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Leveraging Artificial Intelligence in Oil and Gas Industry
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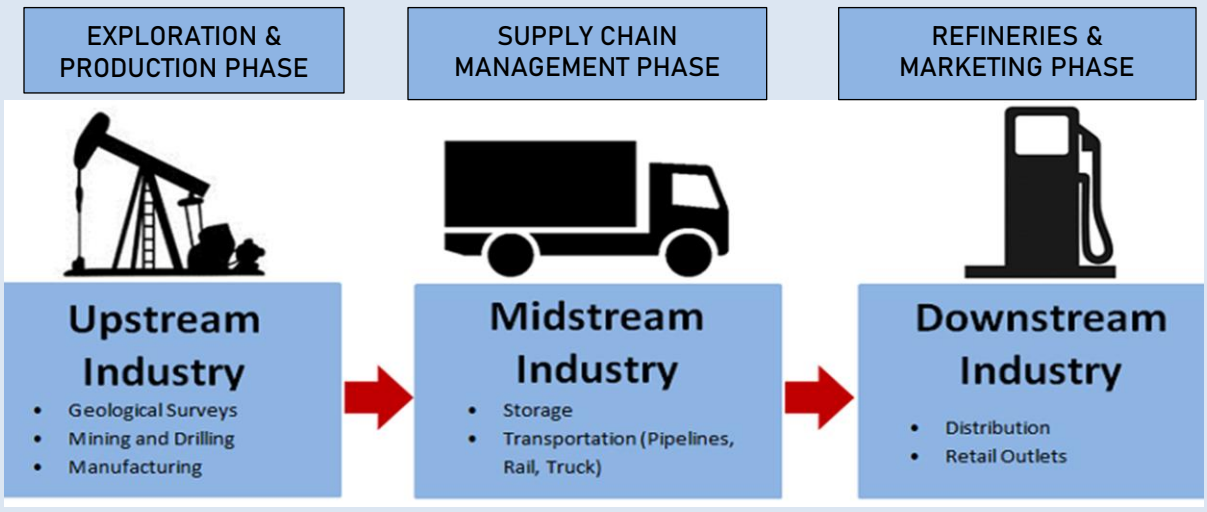
Abstract

In this white paper we analyze how Artificial Intelligence (Ai) can cause technological disruptions to the oil and gas industry. At present the focus is to automate the capital intensive processes in the ONG sector which are considered as a vital part of the country's economy. Based on the analysis of various AI applications and the review of existing processes, we outline the most recent trends in developing AI-based solutions to reduce production costs, improve operational efficiencies and human safety. We also outline some of the possible use case scenarios of how artificial intelligence will benefit and transform the Oil & Gas Industry.

INTRODUCTION:

Over the years, the rise of artificial intelligence (Ai) has fundamentally transformed the very meaning of ideas, innovation, and invention. In the industries like healthcare, transportation, retail, media, and finance, Ai has already triggered substantial changes and transformed the competition rules. Instead of relying on traditional/conventional human-centered business processes, companies from these industries are contributing huge value using AI solutions. For instance Ai has made a major impact in applications such as drug discovery, disease predictions, insurance fraud, supply chain management, etc.

However, not only companies from digital-savvy industries are profiting from Ai, but even Oil and gas/mining industries started embracing and getting more dependent on (AI) solutions to improve efficiency in Production, Transportation and Sales. This greatly helps in reduction of the overall carbon footprint and also providing a safe work environment from hazardous gases. Although the first applications of AI in the oil and gas industry were considered in the **1970s**, the industry started adopting innovative AI solutions only in the recent past. This paper aims to discuss in detail and demonstrate how AI is transforming the oil and gas industry.



Business Challenges



The oil and gas sector is constantly going through disruptions in production and delivery. As the world continues to be dependent on fossil fuels and also the renewable sources of energy, there are micro and macro challenges that are affecting the industry.

The following are the list of common challenges:

- To produce energy at lower cost while maximizing use of renewables and also achieving a reduction in greenhouse gases from fossil fuels.
- Improving equipment reliability to ensure unplanned downtime and increase the throughput.
- Unable to overcome some of the critical economic factors such as volatile market prices, fluctuating demand, complex compliance and regulatory regimes, projects that involve multiple third party suppliers.
- Unable to ensure human safety from hazardous gases during the product, transportation and refining processes.
- Lack of controlling the oil spills which can lead to catastrophic conditions on the planet.
- Unable to accurately predict demand forecasts.
- Unable to identify the root cause and drivers of non-productive time.

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How Ai can help....





Artificial intelligence (Ai) is proving to be a cost-saving investment for the oil and gas industry. It is increasingly being used to improve various processes such as upstream, midstream, and downstream process in the industry i.e. from equipment diagnostics to actual drilling process. Applications such as quality control, production planning, predictive maintenance, transportation and delivery, refining can benefit from Ai solutions.

Ai is used for data analytics and predictions using appropriate algorithms. Data models are developed using historical data to predict events such as Climate change, Equipment failure, geo locations for high oil reserves and optimization of process parameters for Crude Oil refining.



Typical Use Cases for ONG



Oil and gas is one of the most lucrative industries, it's also one of the most dangerous. Artificial Intelligence optimizes business operations, productivity, and safety.
The following are a few Use Cases where Ai solutions can address the various challenges of the oil and gas industry.

Predictive Maintenance:

During inspection and maintenance, we aim to detect any anomalies that may threaten the operational integrity of O&G assets, still errors and mistakes occur during inspection. Also, O&G companies need to perform optimization of inspection and maintenance plan because performing these activities can be costly.



Machine learning algorithms provide increased levels of automation in the knowledge engineering process, replacing much time-consuming human activity with automatic and optimized techniques that improve accuracy or efficiency by discovering and exploiting regularities in data.



Quality Assurance:

One example of the challenges in the oil and gas industry is identifying improper threading in pipelines or material defects in error-prone mechanisms. Defects found at the end of the production line from upstream issues cost factory and budget resources. For example, if the damaged oil pipeline or machine is installed into production line, this could result in severe revenue loss. These revenue losses are comparatively much higher than the cost of AI adoption.

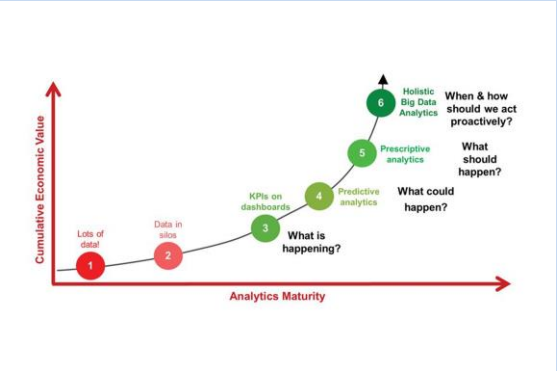
Deploying a computer-vision based system and data analytics will allow us to verify the quality of pipes for oil flow and provide deep insights of defects. AI powered Defect Detection solutions are cost-effective and extremely economical in comparison to the prevailing methodologies. This solution can be customized to determine type of defects for different pipes (material and dimensions). It also provides valuable information regarding the real time condition of the pipes based on the weather conditions.



Production Cost Reduction:

Due to fluctuations in temperatures and environmental conditions, oil and gas components often face material degradation and corrosion. AI solutions can prevent incidents like this from occurring. IoT devices can be used for data capture and Ai can be applied to detect signs of corrosion by analyzing various parameters using knowledge graphs and predictive intelligence to approximate the corrosion occurrence probability and raise alerts to pipeline operators. This allows companies can be proactive in handling the corrosion risks and reduce downtimes by adoption of Ai based Predictive maintenance solutions.





Ai based Data Analytics

Oil and gas businesses deal with lots of data coming from manufacturing processes but due to lack of proper analytics tools, they're unable to capitalize on the massive data resting in data silos. AI solutions study and analyze various data streams from various sensors and machinery of different plants or entire Geoscience data and extract real-time analytics to generate intelligent suggestions based on business needs. These deep insights enable geoscientists to have better visibility of the overall processes and operations, thereby enabling them to make better strategic decisions. This leads to improved operations efficiency, cost reduction and even reduces the risk of failure.

Enhancements to Supply Chain and logistics



The supply chain for the oil and gas industry is a complex operation where there are several key decision nodes like crude oil purchase, transportation to the refinery, refining operations, gantry operations, and retail sale of end products. Application of artificial intelligence and Machine Learning in the supply chain of oil and gas operations plays a vital role which includes Prediction of the market price of crude oil and finished products, proper planning and scheduling, enabling optimization of the crude basket, creating a smart warehouse, maintenance of inventories, handling enabling optimization of the crude basket, creating a smart warehouse, maintenance of inventories, handling shipping operations, Risk hedging, and improved delivery times and reduction in overall costs.

Ensure Safety and Security Standards

Oil and gas plants operate in extremely critical environments and the risk of injury is much higher than traditional manufacturing environments. Employees are sometimes exposed to toxic fumes and unsafe conditions. Not following proper safety protocols can result in injury and financial penalties. Companies are obliged to adhere to safety standards enforced by law. Not adhering to these standards result in hefty fines. Current safety solutions are usually not adequate for possible scenarios. An AI-powered computer-vision solution can monitor the work site to ensure workers are following safety procedures without any deviations. Video data is then analyzed to send alerts and proactive recommendations. AI solutions can alert management even for the smallest deviations in compliance. In another example, Ai models can be used to analyze data from gas sensors to predict dangerous chemical gases or explosions