Digital Transformation: Building Resilience in the Oil & Gas Sector

Going the digital transformation route is critical for Oil and Gas operators to help reduce costs, make faster and better decisions and increase employee efficiency and productivity.





ideate | interface | implement

Digital is the Critical Enabler

The oil and gas industry is considered to be one of the biggest industry in the world in terms of dollar value. Its role is crucial to the global economic framework for both oil producing nations, as well as for consumers like the US, Japan, India and China. Be it their contribution to the GDP or the influence they have on the daily life of an individual, or strategic policies of nations, the oil and gas industry has always been the arena where the action happens. Companies across the spectrum, right from billion dollar oil exploration companies to small scale refineries, each of them has a crucial role to play in the global oil and gas scenario.

The industry under question is known for being capital-intensive, with heavy investments in expensive assets and moderate operating margins. This makes it tough for companies to easily adopt a new technology, without sufficient testimonies. High switching costs make firms go for a proven approach rather than an expensive trial and error method. This in turn demands oil companies to move beyond data-driven decision making, and modernize and digitize physical assets and processes, to become a true leader in a post-COVID, low oil price regime.

The upstream companies, due to their complex ecosystem and legacy asset base, face severe challenges such as difficulty in minimising efforts on bad sedimentary basins. Midstream companies primarily rely on their infrastructure planning capabilities to combat and offset their ageing assets. The challenge is to make their pipelines and valves "**smart**". Among downstream operators, even leading refiners have inefficiency issues lined up, right from scheduling accuracy to field force effectiveness. Sharpening their digital capabilities with a focus on analyticsdriven processes is undoubtedly the way forward. The \$3.3 trillion oil and gas industry is facing seismic shifts with the current pace of technological disruptions. Digital transformation is the biggest disruption of them all, and it simply bridges the gap between the real and ideal, best-case scenario. Fast-paced technological advancements, accompanied by lower cost of digitalization and the ever-widening connectivity of devices, are proving to be an opportunity to beat competitors.

The devastating Covid-19 pandemic has demonstrated - to be a top player in any industry, innovation and adaptability is key.

The increasing importance of a strong and resilient oil and gas sector for a fulfilling economy has made governments appreciate innovation today like never before. In fact, with the pandemic plummeting demand for oil and gas globally, operators in the sector have understood that in order to stay afloat and face these challenges successfully, it is crucial to embrace and implement innovations and modern technologies. During this pandemic, companies have rushed to acquire and invest moderately in newer technologies to keep going. When it comes to Indian companies, the pressure is far more severe as these innovations are new and have only been discussed in board rooms as ideas, especially in the upstream industry. This, however, should not be seen as a challenge, but a great opportunity to leverage modern innovation and technology to beat the competition and stay on top.

Deep industry expertise may suffice for operational success but that alone cannot drive business growth postpandemic. The industry today is complex and competitive enough for that. Digital transformation is pivotal in unlocking new business value. Firms can benefit from cross-industry experiences, technological skills indirect to their businesses, as well as supply chain expertise from businesses worldwide. Indian firms should thus emphasize on accelerating their businesses and profits, by replacing their overreliance on human efforts, with technology.

Uncertainty and Volatility

With the backdrop of the COVID-19 pandemic, there is no doubt that low oil prices and high volatility are threatening oil and gas operators across the world. This has resulted in an increasing need for maximising efficiency at every stage of the value chain, right from oil exploration to marketing and distribution.

Exploration requires massive computing power and strong data processing systems for successful modelling. This requirement becomes all the more important when oil is found mostly in deep wells, compared to the shallow and easily accessible wells of the past. Field development is also facing challenges - with the collaboration of procurement and construction companies, contractors and engineering firms. Drilling is also one tightly fought arena with rapidly changing low cost models, high efficiency logistics and supply chain and high quality wells with safe operations.

Of the \$1 trillion benefit that digital transformation is expected to bring to the oil and gas industry, 58% (~\$600 billion) is expected to accrue to the upstream companies.

The midstream segment has always been the hotspot of investments for the simple reason that with upstream companies evolving and moving into exploration of new wells in harsh offshore environments, there is increased need for transport operations. The sectoral problem of aging infrastructure is not similar to the others, especially because these assets are geographically dispersed. Moreover, outdated technologies and obsolete systems make these assets costly to operators because of their increased vulnerability to theft and severe impact on health, safety and environment. Pipeline theft is a problem that not only causes loss of revenue but also increased chances of explosion, increased environmental damage due to spilling and reduced reliability and credibility about the firm. Hence, midstream firms always aim to transport energy in a safe and reliable manner and at the bare minimum cost.

Digitalization may be the saving grace for oil and gas operators to succeed in a roller-coaster, low-price regime.

The key challenge for refineries is to achieve asset integrity through transparency. Ownership of data and modalities of sharing data with multiple stakeholders have always been a challenge for these power-consuming refineries. Thus, asset reliability and production excellence are two key factors that refineries are obsessed with. Oil marketing companies, on the other hand, are trying very hard to increase their supply chain visibility through demand analysis, better inventory and capacity planning, and logistics optimization. They are also on a lookout for data driven solutions to their range of business operational problems from pricing to advertising.

Since the 4th century AD, when the first oil well was drilled in China, the global oil and gas industry has seen a lot of ups and downs. And while the majority of the global energy demand is still being met by coal, oil and gas, in the past few years, the value of oil and gas companies have halved. Today, with the backdrop of the global pandemic, dwindling oil reserves, increasing costs, geopolitical situation and volatility, ageing workforce, strict environment and health restrictions and preference for renewable energy, the oil and gas industry is under immense pressure to innovate and incorporate disruptive technologies to just keep going.

This white paper discusses how digital transformation can bring about a strategic and disruptive shift in how the oil and gas companies operate and drive significant growth in the sector.

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Digital to the Rescue >



Industrial Internet of Things (IIoT)

Global energy spends and potential economic impact of IoT solutions is expected to be somewhere between \$3.9 trillion to \$11.1 trillion by the year 2025, and only expected to grow at a tremendous pace from there. This begs the question - why are oil and gas companies so optimistic and aspirational about the impact of IoT on their businesses? Survey findings conclude Capex (Capital expenditure) savings to be the prime motivator for initiating IIoT projects. But it is crucial to note that in order to achieve the high standards of operational excellence and intelligence for businesses to harness the benefits of IIoT, three bases have to be covered:

- Real-time data collection
- Reliable storage and management of data
- Availability and conversion of data into real-time business intelligence and decisions

Data Collection and Management

Data collection and monitoring is on the priority list of actions that need drastic evolution, to reduce existing inefficiencies. The key reasons for high cost of data gathering are efficiency and accuracy, both of which are extremely valuable for oil and gas companies, perhaps more than in any other industry. Therefore, even minor improvements in efficiencies can save a lot of resources. Indian oil and gas explorers have their eyes set on this as almost 3/4th of Indian sedimentary deposits are yet to be discovered.

With strict margins guiding the bottom line of the industry, profit is highly dependent on accurate seismic and production data. Oil and gas production operations can now be more efficiently monitored using embedded sensors. Enhanced communication capabilities using automation allows for information gathering across assets from anywhere in the world. This higher level of visibility can improve production efficiency by at least 6% to 8%, translating into millions of dollars saved.

Sensor Monitoring

Sensors facilitate the data for digital cloud dashboards, which in turn monitors real time performance of the rigs and equipments. There are sensors that monitor inventory levels of oil tanks and automatically dispatches the truck on need for emptying. This real time monitoring allows for continuous pumping and at the same time optimising inventory transportation and minimising downtime costs.

Seismic sensors connected by fibre optic cables can immensely change the current exploration methods. They map subsurface drilling sites to determine new drilling sites and thus economise the exploration operations. Millions of readings per site can be collected using these sensors, transferred to servers using the internet and get an accurate, real-time scenario of subsurface sites. This data can be compared to the existing database using modern data analysis techniques to improve the new and old drilling rig productivity. An important factor that is gained is the reduced time required for site selection.

Digital Twins

Digital Twin is a virtual model, bringing together the physical and virtual world, for data analysis and system monitoring, with an aim to improve operations, reduce downtime and lower costs. Digital twins provide users with interactive 3D simulations that site managers and engineers can use to monitor and control the oil rigs and plants from a remote location. The digital twin technology has caught on and become cost effective like never before, with the introduction of IIoT. This enables oil and gas operators, manufacturers and service providers to discover the root of complex problems and determine possible solutions to resolve it, without actually having to implement it physically. Thus, digital twins are the accelerators of change from predictive analytics to prescriptive analytics.

Digital twins are in no way a recent innovation, but due to the pandemic, companies are finding it increasingly beneficial where engineers cannot reach their rigs physically.

Life-cycle Management of Physical Assets

This begins with the optimal design of physical assets using historical data, which itself, brings down the unplanned downtime and failures to a great extent, compared to the past. Real time data gathering and updating made possible through IoT allows the creation of a real time digital copy. This digital twin created through data during design and operation can be used to simulate, visualise and consequentially optimise the input parameters and hence realize maximum output. As oil and gas companies require operational performance data for the assets that they use, OEMs are the parties who are experts in information, such as engineering analysis, performance data, and the performance of their assets. This makes two choices for the digital twin technology to be effective: the information could be shared between OEM and oil and gas firm or OEM could offer a service based model to monitor the performance of the digital twin.

Robots and Drones

Oil and gas operations are capital-intensive, often risky and hazardous due to the difficult terrain, weather and exposure to dangerous chemicals and gases. These risks can be reduced by replacing certain manual processes by robots, in turn increasing efficiency, ensuring safety and preventing any asset damage. One use case, that has particularly picked up of late, is using drones to inspect pipelines in even the most challenging and difficult terrains, which otherwise is a costly, tedious and dangerous process. Moreover, the data captured by these drones and robots can then be leveraged by AI and ML analytics to predict corrosion, leakage and any other mechanical damages or risks.

Cloud Storage and Computation

The very necessity of oil and gas companies to share resources, information, software and other equipment, make cloud-based storage the best-suited solution. The benefits incorporating cloud storage and computing are cost reduction, reduced capital expenditure, IT agility, 100% resource utilization and remote access to data. Leaders in the industry do not view this just as an opportunity for higher performance through stronger computing power, but also as the path to faster application deployment, low cost of service and an accelerator to digital transformation.

Research suggests, most oil companies have cost cutting only as a secondary objective. A higher priority for them is the speed of decision-making and thus, boosting asset and work productivity. This demands oil and gas companies to shift to a digital mix model, integrating AI, machine learning and robotics. Many early movers of cloud technology have already started reaping great benefits.

Barriers to Adoption: Public vs. Private Cloud

Cloud simply means a scalable environment, where hardware and software work in concert, to attain specific business tasks. The type of cloud infrastructure deployed is primarily determined by the enterprises' perceived risk and the companies' IT philosophies and policies. A public cloud is one where a third party manages the 'cloud' outside the company. This model can leverage economies of scale, with minimum investment in resources, where users can simply connect to the portal through a web browser. A private cloud is built and maintained internally by an organization. This model serves the purpose of confidentiality and limiting accessibility for users who do not have valid credentials.

Oil and gas companies look for environments with high performance, for large scale applications. This demands virtualization that can allow multiple operating systems to simultaneously run high end technical applications at a close-tooriginal performance standard. Most firms choose private or public cloud based on fundamental reasons like just in time provisioning, scaling, and elimination of lag time in application launches. Servers and storage visualisations are used as means to lower overall operating costs of infrastructure.

Software-as-a-Service (SaaS)

Field managers today take vital business decisions backed by on-field data. Collection of data from remote sources, product treatment and transmission and facility maintenance has demanded the industry to move from client server based applications to cloud based applications.

There has already been steady progress in using software as a service in rig tracking, data acquisition management, leak detection and fleet management.

Platform-as-a-Service (PaaS)

Platform as a Service is an advanced version of cloud based model with functional core software packages that could be used to provide infrastructure for developing new applications. The speed at which a development platform can be deployed is the primary attraction. Flexibility is another key reason for its high expected potential, since software updates and additional plug-ins are easily accommodated. Last but not the least, it can be opened to a much geographically wider audience of developers and analysts.

Mobile Technology

The convergence of mobile technologies with data and cloud is making a deep impact across industries. Mobility solutions can enable the integration of devices with daily operations and streamline work-flows for better communication and productivity. Real-time monitoring of personnel, assets and operations are made possible by the range of wearable devices, smartphones and tablets, improving efficiency, productivity and safety across the value chain.

Artificial to Actionable Intelligence

Oil and gas companies have a lot of data to work with and thus, a tremendous opportunity to realize the value of machine learning and Al in various areas of their operations. Use of Al in oil and gas can help reduce the time spent on manual inspection, extraction and documentation of objects on engineering drawings for bid analysis. Geoscientists can find the "sweet spot" more efficiently with an Al tool that takes existing information from nearby wells, applies machine learning and produces a 3D model with the production heat map.

Workers in the oil and gas industry are routinely exposed to hazardous situations at work sites, and AI tools can provide better understanding of how risk manifests at the field level and gains visibility into potential work related risks.

Just merely collecting vast amounts of data does not bring critical insights, unless it is combined with intelligent analytics. The most simplest system which firms can adopt is a dashboard that compiles the analytical information derived from real time events, alarms and trends from historical data. Process optimisation, asset management, automated and condition based monitoring and process performance are some key areas of development in the near future.

Significant opportunities exist for cost reductions and revenue generation around prioritizing the reactivation of wells, and realizing opportunities is limited by human ability to analyze and act on large amounts of data. Artificial intelligence can increase shut-in well analysis throughput with automation and can also increase the success rate due to machine learning.

In addition, there is constant pressure to reduce operational costs, but organizations have limited insight into the power usage and emissions. Artificial intelligence helps companies better understand power consumption and cost of operations, optimize asset operations, minimize consumption and reduce greenhouse gas emissions.

The Way Forward Driving Transformation

Unlocking the potential of digital transformation is a different ball game that has been unknown to most today. This requires firms to more than adapt, and in many ways, revolutionize their current operational style. The key to maximising potential is to build the industry ecosystem to adopt digitalization, both internally and externally. They should go beyond their boundaries to work with both governments, policy-makers, customers and equipment manufacturers to overcome the key challenges. The following recommendations are vital for firms to drive the digitalisation wave.

Digital transformation is more about people than technology. Companies need to urgently reskill their workforce to unlock full potential of the digitalization efforts undertaken.

Invest in Building a Digital-Friendly Workforce

Investing in talent development programmes is just enough. To make the value of digitalisation tangible, firms need to fill their talent gaps with the right digital workforce. This might include upskilling the current workforce or hire externally to build a particular expertise, whenever it is necessary

Be an Early Mover in Digital Implementation

The top management needs to have the clear vision to allocate resources early enough to drive the changes. The digital strategy should complement and reinforce the corporate strategy. This realization of value would be maximum when firms build competence over their competitors very early.

Managing a Transforming Organization

When remote sensors and drones drastically reduce the need for humans to monitor the equipment or process, the very nature of the workforce gets reshaped. This impacts the practice of work right from hiring, training till firing. This is why it becomes all the more important to include digital transformation as an organizational change rather than just a capability addition.

We know digital.

Social Friendly is a creatively-inspired, digital consulting firm helping clients unlock growth. With deep technology expertise and industry knowledge, we work with clients globally across industries: Government and Public Sector, Oil and Gas, Financial Services, Retail, Hospitality and Telecommunications.

We are focused on business technology that powers progress and helps organizations to create their firm of the future.



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