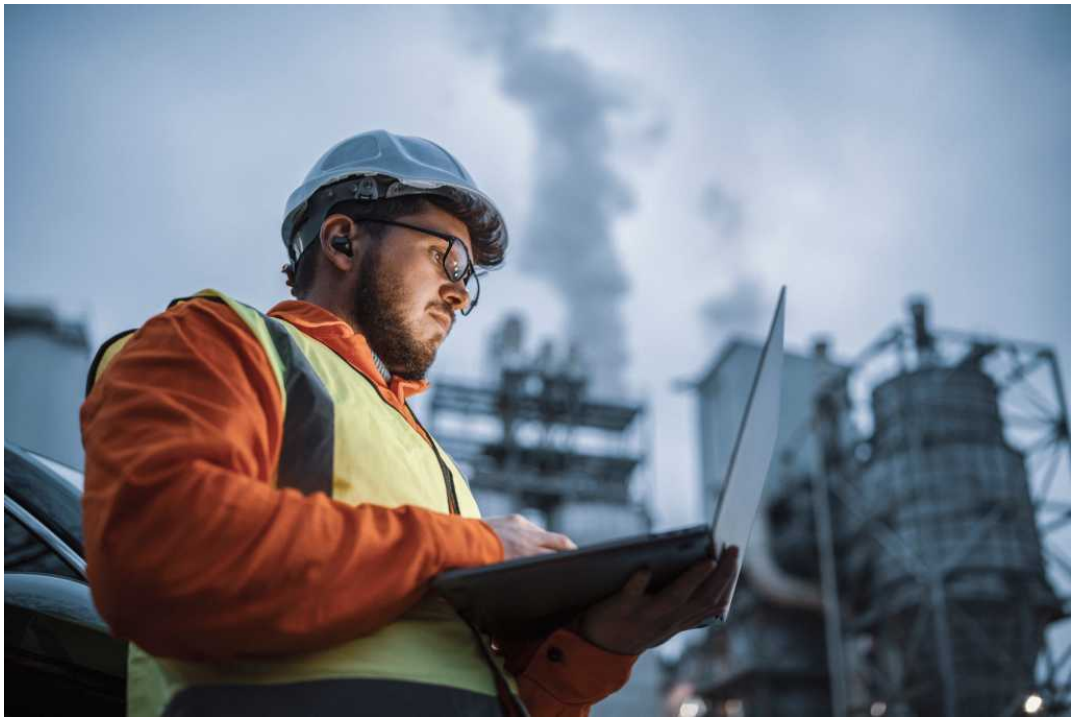
How Cairn Oil & Gas is using IT to overcome one business challenge after another

CIO Sandeep Gupta's innovative use of technology has enabled the company to cut costs, reduce time to first oil, and manage decline in production.



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Cairn Oil & Gas is a major oil and gas exploration and production company in India. It currently contributes 25% to India's domestic crude production (about 28.4 MMT) and is aiming to account for 50% of the total output. The company plans to spend ₹3,16,09 crores (₹31.6 billion) over the next three years to boost its production.

The oil and gas industry currently confronts three major challenges: huge price fluctuation with volatile commodity prices, capital-intensive processes and long lead times, and managing production decline.

Sandeep Gupta, chief digital and information officer at Cairn Oil & Gas, is using state-of-the-art technologies to overcome these challenges and achieve business goals. "We have adopted a value-focused approach to deploying technological solutions. We partner with multiple OEMs and service integrators to deploy highly scalable projects across the value chain," he says.

Reducing operational costs with drones, AI, and edge computing

Sandeep Gupta, chief digital and information officer, Cairn Oil & Gas

The oil and gas industry is facing huge price fluctuation due to volatile commodity prices and geopolitical conditions. In such a scenario, it becomes crucial for the business to manage costs.

Sustained oil production depends on uninterrupted power supply. However, managing transmission lines is a high-cost, resource-intensive task. For Cairn, it meant managing 250km of power lines spread across 3,111 square kilometers. They supply power to the company's Mangala, Bhagyam, and Aishwarya oil fields and its Rageshwari gas fields in Rajasthan.

To reduce operational costs, the company decided to use drones. The images captured by the drones are run through an AI image-recognition system. The system analyses potential damage to power lines, predicts possible failure points, and suggests preventive measures, thereby driving data-driven decision-making instead of operator-based judgment.

"Algorithms such as convolutional neural networks were trained on images captured when the overhead powerlines are running in their ideal condition. The algorithm then compares the subsequent images that are taken at an interval of six months when any anomalies are captured. An observation is then put into portal for the maintenance team to take corrective and preventive action," says Gupta.

This is a service-based contract between Cairn and the maintenance provider where the monitoring is carried out on biannual basis for 220kV power lines and annually for 500kV power lines.

"Since the implementation of drone-based inspection, the mean time between failure has increased from 92 to 182 days. This has reduced oil loss to 2,277 barrels per year, leading to cost savings worth approximately ₹12 crores [₹120 million]. As it enables employees to carry out maintenance activities in an effective manner, a small team can work more efficiently, and the manpower required reduces," Gupta says.

The remote location of operations coupled with a massive volume of data (Cairn generates about 300GB data per day) that is generated make the oil and gas industry ideal for the use of edge-based devices for computing.

With smart edge devices, critical parameters are stored and processed at remote locations. The devices are installed in the field which send data via MQTT protocol where cellular network connectivity is

available. They store data up to 250GB on the Microsoft Azure cloud and perform analytics using machine-learning algorithms, as well as provide intelligent alarms.

Without these devices, the data generated would be transported to faraway data centres, clogging the network bandwidth. “Edge computing helps reduce our IT infrastructure cost as lower bandwidth is sufficient to handle the large volume of data. These devices deployed are tracking critical operational parameters such as pressure, temperature, emissions, and flow rate. The opportunity cost of not having edge computing would result in requiring a higher bandwidth of network, which would amount to around 2X of the current network cost,” says Gupta. “This also has an implication on the health and safety risk of our personnel and equipment.”

Reducing lead times through a cloud-first strategy

The oil exploration process has a lead time of around three to five years and requires huge capital commitment. Out of these three to five years, a significant amount of time is taken up by petrotechnical experts (geologists, geophysicists, petroleum engineers, and reservoir engineers) in simulating models that require massive computational power.

Petrotechnical workflow entails evaluation of subsurface reservoir characteristics to identify the location for drilling the wells. These workflows are carried out by petrotechnical experts via multiple suites of software applications that can help identify the location and trajectory of wells to be drilled.

“Capital allocation and planning for future exploration has become riskier due to long lead times. To achieve our goals, increasing computing capabilities are essential. For this, we have adopted and executed a cloud-first strategy,” says Gupta. Thus, Cairn has completely migrated the workloads for petrotechnical workflows to the cloud. “This migration has removed the constraints of on-premises computational capabilities. As a result, there is almost 30% reduction in time to first oil,” he says.

Managing decline in production through predictive analytics

Cairn has considerable volume, variety, and velocity of data coming from different sources across production, exploration, and administration. “Using this data, we have deployed multiple large-scale projects, including predictive analytics, model predictive control, and reservoir management, which have been scaled across multiple sites,” says Gupta. Model predictive control (MPC) is a technology where the equipment is monitored for various operating parameters and is then operated in a particular range to get maximum efficiency, while maintaining the constraints in the system.

At the heart of this lies Disha, a business intelligence initiative that uses dashboards driving critical actionable insights. “The philosophy for developing Disha was to make the right data available to the right people at the right time. We wanted to remove file-based data sharing and reporting as significant time goes in creating these reports. We connected data from various sources such as SAP HANA, Historian, Microsoft SharePoint, Petrel, LIMS, and Microsoft Azure cloud onto a single Microsoft PowerBI ecosystem where customized reports can be created,” says Gupta.

Disha was developed in a hybrid mode with an in-house team and an analytics provider over the course of three years. It offers more than 200 customized dashboards, including a well-monitoring dashboard, a production-optimisation dashboard, a CEO and CCO dashboard, and a rig-scheduling dashboard.

“With data now easily and quickly accessible in an interactive format across the organisation, which was earlier restricted to a select few, the corrective actions for resource allocation are now based on the data,” Gupta says. “For instance, we leverage Disha to monitor the parameter and output of the electronic submersible pump, which handles oil and water. It helps us in tracking the gains achieved through MPC implementation. All this enables better decision-making and has helped to allocate resources in optimized manner, thus managing the decline in productivity.” Going forward, Cairn plans to partner with a few big analytics providers and build a single platform to help contextualize its data and deploy micro solutions, according to business needs. “This will be a low-code platform that will enable individual teams to build solutions on their own,” Gupta says. “The initiatives are oriented towards sustaining the production levels, while reducing time to first oil. Some of the initiatives include artificial lift system monitoring, well monitoring, and well-test validation,” says Gupta.