increasing

lift gas and creating \$1 million incremental cash flow in just one week of operation, along with longer-term production increases of 2-5%. This case utilized a small-scale, online engineering model, running every five minutes and pulling critical oilfield equipment monitoring data. The main direct benefit is better gas production and yields. While this case was for lift gas, it could have been for sale gas.

An important second benefit is the ability to monitor these expensive and critical compressor trains constantly, instead of weekly, with lower risk from the central office or the operator's home.

In another gas processing example, fast-to-build offline digital twin models for heat exchanger monitoring can rapidly enable engineers to:

- Change operating instructions to increase yields of gas and oil processing
- Reduce energy costs

In several Middle East fields, online and offline digital twins have increased flow and yields 10-15% and reduced energy consumption 5-10% within a few months.



2 Monitor Equipment Health Remotely.

Low-touch, out-of-the-box prescriptive maintenance technology applies and packages machine learning into a worker-friendly solution to monitor the health of oilfield equipment remotely, delivering immediate impact on production optimization decisions. As a



result, operators are maximizing production, identifying future equipment failure without field inspections and improving overall uptime. Maintenance teams are more surgically used where and when needed. This can be proven for an asset in a few weeks and implemented on equipment such as large pumps, compressors and ESPs in a producing field (depending on data streams) in a few months.

A major FPSO operator in Asia is implementing this solution for two geographically distributed FPSOs, with the asset health monitoring happening at the central office onshore. The main focus was on water handling, both injection and produced water treatment, and the typically high-maintenance items, such as sea water and injection pumps as well as water filters. Benefits included reduced maintenance costs, reduced need for staff on the FPSO and increased production uptime.

3



Produce Closer to the Reservoir Engineering Plan.

Advanced process control (APC), a technology that has provided huge benefits in the downstream energy segment, has in some cases even more value in upstream. The opportunity is to orchestrate and control the well, separation and gathering system operations autonomously. This is more suited to assets such as offshore well chokes in which other controls are automated and instrumented. The benefit, though, is high. Several super majors are well down the road in realizing the value of APC and the ability to implement it quickly (and remotely).

Economic benefits can reach hundreds of millions of dollars per year, per asset, with the secondary benefit being taking people out of the field. Specific benefits realized over dozens of implementations include reducing slug formation, keeping wells and compressors online, improving operability of ESPs, ensuring rapid startup after power failures, and lowering energy and water use in injection and EOR applications.

4



Improve Collaboration Among Remote Workers.

With the need to minimize workers in plant settings, remote access is crucial. Visualization and workflow tools provide remote workers the ability to react to changes and collaboratively manage asset production. An Italian energy company is continuing urgent engineering work remotely with a front-end engineering collaboration tool that works as effectively from the home or office.

Data aggregation, visualization and dashboarding technology can be rapidly configured and implemented to enable asset managers and key technicians to monitor widely separated assets from most anywhere.

These digital innovations also allow companies to use a distributed group of experts and technicians to monitor and make decisions to improve safety, performance and productivity.

Digitalization keeps assets productive while greatly reducing the need for staff to be in the field, as evident in both FPSO and oilfield applications.

5



Rebalance CAPEX and OPEX Spending.

In the current business climate, it's vital that you balance capital costs to match the environment. You have put over 20%, or in some cases as much as 60%, of your capital spending budget on hold. Now you need to assess for the next 24 months which projects you should defer, and which are most strategic for your recovery and growth — and to be an advantaged producer as prices and demand recover. Advanced economic modeling and risk tools can rationalize your CAPEX portfolio into a series of scenarios, ranking them by impact on revenue and sustainability, as well as by financial risk and externalities.

You can examine optionality of locations, timing and contracting and their impact on agility, workforce, cost and enterprise value. This can be used on a global basis or by individual assets. Using these tools, you should be able to make similar choices on a rational basis within 30 days.

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A Progressive Recovery

Agility and flexibility will be key in the upstream oil and gas sector, as unpredictable prices, as well as changing patterns of demand, remain front and center. Digitalization is not only a tactical tool, but more importantly, a strategic lever for making upstream producers more agile and flexible. Specific areas of digitalization create significant value quickly and enable companies to be extremely effective, whether using the technology on-site or via remote workers.

From our position as a trusted partner to the upstream industry, we have been working with companies globally to support teams who need critical remote access to AspenTech software to perform their daily mission-critical work. Many companies are evaluating how much of this current work scenario will remain permanent. AspenTech customer and training websites, as well as customer support systems, are available 24/7 to rapidly respond to companies and their teams (or large portions of their teams) who are operating remotely or from home. In addition, we are committed to helping global customers accelerate their digitalization strategies in the highest impact areas.

Learn more at: <https://www.aspentech.com/en/solutions/covid-19-response>

About Aspen Technology

Aspen Technology (AspenTech) is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets safer, greener, longer and faster.

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