



Digital Transformation in Upstream Oil and Gas

By Ramana Palisetti

The Oil and Gas (O&G) industry is often characterized as a brand that resists repackaging efforts. While we agree that the industry has been slow with its transformation compared to other sectors such as banking, manufacturing, health, and many others who have embraced, it's also true that it's one of the pioneering sectors to have adapted to disruption.



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The Trajectory of Growth

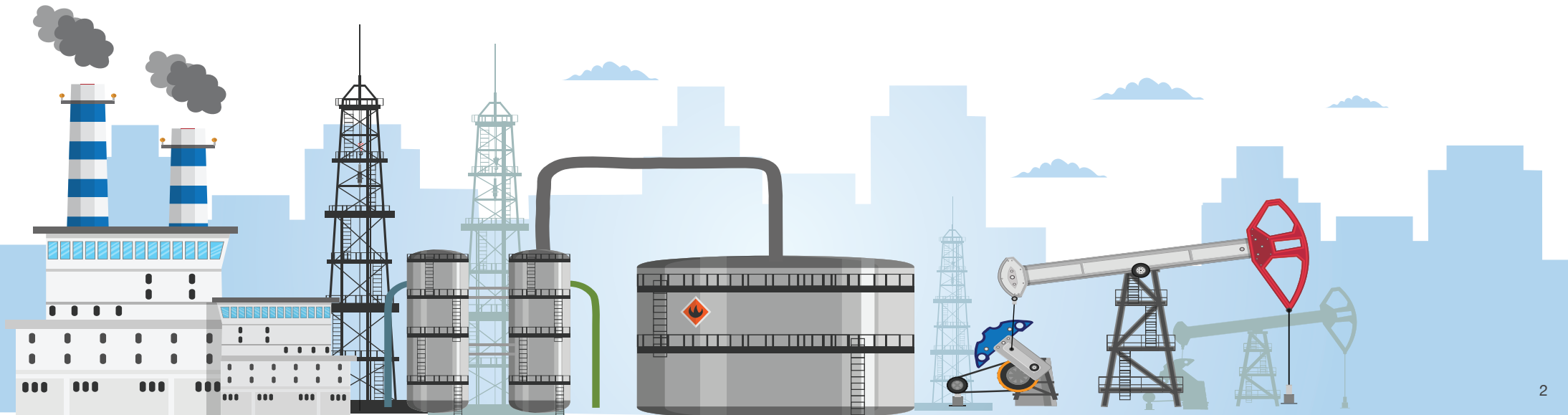
In reality, the Oil and Gas industry has never been sleepwalking through the digital decades. Facts reveal that they adopted technologies as early as 1980-1990s with a focus on improving resource potential, productivity, and health and safety at oil fields worldwide. However, the industry participants weren't able to capture the disruptive potential for the most part of the decade. Obsolete systems, muddled data, and upskilling challenges were a few reasons that eclipsed growth prospects of whatever potential existed.

Today, the Oil and Gas industry is finally attending the siren call of disruption. After a period of decayed growth characterized by decimating and big swings in crude prices, budgetary hassles, schedule overruns, climate change, influx of renewable energy, strict carbon regulations, and talent crunch, the Oil and Gas industry is

seeking new ways to alleviate the fears of today and tomorrow. It is rewiring its DNA to let go out of the dinosaur sentiment.

A panoramic view of the Oil and Gas industry shows that it has been hit by a wave of digital technologies lately, which includes Mobility, Big Data Analytics, the Internet of Things, Cloud, Augmented Reality, Machine Learning (ML), and Blockchain.

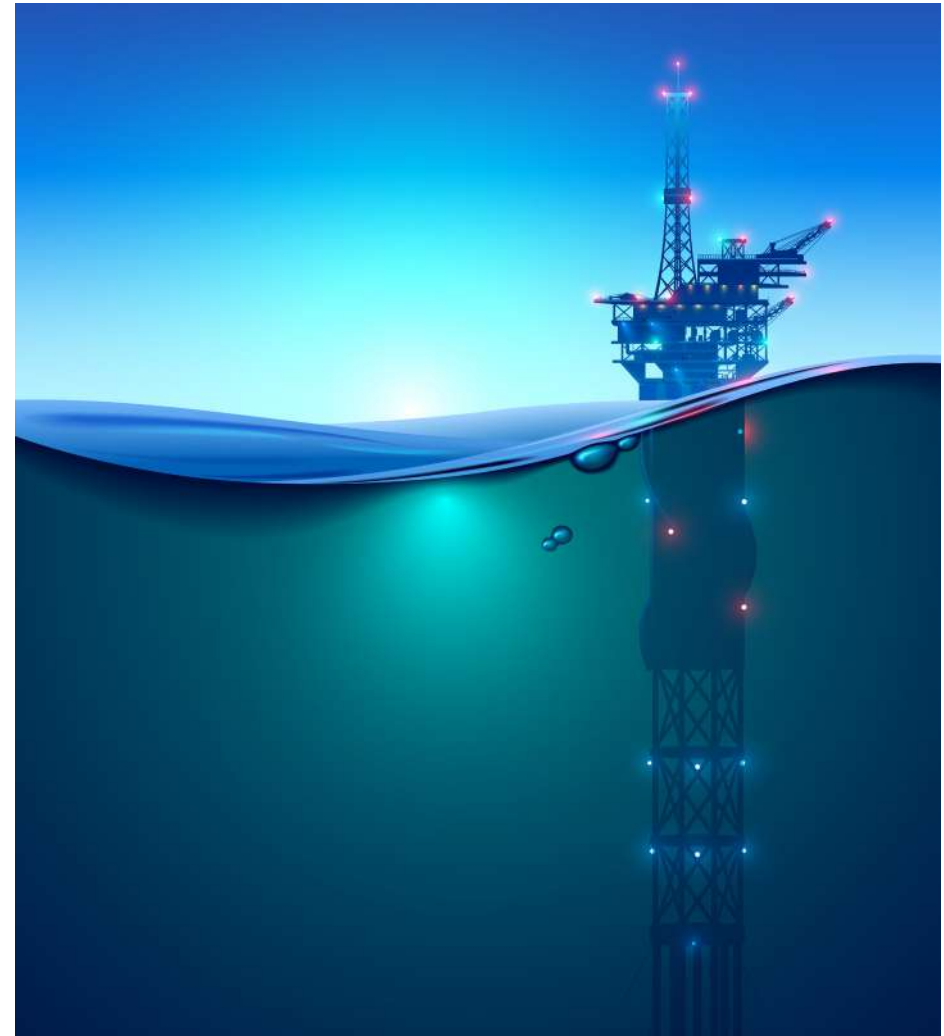
This white paper takes a holistic account of some of the most crucial disruptions in the upstream O&G industry, which have redefined the ways it operates, delivers, improves, and innovates in the times of digital renaissance. Further, we also take a deeper insight into which technologies prove a strategic fit for leveraging multiple aspects of the O&G functioning.



Decoding the Cascading Disruption

The Oil and Gas industry has had a tumultuous journey to transformation all these years. Challenges to continuously innovate in the face of tough geopolitical situations and stringent environmental norms left craters on the industry's growth outlook. In the wake of such unyielding market scenarios, many enterprises have redone their business models to ensure stability, if not efficiency, in the midstream and downstream industries of Oil and Gas. However, this isn't an option for the upstream industry, which relies entirely on Oil and Gas Extraction. It's therefore for the upstream businesses to ensure maximum efficiency, which is only possible if they adapt to disruption

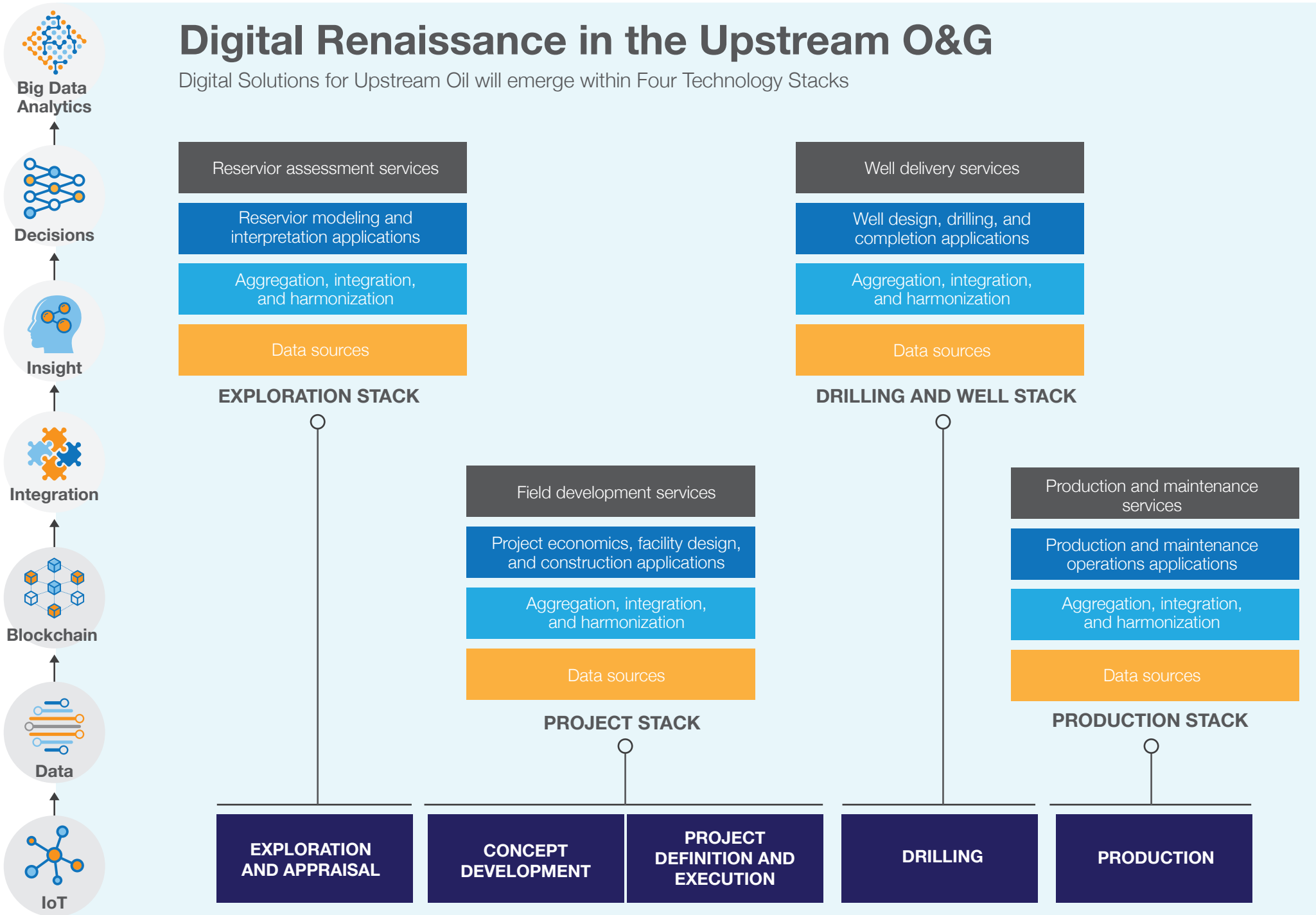
The IoT and Blockchain stand out as the technologies with maximum promise when it comes to reforming the traditional, sluggish, and paper-pushing Oil and Gas into an agile, automated behemoth. While IoT can prove pivotal in connecting multiple supply chains to a single point of access for data insights, Blockchain Technology can help enterprises in solving privacy, transparency, and efficiency challenges. What's more, as a decentralized economy lies ahead, the O&G industry stands to gain huge growth potential through Blockchain implementation.



Other than IoT and Blockchain, technologies such as Edge Computing, Augmented Reality, Virtual Reality, Mobility, Artificial Intelligence, Machine Learning (ML), Big Data, and Cloud have also shown remarkable potential as being the key enablers of O&G disruption. While the firsthand transition is already afoot, it's only imaginable how far the O&G companies will be successful in plugging its vulnerabilities.

Digital Renaissance in the Upstream O&G

Digital Solutions for Upstream Oil will emerge within Four Technology Stacks



Upstream Exploration Stack

Exploration companies have finally begun paying heed to creating value from Big Data. However, the scale of adoption is much less mature. About 36% of Oil and Gas companies are investing in Big Data and analysis, but only 13% are using the insights to transform their bottom lines. This gap suggests that these companies are adopting digital technologies only to let them remain dormant. A full-scale deployment of new-age data consolidation practices has far-reaching impacts on productivity, operations, and decision-making.

Upstream O&G companies must leverage the power of geological data to improve incrementally. Applying advanced data-driven analytics and Machine Learning on data will maximize its value and help exploration teams create a common view across different organizational aspects. These real-time insights, when further coupled with Machine Learning algorithms, will identify patterns crucial for building an effective drilling strategy. These shifts will offer significant benefits, such as effective decision-making, reduced environmental footprint, and improved workflow management.

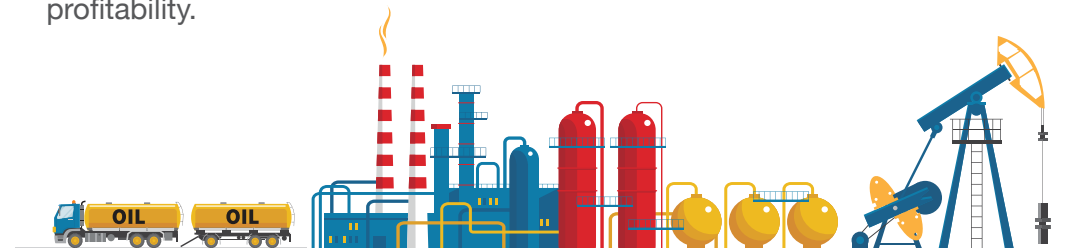
It's important to note that early implementations of Analytics and ML-based technologies are already facilitating the upstream O&G companies to locate geological anomalies. However, to tap into its enterprise-wide opportunities, the companies need to invest substantially not only in acquiring Machine Learning capabilities but also in replacing their legacy systems with high-end computerized infrastructure and upskilling. This is important to minimize the sudden disruption that might leave the business stability in flux.

Upstream Project Stack

Digital Technologies have rewritten many a rule for the Oil and Gas industry when it comes to designing, evaluating, and choosing projects based on as many parameters as possible. With Industry 4.0 sweeping the current digital ecosystem, the fresh set of digital modeling and simulation tools is the latest scoop on transforming upstream project validation. These tools will combine reservoir data, equipment design, field architecture, and economics to create a single digital framework. This will help upstream operations choose the most economical field design from an exhaustive range of options.

Digital Twin Concept is another technology coming with full force to the O&G industry. The companies will be able to use historical design data to develop digital twins—the virtual clones of the assets—to model and evaluate the future performances of complex design, process, and equipment modifications before applying them in the real world. This will lead to improved business capabilities for enabling future-ready efficiency and cost planning.

By the looks of it, there's hope for digital technologies revolutionizing everything across the project phase, from field concept selection to commissioning. It's highly important that upstream O&G businesses lay out a strategic agenda to achieve new-age competencies and return to profitability.



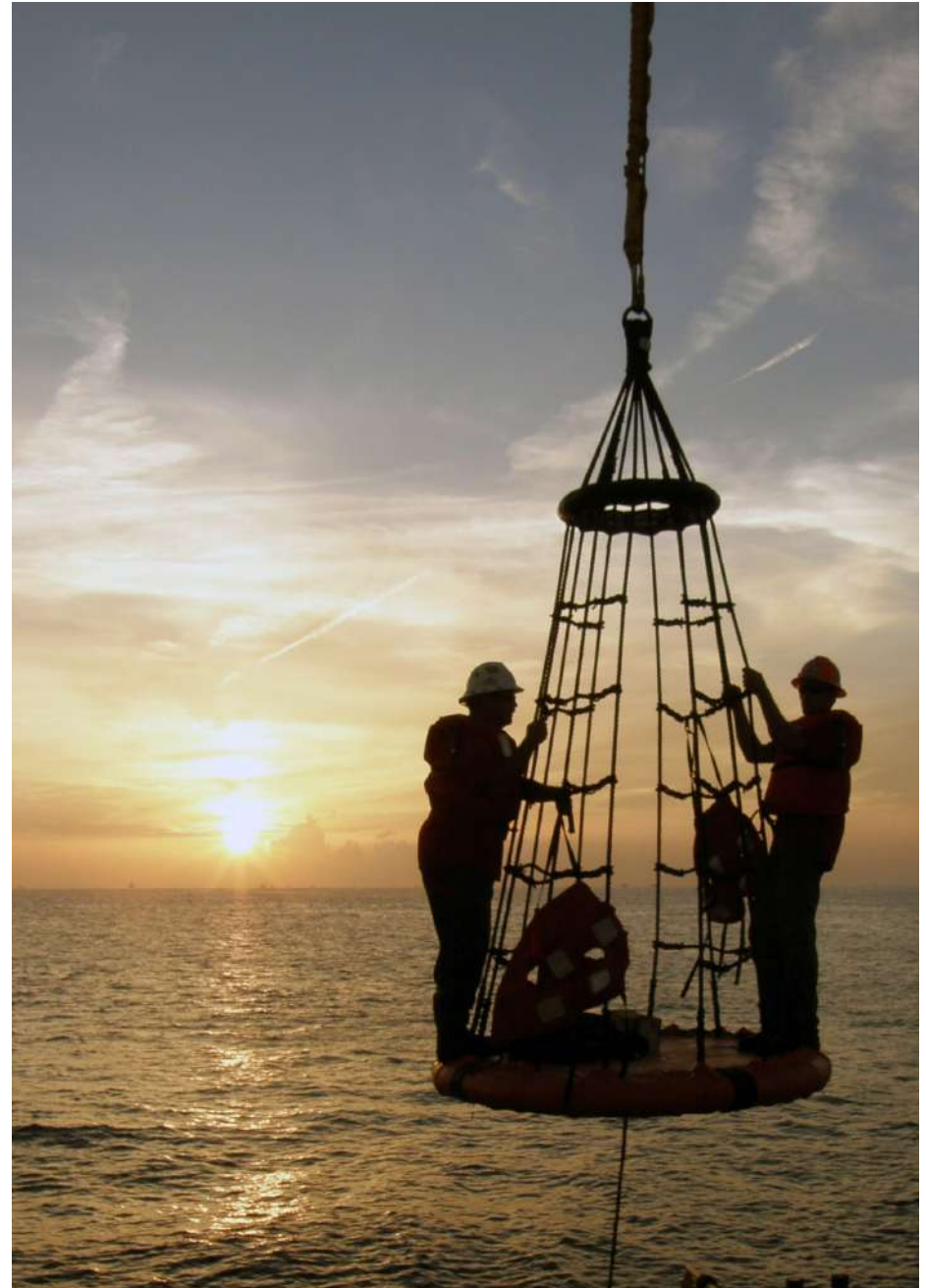
Upstream Drilling and Oil Well Stack

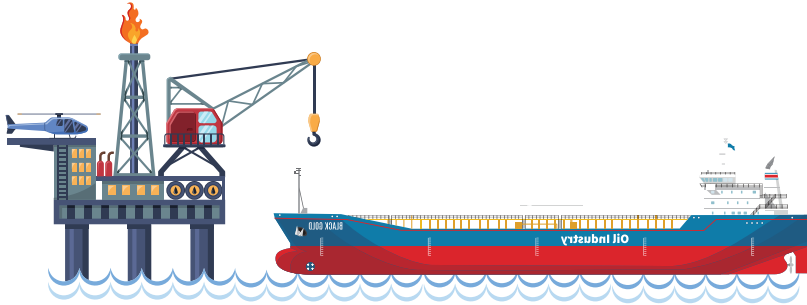
There have been growth hiccups in the upstream oil well drilling due to ineffective coordination among various different stakeholders involved in executing and automating the process. It can be resolved by deploying integrated automated systems to ensure collaboration between rig owners, OEMs (Original Equipment Manufacturers), and OFS (Oilfield Services)

Up till now, disruption has been applied across drilling and well environments in parts. However now, companies are linking subsystems to eliminate the opacity across the drilling operations. Automated well design and drilling will fuel an enormous boost in overall efficiencies and process timelines. At present, Blockchain is emerging as a promising avenue for O&G companies. Using Blockchain, stakeholders and service providers will not only be able to ensure collaborative teaming but also enable secured sharing of data across supply chains. Additionally, the technology will help companies improve cost control with the elimination of transaction fees.

However, before getting their feet wet at automation, the O&G companies must plan around building new value arrangements by integrating physical and digital assets. To achieve this, they must embed sensors across drilling utilities to capture real-time data, collate it with Big Data, and apply advanced analytics to discover aspects ripe for disruption.

Increases in productivity and transparency in the drilling processes will catalyze change in the O&G industry. Day rate compensation models will be superseded with service- and outcome-based models. The transition will help smoothen the rough patches of coordination across multiple quarters while also harnessing the potential of automation





Upstream Production Stack

The O&G companies felt the pain of stagnant growth due to complex, heterogeneous, and incompatible data formats, which cloaked supply chains and restricted optimization. Jittery management never found an opportunity to grow incrementally and boost service value. However now, upstream O&G production environments are waking up to a new era of data processing and fostering a scalable ecosystem where innovation can be applied at large.

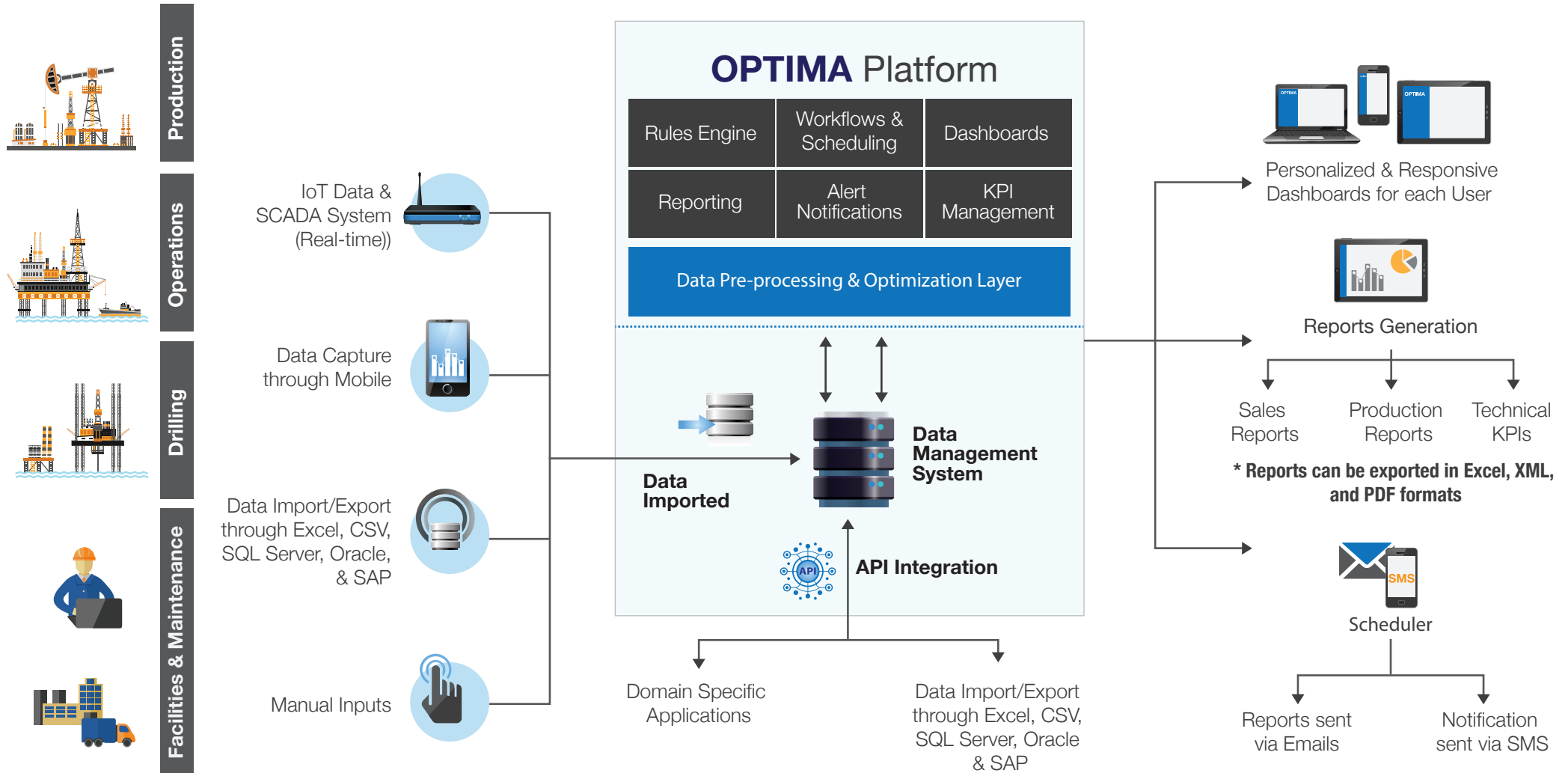
Today, the O&G companies have started applying Big Data and Analytics for maximizing value capture from the complex sets of data and unearthing insights to understand the efficiency and maintenance needs better. In the long run, this will reinforce the quality of decisions, enable predictive maintenance, and improve performance uptimes for consistent delivery.

Alternatively, enhancements in the system performance can be further mobilized for building transparency by collecting and combining data from reservoirs, wells, and field environments in real-time. This will not only provide for pre-emptive maintenance and proactive troubleshooting but also help in overcoming system failures and controlling damage before it occurs.

The Roadmap to Upstream O&G Disruption

A critical deterrent to upstream O&G disruption has so far remained the lack of comprehensive software solutions that could automate, integrate, and consolidate their complex end-to-end operations. As demands for efficiency increase — and competition grows stronger — upstream enterprises are increasingly finding themselves at the crossroads. However, with the emergence of a new digital ecosystem, the potential of disruption in upstream O&G seems no longer speculative. Technologies, such as the IoT and Big Data, hold a high bar of transformation and can open a floodgate of opportunities for tangible growth outcomes.

Kellton Tech, in an effort to build a new era of upstream intelligence and plot a path for a secure future, has developed Optima — an IoT-enabled robust, scalable, customizable, and futuristic micro-services-based platform—to mitigate the operational challenges faced by the O&G industry. The platform facilitates data connectivity, integration, and interoperability to unlock optimization benefits for the O&G companies and improves operations at the grassroots level. Optima is powered by the best-of-breed IoT, Edge, Big Data, and Predictive technologies that allow event detection and sensing, asset monitoring, and resource tracking in real-time. It empowers engineers, managers, and service architects to make faster and more informed decisions with greater automation and higher confidence level. Optima boasts a broad scope of digitization that can be applied across all the O&G Upstream stacks — Exploration, Project, Drilling and Well, and Production.



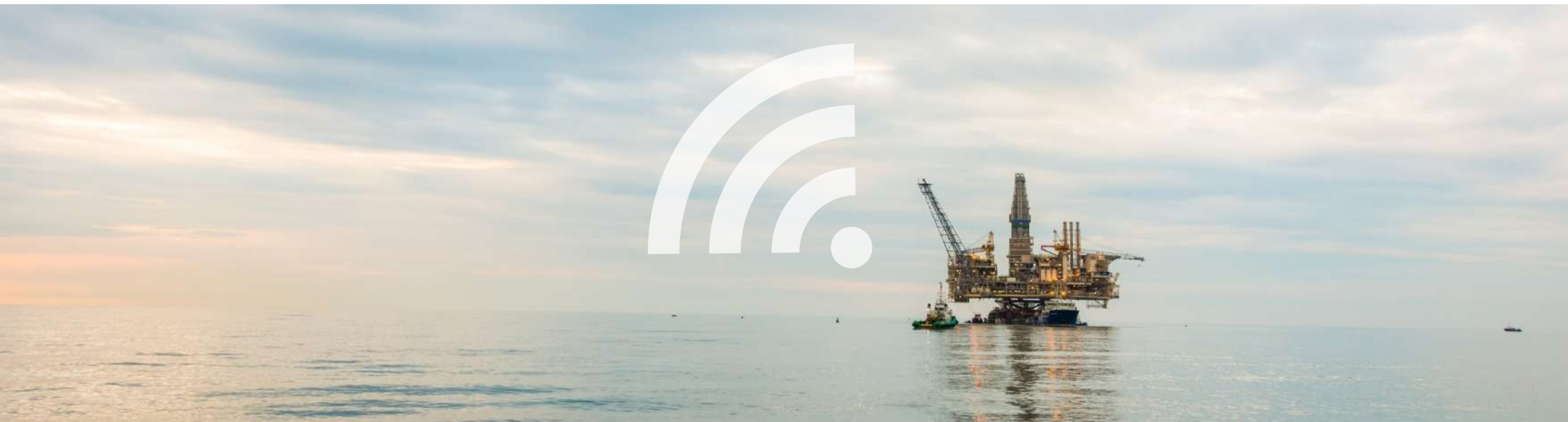
In essence, Optima is a digital enterprise solution for oilfield operation resource management, planning, analytics, communication, automation, control, and decision-making. This business system aims to bring improved levels of collaboration between various departments

in an organization with the vision to help companies achieve operational and process efficiencies in order to maximize productivity and bring significant cost savings.

About the Author



Ramana Palisetti is Global Head - Energy BU at Kellton Tech. He has 25+ years of experience in production optimization and lift operations lifecycle management in the oil and gas industry. Ramana has worked globally at a leading service company in technical and management positions.



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