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Executive summary

The Oil & Gas industry has been at the forefront of technology innovation since the industrial revolution. Following the volatility in oil prices in 2014, companies have looked out for alternative solutions for enhancing efficiency throughout their exploration-to-production process. While some employed alternative extraction methods to cope with the production demand, the primary challenges of sustainable operations and rising costs remained a hindrance. Digitalisation can act as one of the significant enablers to tackle these problems by optimising performance of facilities, assets, and employees.

While many sectors can employ rapid prototyping of various digital solutions, capital-intensive businesses, such as Oil & Gas, typically need to consider each initiative with care to avoid costly failures and leverage digital tools to enable data-based decisions.

The Indian Oil & Gas sector faces several challenges, such as refining capacity versus demand, and availability of core competencies. This in turn raises an important question: What is the impact of these potential barriers and the best way to overcome them? A comprehensive roadmap with a detailed transformation plan could help Oil & Gas companies assess every operation and identify digital initiatives for tackling the barriers and achieving business goals.

This paper takes a perspective on the Indian Oil & Gas industry: the significance of technology-driven change and the value this change can bring to the business. We
have attempted to identify the key digital trends in this paper, which could have competitive advantage in the value chain for the Indian market. The digital trends we see having the most opportunity of growth in the Indian ecosystem are the following:

- Internet of Things (IoT)
- Big Data Analytics
- Seismic Imaging
- Artificial Intelligence (AI) & Machine Learning (ML)
- Digital Reality
- Mobile based solutions
- Unmanned Aerial Vehicle (UAV/Drones)

As some sub-sectors are ahead of others in adopting digitalisation, companies would benefit from a coherent framework that helps them achieve business goals and transform the core of their operations. For example, the digital operations transformation model helps the industry across the board in a structured top-down approach, which contextualises the opportunity of digital Transformation. The approach helps achieve a broader view of operations and faster decision making, resulting in risk minimisation, reduced OPEX, and improved throughput.

In essence, the transformation model should assist Oil & Gas companies in answering three strategic questions: ‘How digital are you today?’, ‘How digital should you be?’ and ‘How do you enable digitalisation in your enterprise today?’
Introduction

Industry context and digital trends

The Oil & Gas industry has been known to be at the forefront of technology innovation since the industrial revolution, driving mobility and power needs of the world. Technology advances, such as hydraulic fracturing, have consistently re-shaped every stage of the Oil & Gas sector, from ground exploration to your tank. However, for most part of this decade, the industry saw a downturn in leveraging the technology advancements in the market, partially due to depleting resources and the focus on reducing operation costs\(^2\).

With a view on the downturn the Oil & Gas industry is prone to, global players have realised digitalisation as a critical means to thrive in this volatile and cost-competitive sector\(^3\). Digital has become a key enabler in reducing costs and making faster, efficient decisions for improved productivity. For instance, Shell Global Solutions has accelerated its transformation journey by employing predictive maintenance through its AI-driven IoT platform\(^4\).

As the third-largest consumer of crude oil, India’s production levels have struggled to rise as fast as the demand as shown in Figure-1 below. India aims to reduce its dependency on oil imports from 82% to 67% by 2022, and so it launched several initiatives and investment plans for local exploration and development. The government intends to invest INR 70,000 crore for natural gas pipeline network expansion\(^5\).
With such initiatives, India’s Oil & Gas market provides an interesting opportunity to improve its efficiency through digitalisation. While solutions such as cloud, big data analytics, and automation have immense potential for Oil & Gas, it is a cohesive offering of these technologies that will help differentiate and provide a competitive advantage. An integrated solution comprising IoT sensors, connected assets, and remote solutions (mobile, AR/VR), aligned with big data analytics and machine learning, will magnify the effectiveness exponentially. This paper presents Deloitte’s understanding of the Indian Oil & Gas industry and the pivotal role digitalisation will play. Companies can benefit from following a comprehensive framework, such as Deloitte’s Digital Operations Transformation (DOT) model, which gives a view on the digital maturity of every operation and helps identify the digital opportunities in achieving business goals.

**Case for becoming digital**

While, globally, the industry has made significant investments in the digitisation of key operational areas through its Oil & Gas journey, the Indian market has been
lagging. This is due to a number of challenges that need to be overcome to realise its maximum potential for business benefit in India. Barriers relating to insufficient product knowledge experts, lack of understanding of digital initiatives, and high initial investment have been the top deterrents in achieving CIO objectives.

The advent of alternative fuel sources, such as hydrogen, and electric vehicles is projected to have a dramatic impact on the oil supply & demand. A latest report from Bloomberg New Energy shows that economics are driving change, with the cost of ownership of electric buses far outperforms the alternatives in the long run, a 110kWh battery e-bus coupled with the most expensive wireless charging reaches parity with a diesel bus on total cost of ownership at around 60,000 km travelled per year. This means that a bus with the smallest battery, even when coupled with the most expensive charging option, would be cheaper to run in a medium-sized city, where buses travel on average 170km/day. That is why the India government has set a target of becoming 100% electric in public transport by 2030.

As there are a number of challenges facing the Oil & Gas companies, it has become imperative to delve into digital transformation as a means of increasing profit margins. Focused point solutions can help find and extract more oil or gas, or deliver it faster, cheaply or safely.
Digital trends

The evidence of technology’s disruptive impact on the Oil & Gas industry is clear and growing\(^9\). Gartner reports that Oil & Gas executives consider Data Analytics and IoT to be the biggest game-changing technologies in 2019\(^10\). With a plethora of technologies to choose from, it becomes essential to identify the ones that would have the greatest impact on the value chain. The following section talks about the digital trends that have the highest value creation potential with respect to the Indian Oil & Gas sector through its upstream, midstream, and downstream journey (Figure).

![Digital Trends Diagram]

**Internet of Things (IoT)**

In this era of automation, digital is woven into everything. ‘Connected intelligence’ is gaining pace and has highly enhanced the ability to collect, process, and analyze data. IoT, by connecting sensing, communications and analytics can form a new information source, in turn creating value. With the help of sensors, firms are able to track their global assets sitting in the comfort of their control rooms. Data received from connected devices provide real-time insights, which can help them in maintenance planning and operations optimisation.

An analysis of public sources indicates that multiple firms in the oil sector are investing in IoT. Shell Global Solutions has been utilising IoT to boost productivity\(^11\).
It has developed a cloud-based learning solution with closed-circuit camera footage and IoT, which can identify safety hazards and alert employees ensuring safety as well as timely mitigation of the risk.

ONGC, one of the dominant players in the upstream sector contributing 61% of the total crude oil production, is planning to tap into big data analysis to raise the output and increase efficiency. Big data, along with sensors would help analyze data in ways that have not been possible in the past. Insights, backed up by facts and numbers, would help in a better understanding of the assets and operations, thus reducing unplanned downtime and optimising production.

Sensors, incorporated in assets, are driving a shift away from the traditional time-based maintenance to condition-based maintenance. IoT can predict problems, analyse situations and with using the information generated, can help in better decision making.
Integrating IT and OT can benefit all sectors by focussing on optimising operations, reducing risks and creating value. The simultaneous relay of information across the organisation about the real-time condition of the assets builds an information value loop and aids in proactive maintenance.

HPCL has implemented IoT in its retail outlet automation systems, tank farm automation systems, terminal automation systems, vehicle tracking systems, surveillance and access control systems and even the SCADA systems used in operating facilities such as cross country pipelines and refineries. Sensors installed in the field units can capture state information such as pressure, temperature, flow rates, density, product-levels, and GPS coordinates, which provides visibility about the status of the systems and monitor performance proactively. The surveillance of trucks is done through vehicle-tracking devices to ensure products are delivered according to logistics plan.\textsuperscript{14}
Embracing and investing in new technologies have become crucial to stay ahead in the digital race. It can provide answers to most of the challenges faced by Oil & Gas industries and can play a vital role in operations, productivity and wastage. Application of solutions like IoT can bridge the gap between OT and IT, enabling analysis of raw, unstructured data to get actionable insights.

**Big Data and Analytics**

The advent of digital technologies has been flooding Oil & Gas companies on a daily basis. With sensors and drones starting to play a major role in surveillance and maintenance, the amount of data is predicted to increase multiple folds in the next couple of years. Efficient processing of this information can reveal numerous underlying issues that generally goes unnoticed until a major breakdown. Big data analytics is the name used to describe the theory and practice of examining and applying computer analysis to large chunks of raw, unstructured data to gain some actionable insights and reveal trends, patterns etc. Over the years, industries have moved ahead of their conventional methods and adopted data-driven strategies to unlock new potential and the Oil & Gas industry has been no different.

Earlier, analysing the vast amount of data coming in varying formats from the sensors has been considered unreliable and time-consuming. Now, with the increased ability to capture, store, and interpret large volumes of information, companies are able to identify reserves better. Energy and petrochemical company, Shell has switched to big data to monitor operations and improve its supply chain operations and inventory. Studying the data received from the sensors and the seismic images, enables geologists with far more accurate information about where to drill. Shell has been using big data for monitoring their machines. Data collected
from the sensors, alongside with the aggregated data, can foresee any upcoming breakdowns or failures and minimise their down-time as far as possible.

With diminishing oil resources and rising prices, it’s necessary that drilling operations take place at the exact locations. Environment is ever changing and thus exploring the real-time data involving geology and operations can enhance drilling, spacing of wells, and wells completion. It also helps in detection of anomalies beforehand and such early detection can save millions in equipment and labour costs. Recent advances in big data techniques have enabled the development of Enhance Oil Recovery (EOR) technique, which can enhance the productivity of mature wells, earlier believed to have reached its peak.

With the midstream companies progressing in their digital journeys, new opportunities are being uncovered to make better use of the data to improve asset performance and reduce the frequency of incidents. Data analytics result in self-aware physical equipment, whose operations and health are holistically monitored and predicted.

Conventionally, pipeline companies have been dependent on manual inspection and collection of data for risk management and routing. Detailed analysis of this information have been both time-consuming and inaccurate. The growing power of big data has enabled the operators to make faster decisions, cutting down the effort on gathering, managing, and processing information. Capturing value from digitisation of assets help the firms drive safer pipeline operations while maintaining environment safety standards and maximising its return on investment.
Big data is here to stay and the explosion of data only ensures that. With the ever increasing volume, the traditional analysis tools and storage technologies fail to capture, manage, and uncover hidden information. The effective exploitation of big data can help companies improve their bottom lines and attain a competitive advantage.

**Digital reality**

Enhancements in the smartphone industry have made creation of photo realistic content accessible, which in turn has driven the global adoption of Augmented Reality (AR) and Virtual Reality (VR) applications. Deloitte predicts that over a billion smartphone users will create Augmented Reality & Virtual Reality content at least once this year. While, tens of thousands of apps incorporating AR capability will become available during the year. The Government’s vision for a Digital India through mass digitisation has made the practicality of a “mobile first” generation, which uses mobile phones as primary interface for information, a possibility. Increasing adoption of smartphones and mobile internet penetration, has allowed usage of data-intensive apps in remote locations, which are generally home to oil and natural gas refineries.

As AR content creation capability has gone mainstream due to business use cases across industries, the ecosystem in India is still evolving. Retail and consumer industries are among the front-runners in adopting AR, and the latest trend has seen the Industrial Manufacturing sector embrace AR as a means to resolve their on-ground constraints. With a flurry of proof of concepts in recent years, we expect organisations to move ahead from the pilot phase to full commercialisation. Considering various business use cases for digital reality, we have identified the following key focus areas that could benefit the Oil & Gas industry in India:
• Risk assessment: Deliver real-time information about a rig’s machinery for engineers
• Maintenance: Provide engineers a live feed of the maintenance needs of the machinery
• Real-time training: On-demand, virtual, simulated training sessions which enhance user experience
• Planning & review: Enable immersive reviews of installations and resolving complications beforehand

According to our study, a 100,000 bpd refinery losing a single day of operations could reduce revenues by more than USD 5.5 Million and cut profit by USD 1.4 Million\(^1\). And, Oil & Gas facilities shut for 27 days a year on average\(^2\), due to unplanned shutdowns, of which 23% attributes to human error. Shell has started using VR for training in operational safety procedures by having people navigate the decks of the platform as if they were really there\(^3\). Meanwhile, BP has started using AR smart glasses in its US operations\(^4\).

These VR solutions have shortened the learning time for new teams as they come aboard, and resulted in increase in safety and efficiency, and lower costs. These on-demand sessions improve knowledge retention and reduce traditional classroom training costs. Safety and compliance protocols for hazardous situations can be tested in highly realistic VR training, which improves reaction time and execution process in an emergency event.

Since, the Oil & Gas industry is a cost-intensive sector, with rigs and refineries in operation for decades. As, the high value machinery requires constant maintenance, it makes sense to utilise IoT sensors for real-time feedback on their...
operations. Now, the true value of digital reality can be realised when it’s integrated with the smart assets (IoT sensors) and analytics. AR allows users to enhance their view with real-time superimposed digital information from these sensors. With remote support and real-time status of machinery at hand, the expert can talk the worker through tasks and provide annotated instructions on the AR display. The costly expenses of transferring skilled workers to troubleshooting site are reduced, and efficiency is increased by faster handling of compliance checklist and basic troubleshooting. We believe this might be a popular use case for augmented reality for this sector in India. With the advent of image recognition driven automated instructions being provided by augmented reality display, the impact of productivity can be significant and will allow less experienced technicians to be highly effective leading to increased adoption of such digital reality systems.

As ONGC plans to purchase 27 drilling rigs to replace half of its ageing on-land rigs in a deal worth Rs. 3000-3500 crore\(^2\), and GAIL expands its pipeline network capacity by 50% over 3 years for its piped natural gas (PNG) and upcoming CNG stations\(^2\), it raises an important question: ‘how efficient is the pre-installation phase?’ While, Oil & Gas players spend a plethora in surveys, designs and implementation, many a times their installation costs overshoot due to compatibility changes, unfeasibility of solutions or budget over runs. Virtual Reality can play a key role here. An in-depth immersive virtual model of the plant’s schematic design, which showcases each component, will enable engineers and planners to view the structure from multiple angles. This will allow them to identify bottlenecks and resolve them before actual installation begins.

ONGC has set up 3D virtual reality centres known as ‘Third Eye’ for real-time supervision of the Oil & Gas fields, bridging the gap between centres with parallel computing technologies for all its major projects\(^2\).
As the enterprise potential of AR and VR in the Oil & Gas industry continues to grow through business use cases, India’s service industry has potential to play a key role in increasing the opportunities by integrating with other technologies such as IoT (sensors and connected assets), and analytics. With an extended digital landscape, AR/VR products will transform into increased productivity and operational efficiencies, through reduced downtimes and increased throughput.

Seismic imaging

Global energy demand was 270 million barrels of oil equivalent per day in 2012. By 2060, energy demand could rise to 470 million barrels of oil equivalent per day\(^2\). With the gradual depletion of the existing Oil & Gas reservoirs, discovering and recovering new sources has become imperative.

Seismic/geophysical imaging techniques are used by Oil & Gas players to understand the subsurface geology and locate Oil & Gas deposits. Oil India is the first E&P company that has conducted cable-less seismic data acquisition technology to meet the exploration and logistics challenges of the remote areas. It has been able to produce significant oil from the mature and ageing fields by adopting systematic reservoir management & monitoring practices through fit-for-purpose technology. These well-planned and monitored EOR schemes helped increase the recovery up to 35-50%\(^2\).

As a first in India, Cairn conducted Time Lapse (4D) seismic technology using an Ocean Bottom Cable (OBC) seismic survey at Ravva. An infill drilling campaign planned using 4D seismic successfully arrested production decline and extended the life of the field by identifying areas of un-drained and by-passed oil. Oil production went beyond 30,000 bopd in March 2015 after a gap of almost three and
half years — a remarkable turnaround for a mature asset, driven by successful application of 4D seismic technology, better than expected results from infill drilling campaign and contribution from RE-6 exploration well.\textsuperscript{28}

Geophysical surveillance not only helps in locating reservoirs, but also gives an insight of its behaviour. Repeated surveys can help keep track of the changes that occur due to production in the Oil & Gas reservoirs. This data can be useful for predicting future trends and enable better decision making.\textsuperscript{29}

Given the oil deficit nature of India and the push to increase production in India for national energy security, it is natural to expect increase in usage of seismic imaging.

**Artificial Intelligence (AI) and Machine Learning (ML)**

The Oil & Gas industry is one of the sectors that is constantly booming. In this digital age, business information holds enormous amount of information and processing them can unlock new values. The data must be analysed and translated into actionable insights. This is where AI and Machine Learning make the difference. With tools like AI, companies have shifted from “production at all costs” and adaptation of “production in context” has risen. Along with machine learning, it helps in quick identification of patterns and trend that, otherwise have been difficult and time-consuming to detect.

AI has been impacting some of the major areas in the upstream sector like location of new reserves, real-time drilling optimisation and exploration and production lifecycle. With AI and machine learning intersecting with seismic data, it has the potential of more accurate detection of the reserves.
Machine learning, the ability ‘to learn without being explicitly programmed’, has the capability to make predictions based on probability. Drilling has been one of the most expensive and riskiest ventures in the upstream. Comparing with previous similar situations it can save time, money and manpower across the process. It can also be used in optimising drilling processes. AI-driven platforms can benefit in controlling drilling equipment condition, risk recognition, and decision-making.

Companies can now perform their profit and loss calculations, leveraging AI solutions. By tying predictive information received from data visualisation with the current market demands and financial reports, it can strategically plan for next operations. Operators can now build systems which, with the help of machine learning, are able to identify and provide solutions to issues by studying data over time. Looking back at past failures and applying the lessons efficiently, which had been a fundamental to solve problems and a tedious process for the employees, can now be automated.

Leading companies in the Oil & Gas sector show that AI, when integrated with systems can improve efficiency. Most application of AI had been in virtual assistants and intelligent robots. Shell launched an AI customer assistant system (Shell LubeChat) which would assist customers navigate through the large database. ExxonMobil, with partnership with MIT aims at developing intelligent bots for exploration of hydrocarbons. The use of such AI-driven virtual assistants
is already common among other sectors both for customer facing applications and internal enterprise applications and the use of such advance technique to simplify finding information can be expected to grow in Oil & Gas as well.

**Mobile solutions**

The mobile industry’s contribution to India’s GDP currently stands at 6.5% ($140 billion) and is likely to reach 8.2% by 2020\(^3\). Deloitte predicts that India would be leading the smartphone revolution in the coming years as the largely untapped market gradually gets included into the realms of digital services. So, India’s smartphone user base is expected to increase from 300-400 Million\(^3\) to 810 Million by 2021\(^3\). Aided by Government initiatives, such as Digital India program, the shift in technology is evident where mobile technology adoption is widespread: improved employee safety, increased production, reduced costs, lower environmental risks are some of the benefits from the rapid automation and use of mobile technology.

Transforming into a true digital business is much more than implementing new technologies, it needs to begin at the core of the business, from the people to the processes and technology. Identifying these opportunities will help organisations become agile, adaptable, and cost-efficient enough to survive in the current economy, and continue to thrive long into the future.

For instance, ONGC has implemented an enterprise-wide paperless office solution\(^3\). This Paperless Office Project aims to eliminate the age old process of paper bureaucracy within ONGC at all levels. While, a notable progress towards a digital footprint, change management can be considered as the biggest challenge as it involves training more than 34000 employees across the organisation. Other initiatives include the digitisation of the Vendor Invoice Management (VIM) system, which has been adopted by several Indian Oil & Gas companies.
As, Oil & Gas companies collect data from a wide array of sources, such as IoT sensors or connected assets, only the digitally mature companies will have the potential to gather key insights from in-depth analytics to gain a competitive advantage. The convergence of mobile, cloud, and big data analytics will have profound effects on business. Remote monitoring and measurement applications can enable passive monitoring of assets on the ongoing basis until intervention is required, substantially reducing cost. Operations in hostile and hazardous places can be managed more efficiently and will engage organisations to control risk more effectively.

A more connected network of people, collaborative digital constructs can connect the trading partners with the parent company. Employees could share a common database and see the pieces of information as designs get developed on their fingertips. Mobile applications can further simplify efforts by providing satellite sensing data and pipeline monitoring, for quick action from any remote location.

GAIL has been one of the front runners in this area, as they developed a mobile application that utilises space technology for its pipeline safety application. A report system integrated with the Bhuvan-GAIL portal sends alerts to relevant executives via SMS and email, and notes the changes along the pipeline.

When it comes to midstream logistics, transportation of oil is considered to be one of the highest priority concerns. A distributed GPS tracking system can manage the location and movement of all vehicles across the fleet, improving dispatch efficiency and responsiveness to unanticipated changes in conditions and also allowing the organisation to monitor driver efficiency. Scheduled and planned routes while simultaneously ensuring that the fleet is running as per the schedule, will ensure lower transportation costs and improve fuel efficiency.
Investment on mobile technology alongside cloud-based technologies and services will help not only reduce cost and improve efficiency but also increase production and transform how the Oil & Gas workforce operate. Reduced capital expenditure will increase operational efficiency and make the existing assets more productive.

**UAV/Drones**

From keeping an eye for mishaps (fires, intrusion, etc.) to carrying out inspections along the pipeline, drones have been carrying out a long list of tasks.

The thorough inspection of the pipelines has always been a costly and tedious process. The implementation of UAVs with simple video recording and still photo capabilities has been successful in easing it out to quite an extent. The new age larger drones can carry a wide variety of sensors which are able to produce and transmit data. This data, fuelled by machine learning and artificial intelligence helps in real-time monitoring and is able to alert the operators regarding probable risks in critical areas in pipelines—like corrosion, third party/mechanical damage.

GAIL, one of the leading midstream companies has implemented drones for tracking its vast network of pipelines. It did a pilot project on satellite surveying its 610 km Dahej-Vijaipur pipeline and plans on extending it to 15000km based on results\(^3\).

RIL wants to use drones to undertake inspection of chimney stacks, which are essential but inaccessible areas of petrochemical complexes\(^3\).
Challenges in Indian ecosystem

Digital transformation changes business and operational models by exploiting data using advanced technologies. These advances equip organisations with faster and efficient decision making skills, lower operation costs and boost safety. Though digitisation has become critical for industries to survive in the highly competitive market, Oil & Gas sector still lags behind other industries in terms of widespread implementation of integrated technologies. One of the major reasons for the slow adoption is the amount of initial capital investment.

There’s still a divide between the potential of digital and what’s achievable. From acquiring the right talent to training the employees on the advanced solutions, getting on-board the digital journey is more than just implementation. It’s about the revolution of mindset- shifting away from the conventional to venture into the unknown. While the Oil & Gas sector had been one of the earlier adopters of digital, its implementation across the ecosystem becomes challenging due to the enormous cultural shift involved. Employees are still anxious with the increased human-computer interaction that did not exist a few years ago. Learning to process the data and make real-time decisions based on it is a drastic shift from the legacy processes and would take time to adjust.

With digital wave hitting the market, another real issue lies in choosing the right one that fits the organisation. No two firms are alike and there are no fit-to-all solutions. With the huge number of new technologies, the real task is to determine where and how they fit, or do they at all.
A look into India’s budding tech startups

Digital has been considered a remedy for many industrial processes from operational efficiency to safety and lack of visibility. IOCL, a leading firm, spends ₹ 70,000 per kilometre annually to maintain its 13,000 km long pipeline network. Exxon Mobil recently reported that nearly 4.6 billion barrels of reserves are at risk, with the company hitting a seven-year low that dropped net income from $4.24 Billion in 2015, to a 2016 third quarter income of $2.65 billion. The global leaders saw their price per barrel fall to an average of just $47. With the challenge to optimise operations while the oil price/barrel dropping in recent years, companies are trying to do more with less. Dropping their conventional methods, companies are now looking at investing in entrepreneurial businesses to help them revaluate their approach and adopt a smarter working model.

Federation of Indian Petroleum Industry (FIPI) introduced an annual award to serve as a strong facilitator for startups in the Oil & Gas industry. Moreover, Chakr Innovation winning the inaugural award emphasizes the industry’s effort towards creating a sustainable cleaner environment.

Indian Oil started a start-up scheme, “an initiative to promote innovation and newer technology in the Oil & Gas sector.” Through this, it aims to provide a platform and market to commercialise its ideas. While, state-run Bharat Petroleum has shifted its focus to drones for surveillance of its pipelines. It is currently focusing on an underwater drone created by EyeROV Technologies, which can gather deep sea data.

As startups that assert innovation in Oil & Gas with their products emerge, it becomes imperative to partner with digital experts to create a long term vision which could help leverage these solutions and align them with business objectives.
How Indian firms can become more digital

Digital had crept into the Oil & Gas industry much before it became a staple for survival. Yet in a country, having a network of 10,299 km of crude pipeline and an oil production of 36 million metric tons, its adoption and application have been surprisingly low. Being the latest disruptor, challenging the long-established and customary recipes, the amount of interest and expectations in ‘Digital’ have been big, along with an equal quota of apprehensions.
While IoT, seismic imaging, drones, etc. have been prominent in the Indian Oil & Gas market, solutions such as AI and Machine Learning are yet to leave their mark. Compared to global, the Indian Oil & Gas companies are still at a nascent stage on their digital journey. India’s energy demand is expected to double to 1,516 Mtoe by 2035 from 723.9 Mtoe in 2016. With the ever increasing demand, improving operational efficiencies has become crucial. Digital solutions can open up a host of opportunities for the players in the next 2-3 years (figure). They have the potential to mitigate risks, enhance productivity, remove redundancy and minimise operational costs.

Becoming “digital” is not just about technology. It is about rethinking the processes end-to-end and challenging the tried and tested methods. It is about fabricating a world where the physical and digital merge to generate a pool of information that is real-time, relevant, and actionable.

**Decoding the digital journey – DOT model**

During 2014-2016, downturn in oil prices, which led to a decline in upstream development activity, the oilfield services sector was hit hard by reduced revenue, cancelled or negotiated contracts at lower rates and massive personnel layoffs. With a host of starting points and choices available and a decline in Oil & Gas commodity prices, focusing on improving the processes and technology efficiencies has been emerging as a critical success factor. The World Economic Forum is predicting that by 2025, new digitalisation technologies will add $220 billion in value to the Oil & Gas industry.
Innovation allows organisations to take advantage of today’s dynamic landscape. Digitisation brings along with it a host of opportunities, enabling Oil & Gas companies to track field equipment, conditions and overall system efficiency through a continuous flow of information and action between the physical and digital worlds. Over the years, Oil & Gas sector had been leading in innovation. Evidence of technology’s disruptive impact on the Oil & Gas industry is clear and growing. With business strategies linked inseparably to technology, leading organisations are fundamentally rethinking how they envision, deliver, and evolve their IT infrastructure and solution.
In today's scenario Oil & Gas companies, pursuing digital transformation, can largely benefit from tools and a focused framework that helps them prioritise business objectives, chart their ever evolving digital progression and, reinvent the core of their operations- the business model itself. For the successful execution of this business strategy, executives need access to real-time data, guiding functions to deliver real customer value. The Digital Operations Transformation (DOT) model functions as a roadmap depicting the digital journey in 10 milestones, where the leap from one stage to another corresponds to completion of planned business objectives. Cybersecurity and an organisation’s digital traits are at the core of DOT. According to DOT, though the journey completes at stage 10 for a specific asset or operation, it must be transformed into a never-ending loop to include the entire organisation. This entails covering more assets, business processes, and ultimately entire ecosystem of the company, including supply chain as well as external stakeholders.
Mechanising the processes involving hydraulic, pneumatic, or electrical control systems allows the players to prepare for failures and unusual conditions. Sensorisation is the next step in the journey that enables capturing information from the physical world with the help of sensors (the physical to digital realm) and transmitting data generated in the field using IT networks. This step facilitates remote monitoring and managing of field operations by an Oil & Gas company. To attain their objectives, a company progresses from integrating diverse data (using cloud-solvers, servers, data standards, etc.), analysing and visualising data using new-age computers and platforms (for example, big data analytics, wearables, and interactive workstations) to augmented decision-making (for example, self-learning machines).

By creating digital twins, companies can gain insights about the physical state of assets and helps extend the life and adopt new business models. Once the physical-digital-physical loop has covered an asset/process, the same loop can be piloted to include a new set of assets in a new business line or geography. Consequently, the loop extends to the entire organisation and, finally includes entire supply chain and external stakeholders of the organisation. What remains at the core of this transformation is a comprehensive cyber risk management programme, which is secure, vigilant, and resilient. Another equally important element for this transformation is the organisational culture—or what we call the ‘digital DNA’.

This model helps in identifying the current digital standing of the industry, and facilitating digital leaps that can be taken up to meet their short-term and long-term goals.
Embracing a digital future

To be prepared for the changes ahead, the Oil & Gas industry should consider adapting and even revolutionising the existing processes through digitalisation. Each completed loop (physical-digital-physical) could result in new operating, capital, and business models for a company.

As disruptive new capabilities, such as cognitive computing and 3D printing are introduced to the industry, it becomes imperative to have a well-defined digital roadmap focusing on the digital solutions most applicable to the Indian ecosystem, as discussed in this paper. Further, a comprehensive digitalisation framework, leveraging and integrating multiple digital solutions, could help achieve a company’s goals of improving efficiency, increasing productivity, and optimising costs, while preparing for the volatility ahead.

The emergence of the digital theme in India has become more evident with a spate of recent Request for Proposals (RFPs) around digital from Oil & Gas firms. While FIPI introducing an award valuing digital initiatives, RIL winning the inaugural award for its petro retail excellence in 2017[^51], confirms that we can expect an increased momentum around digital practices in India.
Summary

Digital transformation is a journey and not a one-time exercise. Successful organisations need to put in a digital transformation framework that addresses capabilities, competencies, and culture.

The Oil & Gas industry in India has started placing structures in place with the following common themes:

- **Driving a culture of technology adoption**
  Top-driven, clear digital vision and empowered teams thinking beyond their channels and perspectives.

- **Cross-discipline, cross-company workflows**
  Deploying securely integrated platforms that harmonise data flow for effective decision making across the board.

- **Cultivating talent pools**
  Designing mechanisms to create talent as a catalyst for innovation and collaboration. In India, these interventions are designed to understand current personnel capabilities and build a strategy to bridge the path to future competencies. There is an openness to work with ecosystem players, including startups, in fueling digital innovation.

- **Business value driven**
  Articulating a long term vision that focuses on benefits of digital in achieving business objectives.

These are exciting times for digital Oil & Gas. The impact of the newly created digital strategies should be visible over the next year or two when we can expect a lot more investments in this sector as the business value realised becomes more understood.
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This paper takes a perspective on the Indian Oil & Gas industry by discussing the significance of technology-driven change and the value this change has on the business and contextualises this for Indian firms. The report also discusses the readiness of Indian firms and their alignment to digital transformation by analysing public domain sources on their current investments and focus areas.
Endnotes

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