

Digital Innovation Snapshot Oil & Gas

October 2024



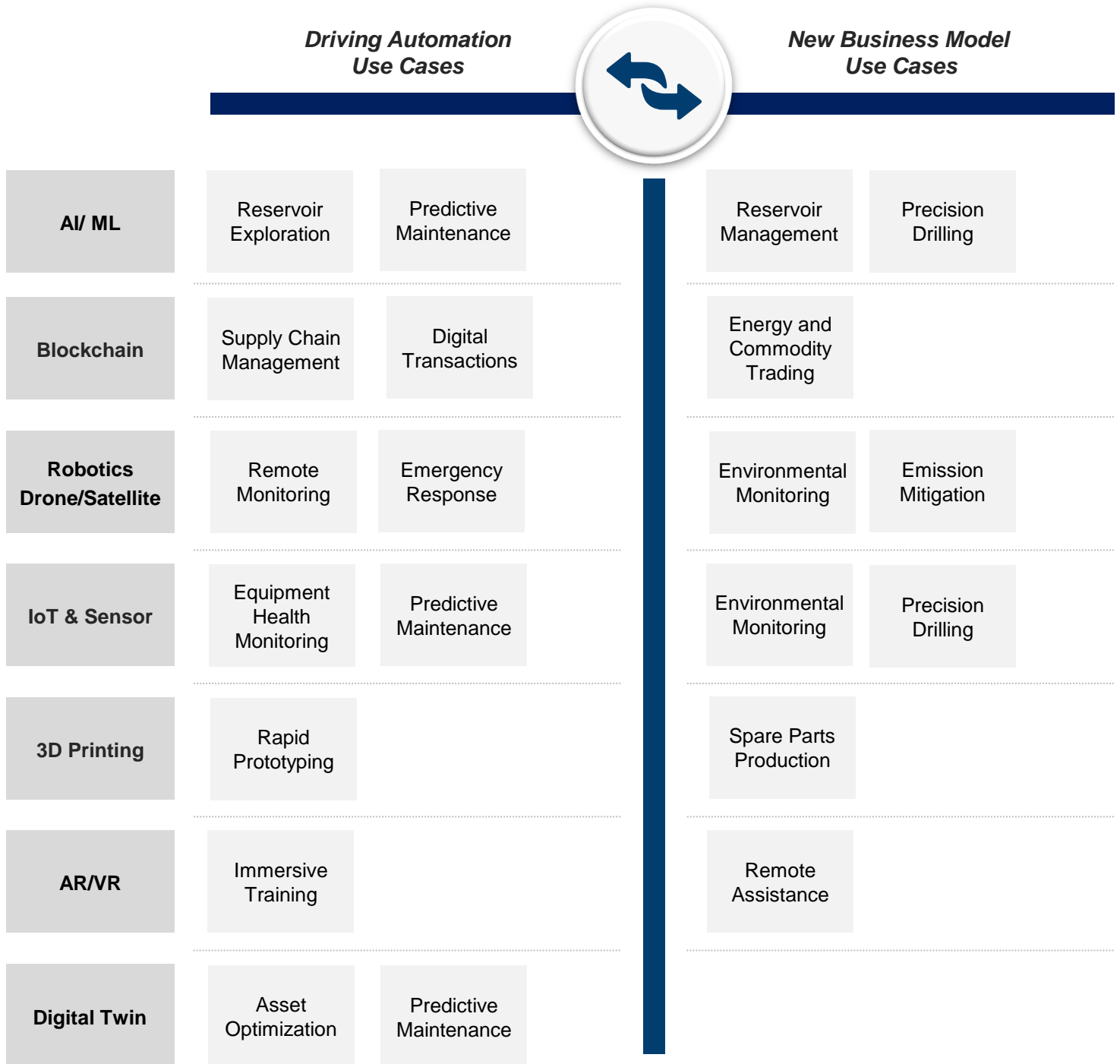
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Aranca’s Digital Innovation Snapshot report helps you understand the impact of digital technologies on your industry. In this report, we have captured the use cases enabled by digital technologies such as AI, Blockchain, IoT, Robotics, etc. These use cases are driving new business models and facilitating automation in existing processes across industries. Automation improves efficiency and helps organizations focus on more important aspects of business, while new models generate additional revenue streams and drive global growth.

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Digital Innovation Technology Themes enabling Use Cases



Digital innovation technology themes: Digital technologies enabling digital transformation at scale across industries

- **New business model use-cases:** The use cases realized using digital technologies under this category have a high impact on the top line of organizations and help them explore new business models.
- **Driving automation use-cases:** The use cases realized using digital technologies under this category have less impact on the top line of organizations and help them in automating/streamlining existing processes. These use case have the potential to aid organizations to grow at a faster pace and increase operational efficiency.

Use Cases and Early adopters (1/6)

Sr. No	Use Case	Comments
1	Reservoir Exploration	<p>In reservoir exploration, companies are using AI to boost efficiency and safety. British Petroleum (BP) enhances drilling site identification and production optimization with AI. Total S.A. partners with Google Cloud to automate subsurface data analysis and seismic interpretation. Saudi Aramco leverages AI and machine learning for optimized exploration and automated seismic processing. Meanwhile, ExxonMobil collaborates with MIT to create AI robots for ocean exploration, improving natural seep detection and reducing exploration risks.</p>
2	Predictive Maintenance	<p>Oil and gas companies are increasingly leveraging advanced technologies like AI, machine learning (ML), IoT, and digital twins for predictive maintenance to enhance operational efficiency and minimize costs. Shell and Aker BP employ AI to anticipate equipment failures and prevent production losses, while Chevron utilizes machine learning and sensor-enabled equipment for precise maintenance forecasting. ExxonMobil enhances its operations by analyzing sensor data to predict failures, particularly in critical refining processes. Additionally, Petrobras harnesses digital twin technology to simulate refinery performance in real time, enabling better operational management through scenario analysis.</p>

Use Cases and Early adopters (2/6)

Sr. No	Use Case	Comments
3	Reservoir Management	ExxonMobil, Chevron, and Saudi Aramco are leveraging AI and machine learning to improve reservoir management and safety. ExxonMobil optimizes extraction processes while ensuring safety compliance. Chevron uses machine learning to integrate data from sources like mechanical earth models for enhanced decision-making. Saudi Aramco employs AI for real-time updates on reservoir conditions, improving modeling and responsiveness.
4	Precision Drilling	In precision drilling, Shell and Saudi Aramco are utilizing advanced technologies to improve efficiency. Shell uses reinforcement learning to control drilling equipment, adapting to subsurface conditions for enhanced accuracy and reduced equipment damage. Meanwhile, Saudi Aramco employs camera-based well spacing with Industrial IoT and AI for efficient drill string placement.
5	Supply Chain Management	Blockchain technology is enhancing transparency and optimizing processes within the supply chain for companies like Abu Dhabi National Oil Company (ADNOC) and PetroChina. ADNOC , in collaboration with IBM, is implementing a Hyperledger-based blockchain network to streamline financial processes among its group companies, with plans to extend this innovation to supply chain management. Similarly, PetroChina is developing a blockchain project aimed at improving the efficiency of petroleum trading, thereby enhancing overall supply chain logistics.

Use Cases and Early adopters (3/6)

Sr. No	Use Case	Comments
6	Digital Transactions	Blockchain is significantly streamlining financial transactions in the oil and gas sector. ExxonMobil has successfully completed a trial for blockchain-based authorization for expenditure (AFE), highlighting the technology's potential in this area. Additionally, companies like Lukoil are embracing alternative payment solutions by accepting Bitcoin at gas stations in Estonia, Lithuania, and Latvia.
7	Energy and Commodity Trading	Blockchain is transforming energy commodity trading by digitizing post-trade document management and automating processes. The VAKT platform, developed by BP, Shell, Equinor, Gunvor, and Mercuria , integrates trade details, invoicing, and third-party services like letters of credit. Saudi Aramco is collaborating with VAKT to enhance post-trade processing efficiency, while BP is also focused on creating a platform specifically for energy commodity trading in the oil and gas sector.
8	Remote Monitoring	Drones enable inspection of hard-to-reach assets, greatly improving efficiency and safety. Example, Shell employed drones in the Surat Basin, Australia, to monitor over 3,000 gas wells efficiently. Similarly, Sinopec has revolutionized its pipeline inspections using Microdrones, increasing daily inspection capabilities from 7 km to 100 km and reducing personnel exposure to hazardous conditions.

Use Cases and Early adopters (4/6)

Sr. No	Use Case	Comments
9	Emergency Response	Drones significantly enhance safety by improving emergency response capabilities. In 2016, Chevron tested drone technology for oil spill assessments, successfully mapping over 70% of oil targets along five miles of coastline. This advancement enables faster emergency responses while minimizing risks to personnel.
10	Environmental Monitoring	Oil and gas companies are increasingly leveraging advanced technologies such as drones, satellites, IoT, and sensors for environmental monitoring and operational efficiency. For instance, Saudi Aramco has harnessed extensive data sources to significantly reduce flaring operations, showcasing its commitment to sustainability. Similarly, Chevron utilized multirotor drones for flare stack inspections, enhancing maintenance planning and condition assessments. BP's use of IoT devices for real-time emissions tracking and hazard detection ensures compliance with environmental regulations and bolsters safety.
11	Emission Mitigation	Drones are essential for monitoring methane emissions. TotalEnergies has equipped its drones with dual sensors to effectively detect both methane and CO2 emissions, aiding compliance with environmental regulations and reducing carbon footprints. Similarly, Neptune Energy conducted a study in 2021 using sensor-equipped drones at their North Sea facility, reflecting their commitment to achieving zero methane emissions by 2030.

Use Cases and Early adopters (5/6)

Sr. No	Use Case	Comments
12	Equipment Health Monitoring	Oil and gas companies like Chevron are employing IoT technology for pipeline monitoring and leak detection by embedding sensors along pipelines to continuously track parameters like pressure and flow rates for rapid identification of leaks or anomalies. Similarly, Shell has employed Digital Oilfield solution to enhance pipeline surveillance. Additionally, British Petroleum (BP) uses sensors for real-time equipment health monitoring by optimizing maintenance strategies.
13	Spare Parts Production	Spare parts production through on-demand manufacturing reduces downtime and inventory costs by enabling local production. For example, Shell partnered with 3D Metalforge to 3D-print heat exchanger parts in just two weeks, while Chevron worked with Lincoln Electric to produce eight nickel alloy parts on-demand, effectively preventing supply delays.
14	Rapid Prototyping	Rapid prototyping with 3D printing accelerates design iterations and reduces time-to-market. A notable example is ExxonMobil 's project to create an 8-meter-long metal pressure vessel, the largest commercially available 3D-printed vessel, expected to be completed in just 12 weeks.

Use Cases and Early adopters (6/6)

Sr. No	Use Case	Comments
15	Immersive Training	Immersive training provides a safe environment for employees to practice skills and scenarios, significantly enhancing retention and engagement. For instance, ExxonMobil employs VR to create training programs that simulate real-life situations for field workers, while Royal Dutch Shell uses VR for deepwater safety training, allowing workers to rehearse safety procedures in a realistic 3D setting.
16	Remote Assistance	Technicians can visualize equipment and conduct inspections from remote locations using AR/VR technologies. ConocoPhillips at its Onshore Drilling Center in Norway employs a 3D visualization package for real-time data analysis alongside simulated downhole equipment. Equinor's 3D simulator allows geoscientists and drilling specialists to examine geological formations and assess hydrocarbon reserves using seismic data models.
17	Asset Optimization	BP and Saudi Aramco are using digital technologies to enhance asset performance. Since 2017, BP's implementation of digital twins has cut analysis time from over a day to 20 minutes, yielding an extra 30,000 barrels of oil that year. Their dynamic visual twin technology improves efficiency and safety through real-time data monitoring. Similarly, Saudi Aramco utilizes digital twins to boost production, reduce power consumption by 18%, lower maintenance costs by 30%, and significantly shorten inspection times.



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