

# Transforming National Data Repositories (NDRs)

## Pioneering Data Management and AI/BI\* Deployments

\* Artificial Intelligence/ Business Intelligence

**greenojo**  
smart n sustainable solutions 



# COMMITTED ORGANIZATION FOR OIL & GAS INDUSTRY



Local & International  
technical personnel

Principals with average  
of 20+ years in select  
Industry verticals

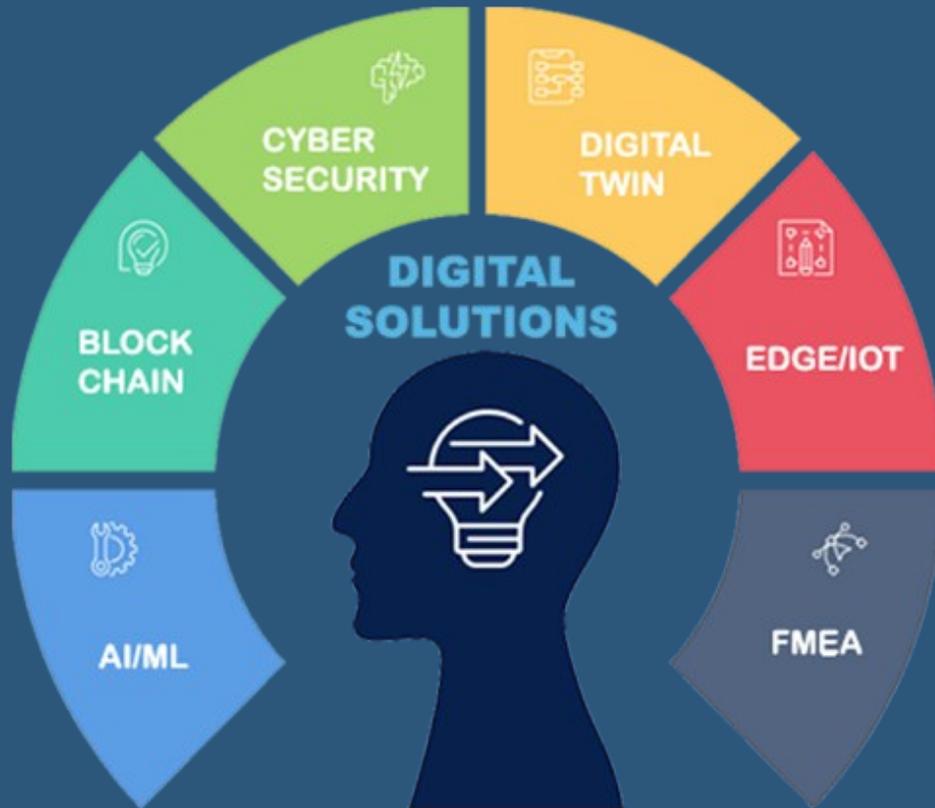
Project and risk  
management  
methodologies

Quality service delivery  
focused

Industry specialists in  
designing and  
developing next-  
generation digital  
platforms

Head office in India,  
Project offices in US &  
Nigeria

# PARTNER FOR NEXT GEN DIGITAL ENTERPRISES



Digital Transformation  
Strategy

Platform Architecture  
and Analysis

Industrial AI Center of  
Excellence (CoEs)

Technical Solution  
Design  
and Development

Service Experience  
Design to Deploy

Business Process  
Reengineering

# PROJECTS - OIL & GAS

## Production & Facility Engineering

Designed Production Optimization Models, Tuned Models (Production Allocation, Target Monitoring), Tuned Integrated Models (Optimum Choke Setting, Separator Parameters)

## Asset Evaluation Reports

Designed an integrated asset development framework covering Reservoir Performance Model, Economic Model and Forecast & Development Model

## 3D Seismic Data Re-Processing

Project involved 2D seismic PSTM and AVO test processing, Inversion studies, Field Development Studies, seismic PSTM reprocessing

## Water Injection Study

Prediction of oil production by water flooding, Petrophysical analyses on 28 wells, wireline logs and core data analysis, geo-cellular model using object modeling with production history reconciliation

## AVO & Seismic Inversion for Reserves Delineation

Project involved provision of amplitude versus offset (AVO) study to delineate possible areas of gas accumulation along with Inversion study with Seismic Sculpting to produce 3D Facies

## Brown Field Production Enhancements

Brown field production enhancement deploying techniques that optimize well performance and production levels

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Developing Master  
Data Management  
Platforms

PPDM 3.9

Deploying AI CoEs  
for NDRs

AI/BI Workbench

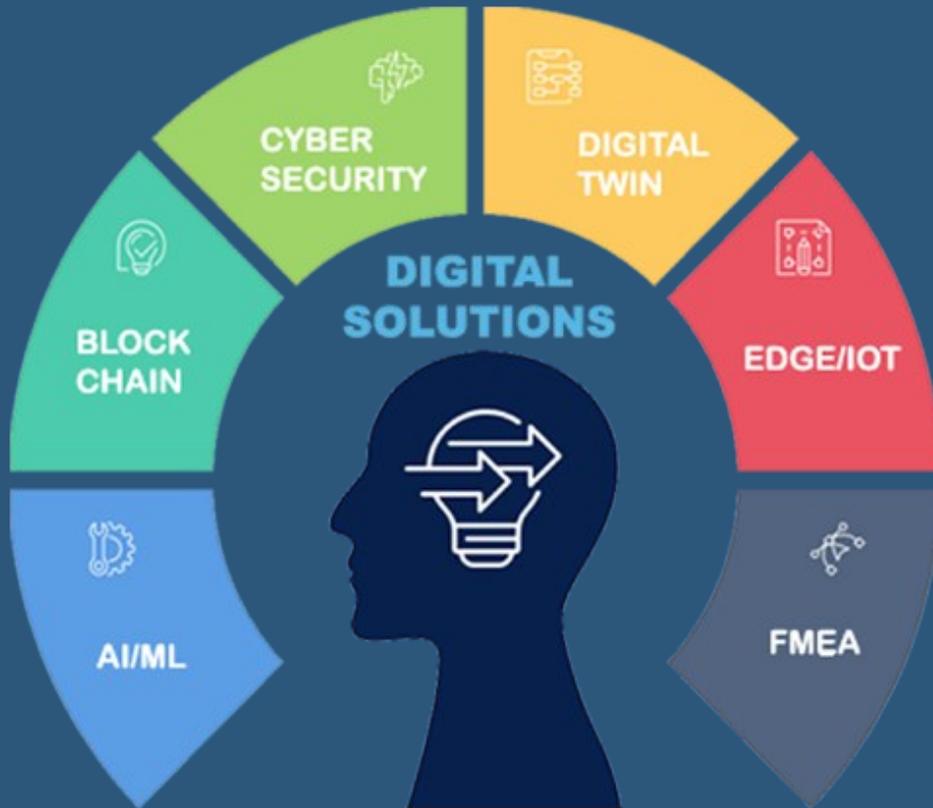
Designing QA/AC  
Rules

Open Platforms

Managing  
Brownfield  
Production

Applied AI

# Data Management for National Data Repository (NDR)



## CASE STUDY 1

**Custom Built Data Management Platform (PPDM 3.9) for an Upstream Petroleum Regulatory Commission**

# NDR DATA MANAGEMENT

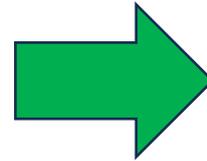
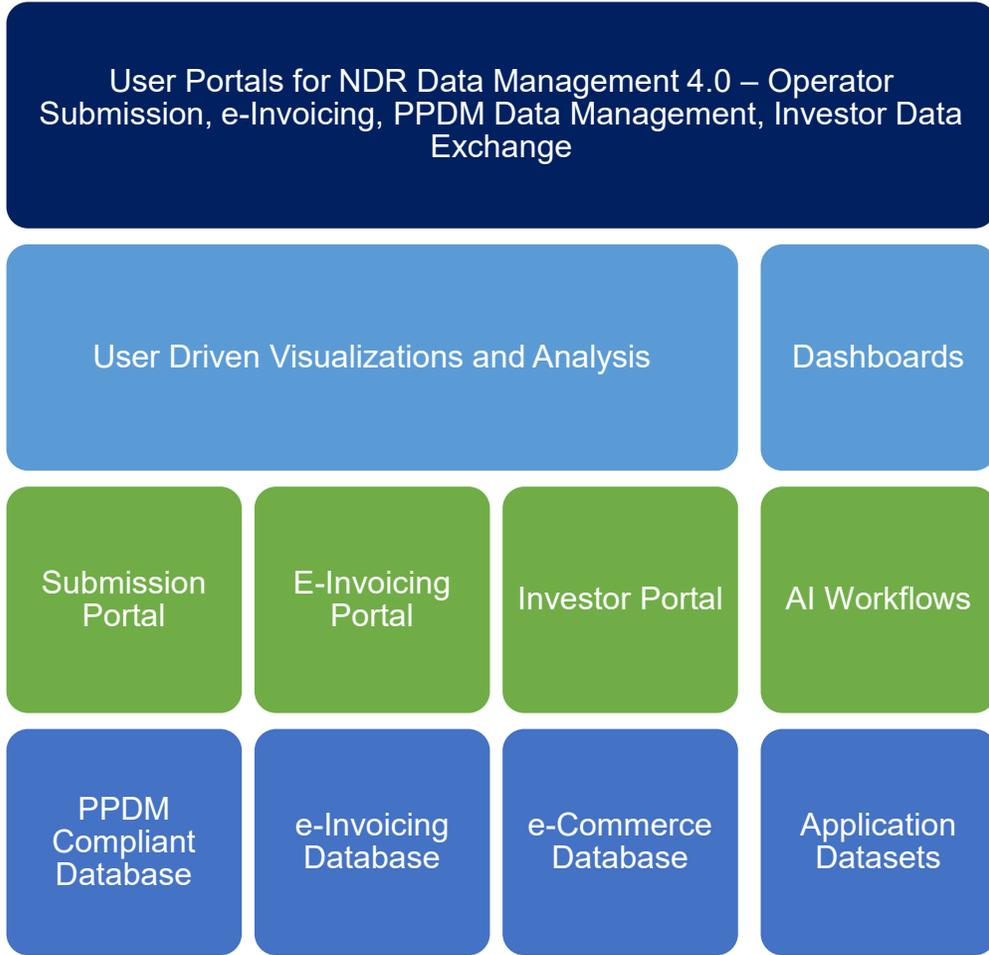
NDR Data Management Layers	Layer Description
Data Acquisition Layer	This layer consists of data acquisition tools and processes that collect data from various sources, including oil and gas companies, government agencies, and other stakeholders. The data may include geological, geophysical, well log, production, and other types of data.
Data Storage Layer	This layer consists of a centralized data repository that stores all the data collected from various sources. The data is stored in a standardized format using the PPDM data model and is accessible to authorized users through various interfaces.
Data Integration Layer	This layer consists of tools and processes that integrate data from different sources into a single repository. This layer is responsible for ensuring that the data is consistent, accurate, and up-to-date.
Data Analysis Layer	This layer consists of tools and processes that analyze the data stored in the NDR. This layer includes tools for data visualization, statistical analysis, machine learning, and other types of data analysis.
Data Governance Layer	This layer consists of policies, procedures, and processes that ensure that the data stored in the NDR is managed properly. This layer includes data quality control, data security, data access control, and other types of data governance processes.
Data Delivery Layer	This layer consists of tools and processes that deliver data to various stakeholders, including oil and gas companies, government agencies, and other interested parties. This layer includes data delivery interfaces, such as web portals, APIs, and data feeds.

# DATA MANAGEMENT TOOLS

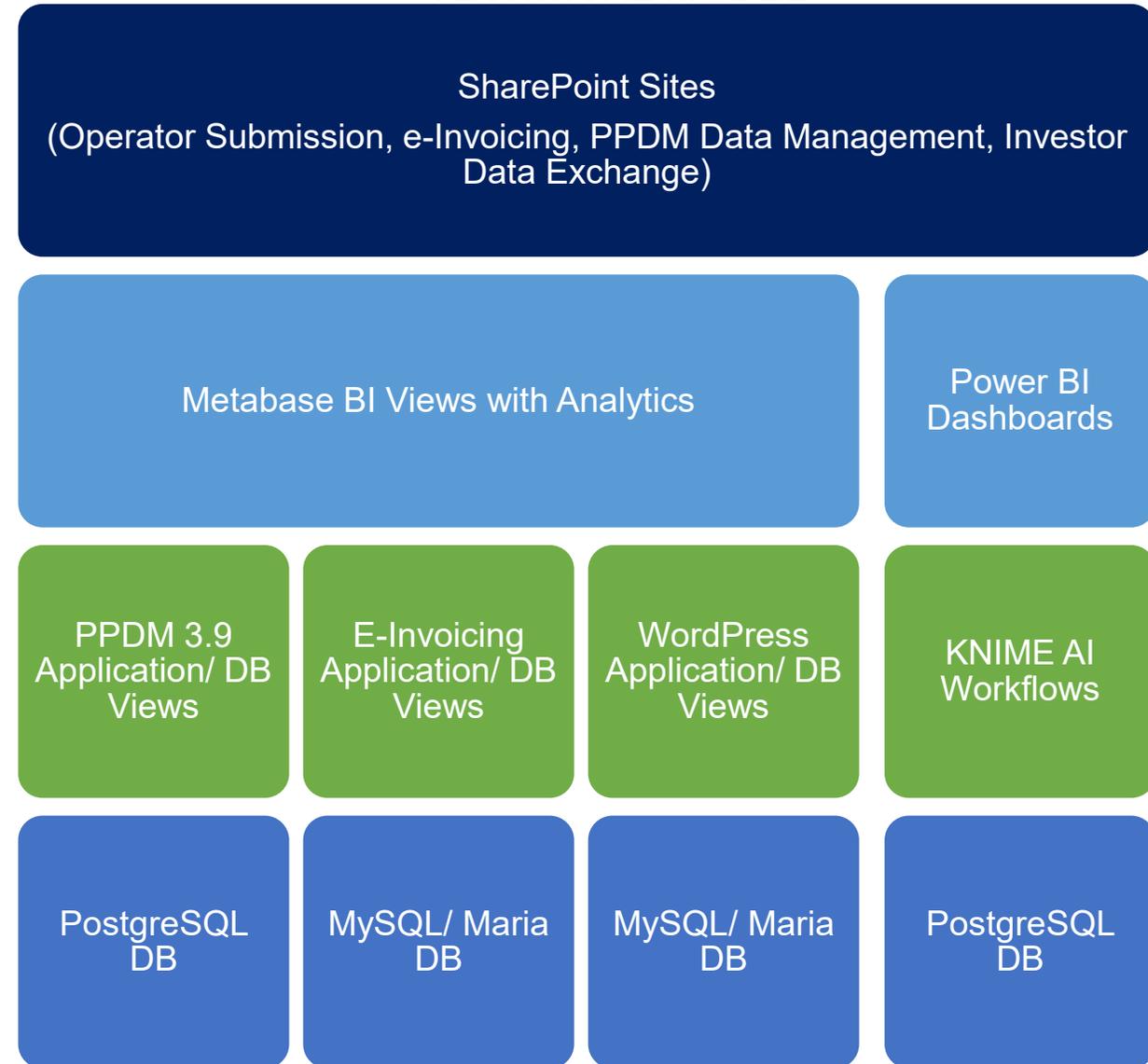
NDR Data Management Layers	Open License Stack	MS License Stack
Data Acquisition Layer	<b>SQL Query Workbench (pgAdmin, mySQLWorkbench)</b> : A data integration tool for collecting, transforming, and routing data.	<b>Power Apps</b> : A low-code platform for building custom data collection apps.
Data Storage Layer	<b>PostgreSQL</b> : A relational database management system that supports the PPDM data model. <b>MySQL/Maria</b> : A relational database management system that supports the e-Invoicing and e-Commerce Portal.	<b>Azure SQL Database</b> : A cloud-based relational database service
Data Integration Layer	<b>SQL Query Workbench (pgAdmin, mySQLWorkbench) / Pentaho Kettle (optional)</b> : A data integration tool that supports ETL (extract, transform, load) processes.	<b>SharePoint Online</b> : A cloud-based collaboration & document management platform for integrating and sharing data and metadata.
Data Analysis Layer	<b>Metabase</b> : A data visualization and business intelligence platform. <b>KNIME</b> : An open-source data analytics, reporting and integration platform.	<b>Power BI</b> : A business intelligence platform for data visualization and reporting. <b>Power BI Report Builder</b> : For managing paginated reports from Power BI workspace and other data sources.
Data Governance Layer	<b>Native/Built-in DB Specific Governance Tools</b> : Metadata management and governance tools (part of the PostgreSQL as well as MySQL/Maria) that can be used to manage data lineage, data classification, and data access policies.	<b>Azure Active Directory</b> : Cloud service identity & access management service for managing data access policies. <b>Azure Policy</b> : Cloud service for enforcing policies for data access & other types of governance.
Data Delivery Layer	<b>WordPress with WooCommerce</b> : An open-source content management platform with an e-commerce that is used for publishing, sharing & selling E&P data catalogues with payment integrations. <b>E-Invoicing Platform (Ninja)</b> : An open-source e-invoicing platform for to invoice clients, accept payments, track expenses & time billable-tasks	<b>SharePoint Online</b> : A cloud-based collaboration & document management platform for integrating and sharing data and metadata. <b>Azure API Management</b> : Cloud service for building & managing APIs for data delivery.

# DEPLOYED STACK

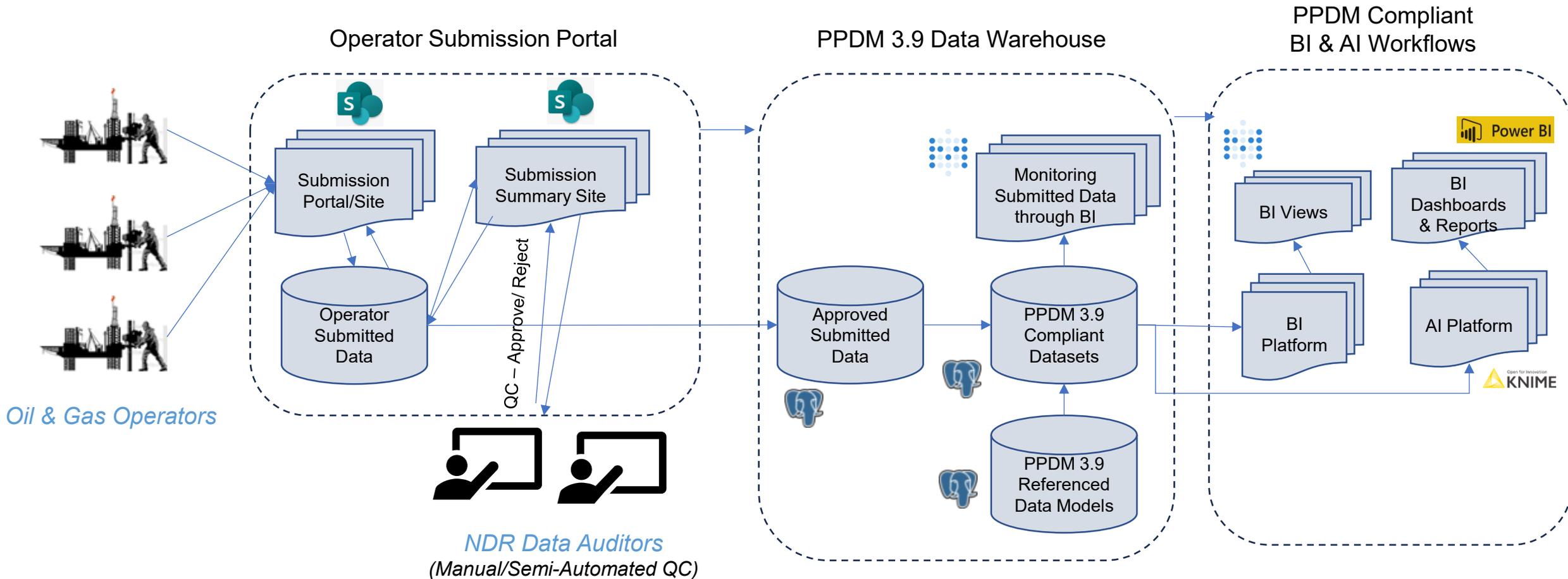
## FUNCTIONAL MODEL



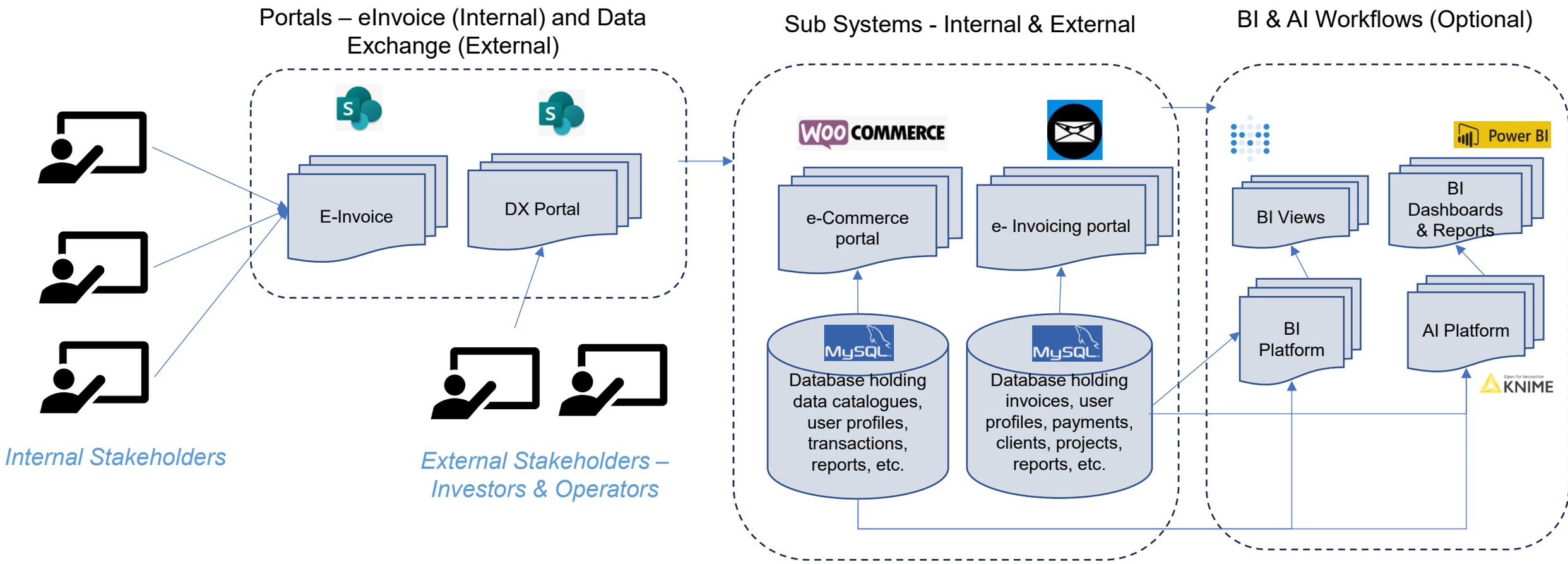
## TECHNICAL MODEL



# SYSTEM WORKFLOWS



# SYSTEM WORKFLOWS



# PPDM 3.9 BENEFITS

Standardized data model for easy integration and analysis of upstream petroleum data

Enhanced data accessibility with a centralized repository for all upstream petroleum data

Access to analyst reports for informed decision-making

Increased transparency and efficiency in trading E&P data

**Supervising Upstream Petroleum Operations:** PPDM 3.9 provides a standardized data model for managing all aspects of upstream operations, including well data, production data, and lease information.

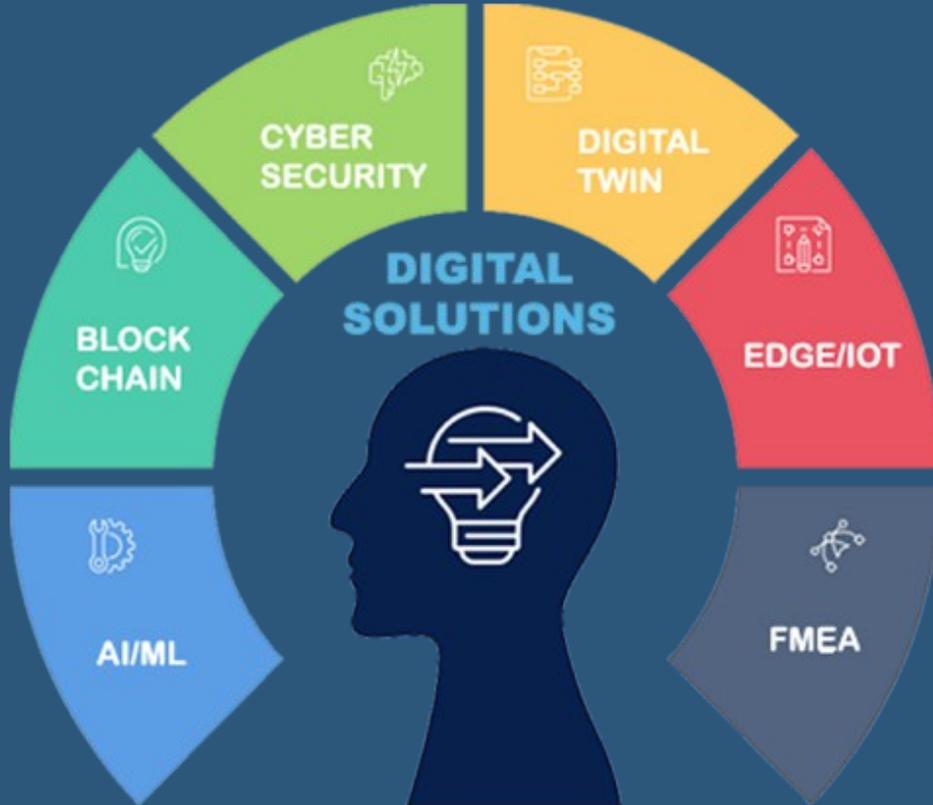
**Monitoring Operations:** PPDM 3.9 helps NDR to monitor operations by providing real-time data on production, reserves, and other key metrics. This data can be used to ensure that operations are in line with national goals and aspirations.

**Ensuring Compliance:** PPDM 3.9 includes data governance features that supports compliance with health, safety, and environmental regulations. It can also help track and manage compliance with domestic gas delivery and crude oil supply obligations.

**Maintaining Records:** PPDM 3.9 provides a robust data management platform for maintaining records on upstream petroleum operations. It helps NDR to track production, exports, licenses, and leases more effectively.

**Advising Government:** PPDM 3.9 provides timely and accurate advice to government and relevant agencies on technical matters and public policies. It provides data-driven insights to support decision-making.

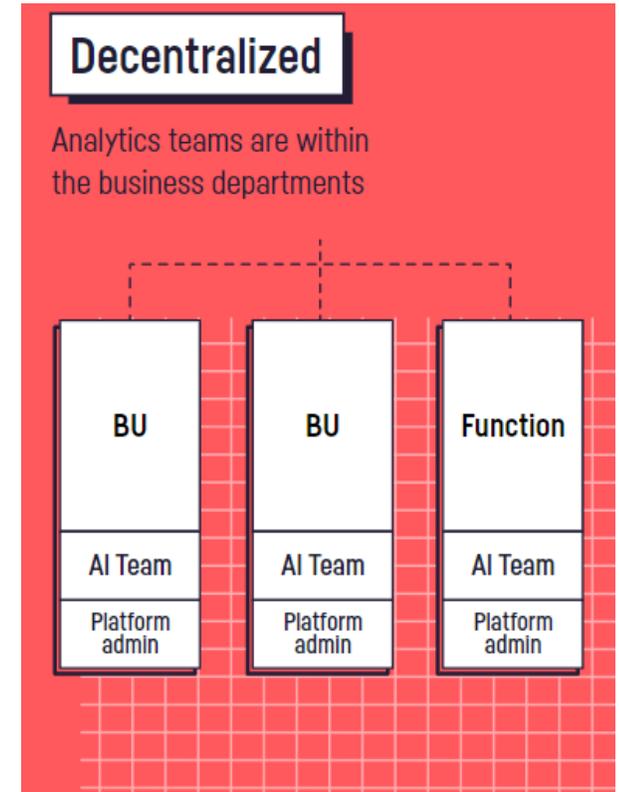
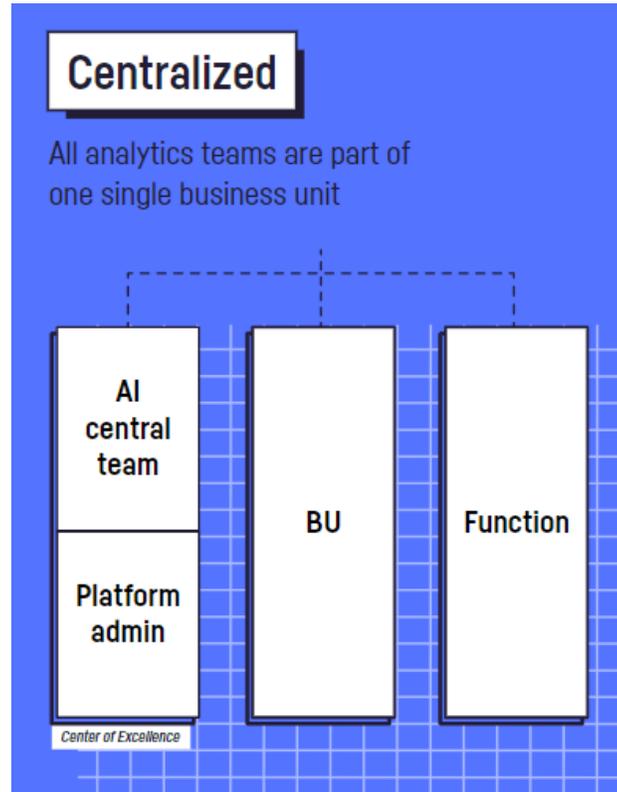
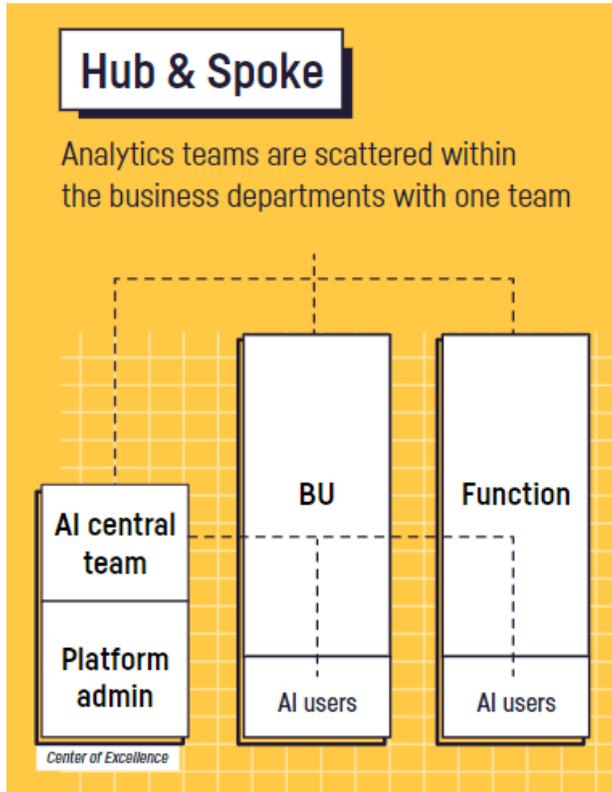
# AI COE for National Data Repository (NDR)



## CASE STUDY 2

Designing an AI Centre of Excellence (CoE) for an Upstream Petroleum Regulatory Commission

# AI COE - "CENTRALIZED" AS THE PREFERRED MODEL



# AI COE PROGRAMS

## National Data Repository (NDR)

E&P Data Management

Production Monitoring System & Forecasting

Upstream Leases, Licences and Permits Management

## Oil and Gas Excellence Centers

National Improved Oil Recovery Centre

Oil & Gas Competence Development Centre

Integrated Data Mining & Analytics Centre

## Other Key AI Initiatives

Managing Gas Flare Management

Oil Production Reconciliation & Revenue Management

Health Safety & Environmental regulations related to Oil Spills

# AI COE - USE CASES FOR E&P DATA MANAGEMENT



Seismic	Well Logs	Drilling	Production	Reservoir
Seismic Data Analysis	Well Logs Digitization	Drilling Operational Dashboards	Production Forecasting	Reservoir Modelling
Seismic Scanned Images to SEG-Y	Well Logs Splicing & Merging	Auto Identification of Drilling Process	Production Audits	Reservoir Production & Recovery Factor Analysis
Salt Prediction	Well Logs Correlation	Measuring Drilling Efficiencies for NPT	Decline Curve Analysis	Pressure distribution in the reservoir
Seismic Inversion	Lithology Prediction/ Facies Classification	Well Integrity Incidents Analysis	Production Optimization (Flow Rate Forecasting)	EOR Analytics

# AI COE - E&P DATA MANAGEMENT SERVICES

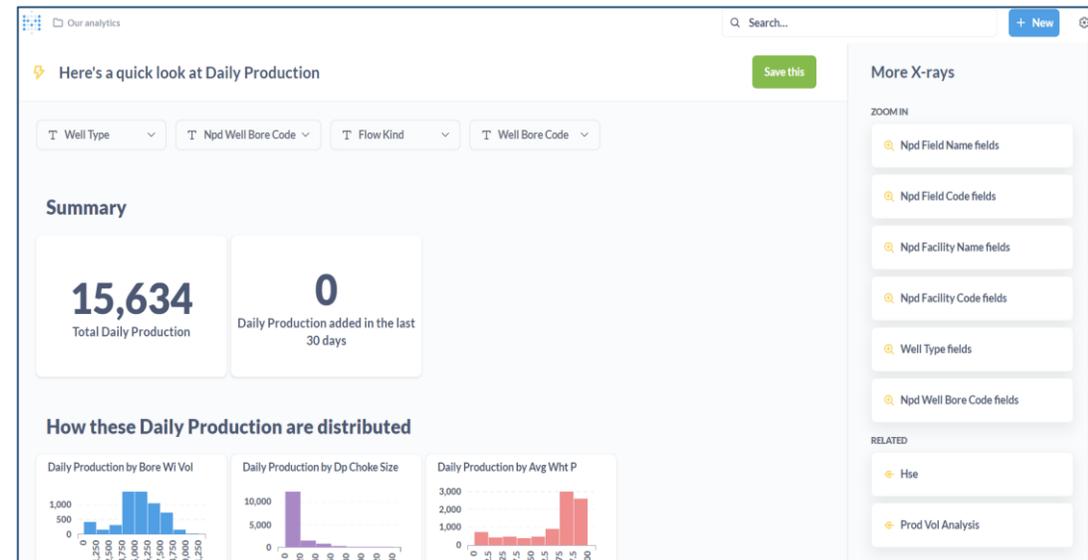
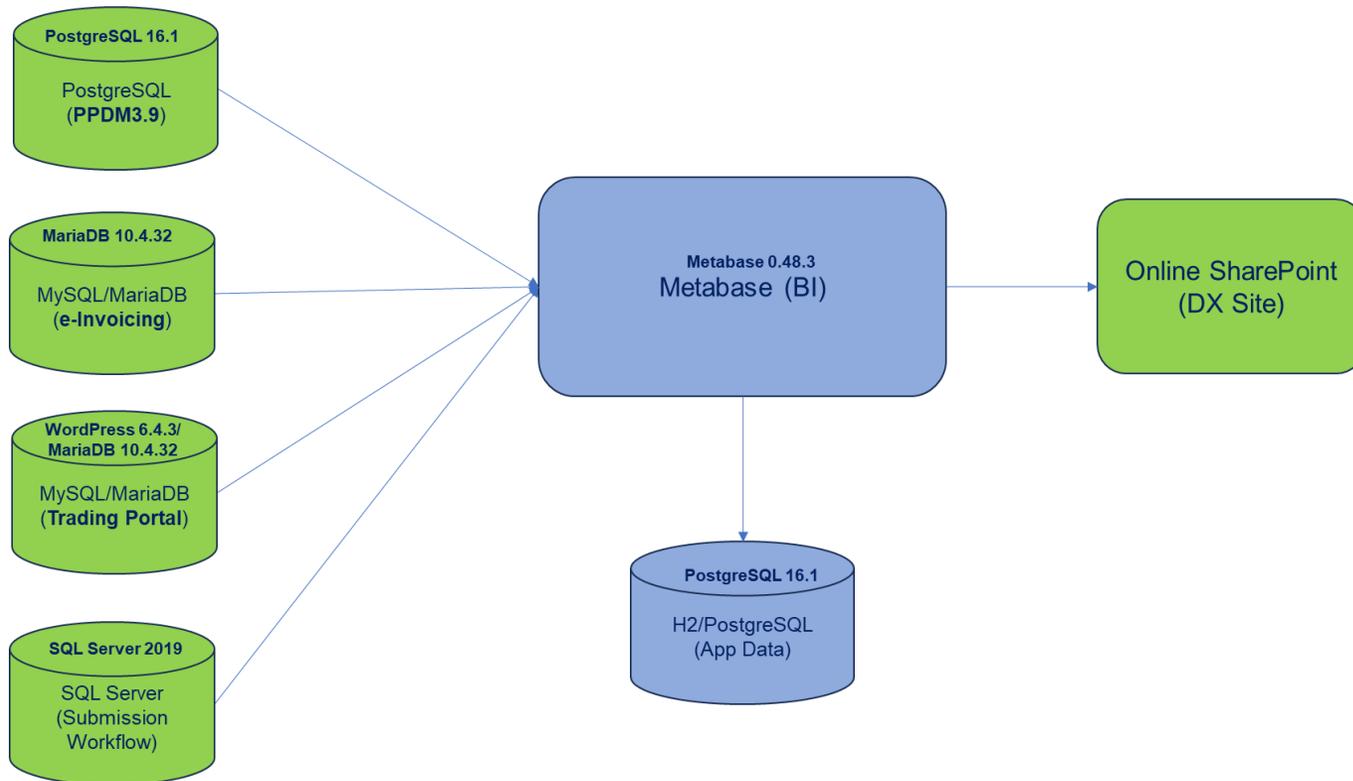
Automation in E&P Data Management	Analytics in E&P Data Management	AI in E&P Data Management
<ul style="list-style-type: none"> <li>• Seismic Digitization (Sections Images to SegY)</li> <li>• Well Logs Digitization (Images to LAS)</li> <li>• Well Logs Splicing and Merging</li> <li>• Well Logs Correlation</li> <li>• Drilling Operations Monitoring</li> <li>• Measuring Drilling Efficiencies for NPT</li> </ul>	<ul style="list-style-type: none"> <li>• Salt Prediction</li> <li>• Seismic Inversion</li> <li>• Lithology Prediction</li> <li>• Rules Based Monitoring of Fracture Index</li> <li>• Well Integrity</li> <li>• Production Analysis, Decline Curve Analysis (DCA)</li> </ul>	<ul style="list-style-type: none"> <li>• Facies Classification</li> <li>• Stuck Pipe, Drill Bit Selection</li> <li>• Production Optimization (Flow Rate Forecasting)</li> <li>• Gas Lift Optimization (Artificial Lift Selection)</li> <li>• Reservoir Production Analysis</li> </ul>

## AI Capability Maturity Model

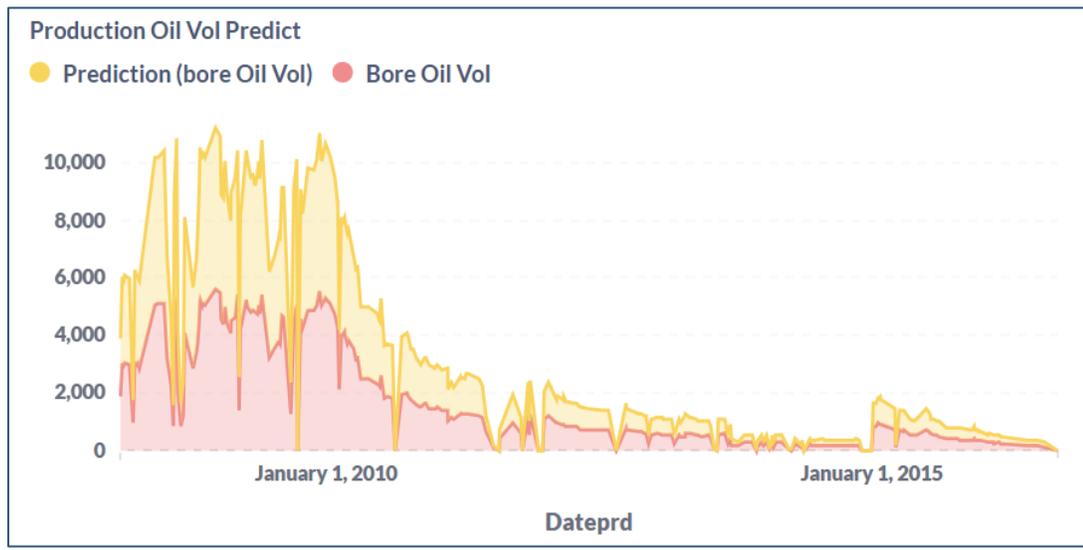
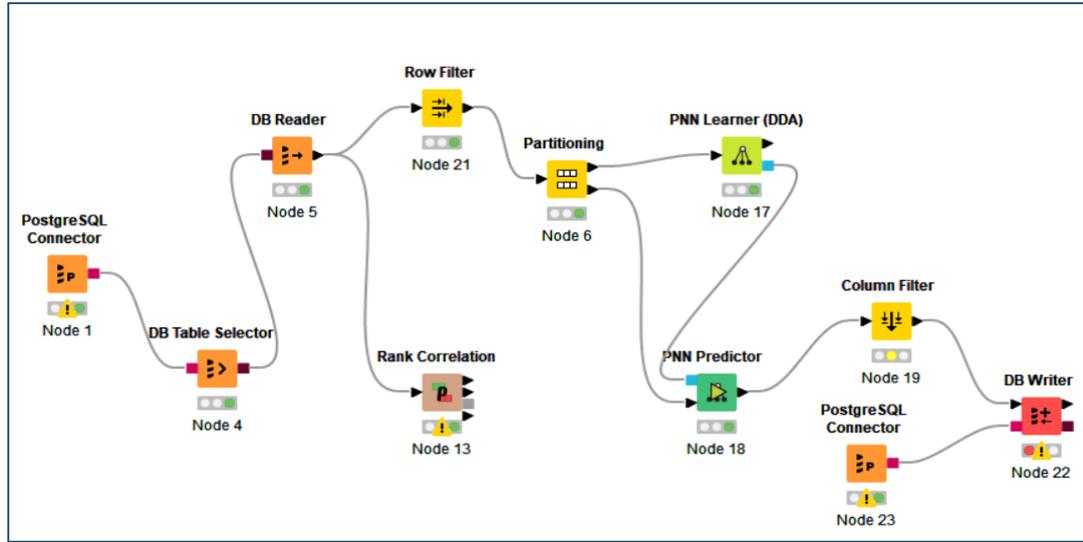
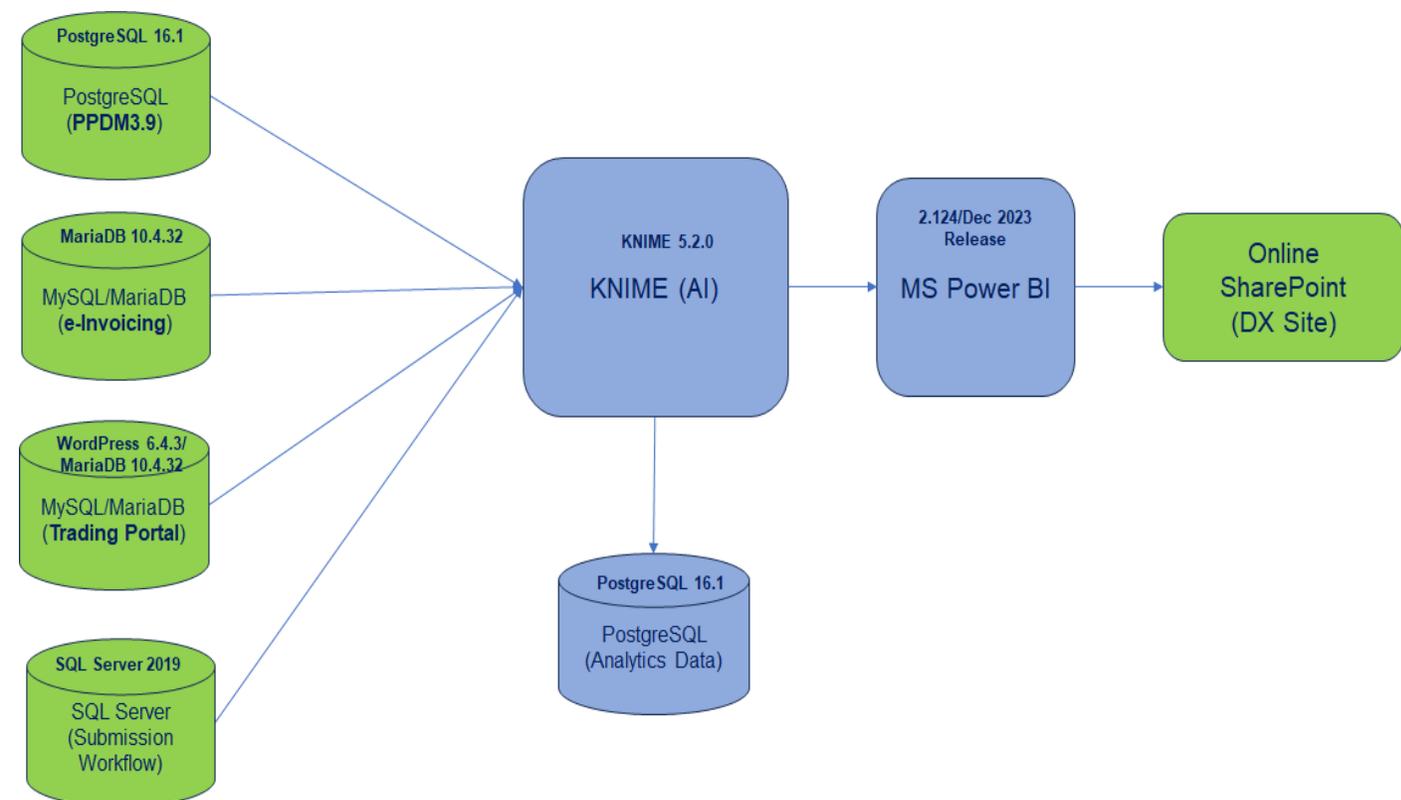
**Organizational Maturity**  
Capacity to Execute and Manage AI Initiatives.



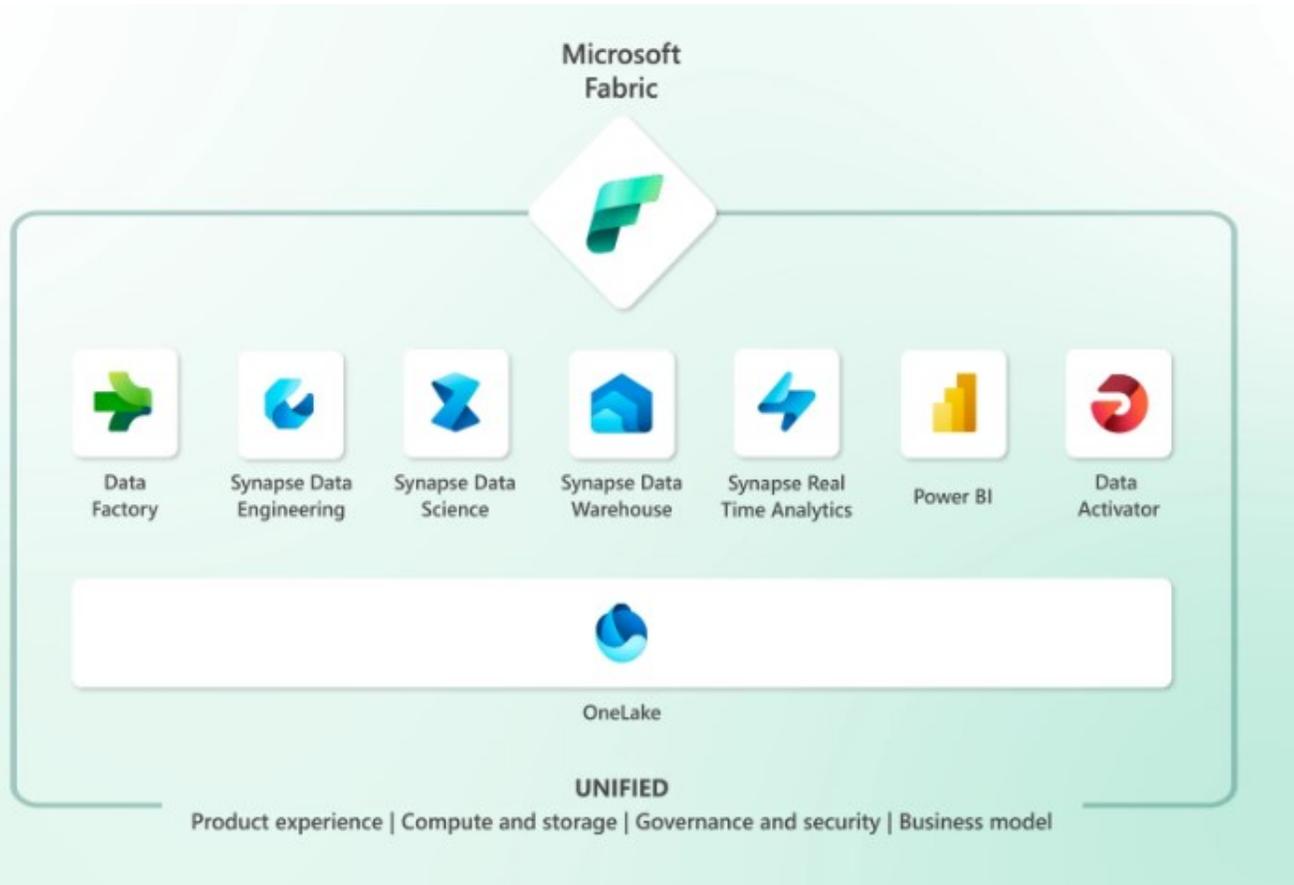
# E&P DATA MANAGEMENT - SETTING UP BI WORKBENCH



# E&P DATA MANAGEMENT - SETTING UP AI WORKBENCH



# AI COE STACK - LEVERAGING MICROSOFT FABRIC



**Data Factory** provides 100+ connectors to cloud and on-premises data sources, drag-and-drop experiences for data transformation, and the ability to orchestrate data pipelines.

**Synapse Data Engineering** enables great authoring experiences for Spark, instant start with live pools, and the ability to collaborate.

**Synapse Data Science** provides an end-to-end workflow for data scientists to build sophisticated AI models, collaborate easily, and train, deploy, and manage machine learning models.

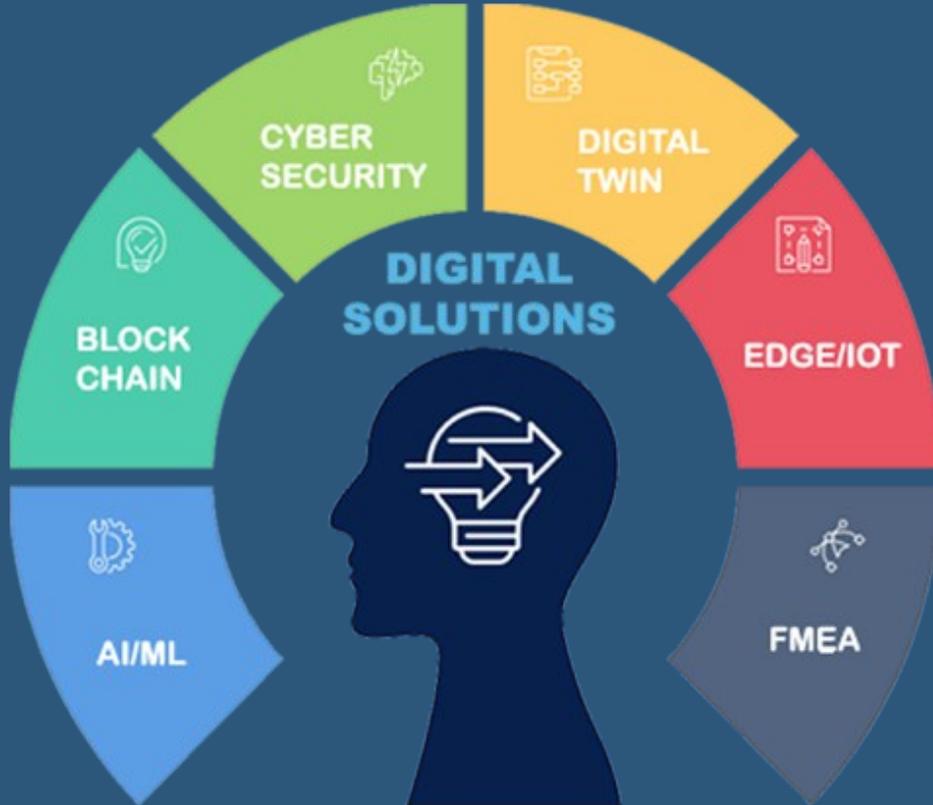
**Synapse Data Warehousing** provides a converged lake house and data warehouse experience with industry-leading SQL performance on open data formats.

**Synapse Real-Time Analytics** enables developers to work with data streaming in from the Internet of Things (IoT) devices, telemetry, logs, and more, and analyze massive volumes of semi-structured data with high performance and low latency.

**Power BI in Fabric** provides industry-leading visualization and AI-driven analytics that enable business analysts and business users to gain insights from data.

**Data Activator** provides real-time detection and monitoring of data and can trigger notifications and actions when it finds specified patterns in data—all in a no-code experience.

# QA/QC Rules for National Data Repository (NDR)



## CASE STUDY 3

### Designing QA/AC Rules for an Upstream Petroleum Regulatory Commission

# E&P DATA MANAGEMENT SERVICES

Data Standardization	Data Migration	Data Cleansing	Data Integration
<ul style="list-style-type: none"> <li>• Seismic Headers Standardization (SEG)</li> <li>• Extraction of Metadata &amp; Metadata Management</li> <li>• E&amp;P Data Standardization (Energistics Standards)</li> <li>• Well Log Naming Standardization</li> <li>• Well Naming &amp; Nomenclature</li> <li>• Horizon Naming</li> </ul>	<ul style="list-style-type: none"> <li>• Data base Creation with PPDM 3.9 Data models</li> <li>• Data mapping as per Industry standards.</li> <li>• Data Loading (Scripts/Forms)</li> <li>• Data capturing tools.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspection &amp; Cleaning of data for errors, inconsistencies, redundancies, and incomplete information in Seismic, Well and Well Log, Drilling and Production Data</li> <li>• Data Quality – Correct, standardize and verify data, consistent datum'</li> </ul>	<ul style="list-style-type: none"> <li>• Match, merge or link data from a variety of data sources</li> <li>• Integration of E&amp;P databases with ERPs for MIS and BI reports</li> <li>• Integration of E&amp;P databases with GIS portals</li> </ul>

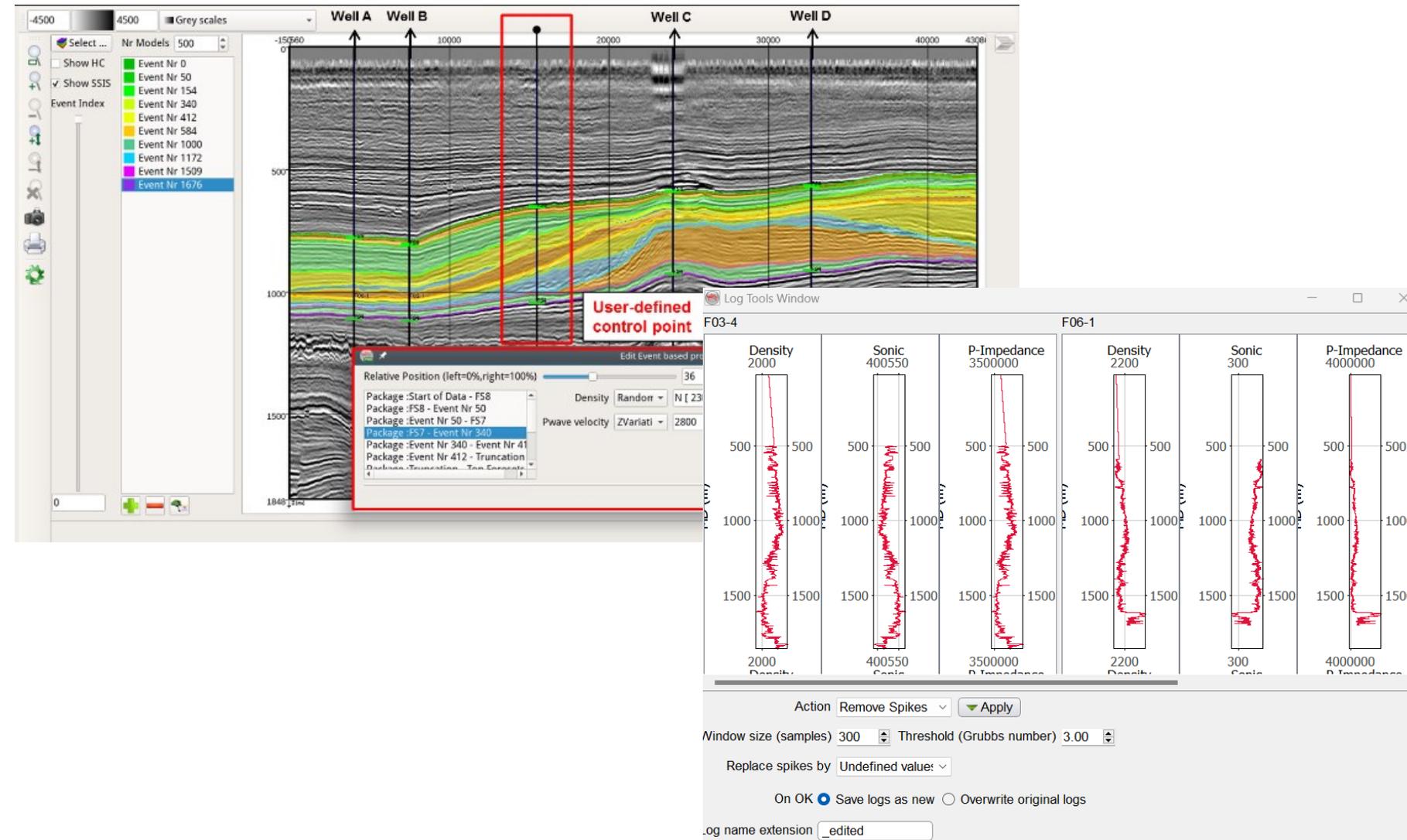
# DESIGNING QA/QC RULES REPOSITORY FOR E&P DATA

<b>Seismic Data QC Rules</b>	Geometry Consistency	Detailed QC Rule: Verify that the shot and receiver positions are accurate and align with the specified survey design. Check for inconsistencies in source-receiver geometry that may affect the reliability of seismic data interpretation.
	Amplitude Scaling	Detailed QC Rule: Confirm that the amplitudes of seismic traces are consistently scaled. Inconsistent amplitude scaling can lead to misinterpretation of subsurface features, affecting the reliability of seismic attributes and analysis.
	Metadata Completeness	Detailed QC Rule: Validate the completeness of metadata, including acquisition parameters (frequency, source type, etc.) and processing history. Incomplete metadata can hinder the understanding of seismic data and its proper utilization.
	Time-Depth Conversion	Detailed QC Rule: Assess the accuracy of time-depth conversion by comparing seismic-derived depths with well-defined depths. Ensure proper calibration of time-depth conversion to avoid misalignment issues.
	Interpretation Consistency	Detailed QC Rule: Check for consistency between seismic interpretation results and geological models. Validate that seismic features align with subsurface structures as interpreted by geologists.
<b>Well Data QC Rules</b>	Well Naming Conventions	Detailed QC Rule: Ensure that well naming conventions follow industry standards and are consistent across datasets. Consistent naming conventions facilitate data integration and retrieval.
	Log Data Completeness	Detailed QC Rule: Validate well log data for completeness, checking for the presence of essential logs such as gamma-ray, resistivity, and porosity logs. Missing logs can impact the accuracy of reservoir characterization.
	Trajectory Alignment	Detailed QC Rule: Verify the alignment of well trajectories with seismic data. Ensure that deviation survey data accurately represents the path of the wellbore.
	Drilling Parameter Checks	Detailed QC Rule: Confirm the accuracy and consistency of drilling parameters, including depth, inclination, and azimuth. Inaccurate drilling parameters can lead to errors in subsurface mapping.
	Duplicate Well Records	Detailed QC Rule: Check for and resolve duplicate well records in the database to avoid errors in data analysis and interpretation.

# DESIGNING QA/QC RULES REPOSITORY FOR E&P DATA

<b>Production Data QC Rules</b>	Production Rate Consistency	Detailed QC Rule: Validate the consistency of production rates and volumes over time, ensuring that there are no sudden variations or anomalies.
	Allocation Method Validation	Detailed QC Rule: Ensure the accuracy and consistency of production allocation methods. Validate that the allocation methods used are appropriate for the reservoir characteristics.
	Well Test Data Anomalies	Detailed QC Rule: Check for anomalies in well test data, such as abrupt changes or outliers. Investigate and correct any issues that may affect the reliability of well test results.
	Fluid Property Accuracy	Detailed QC Rule: Assess the accuracy and consistency of fluid property data used in production calculations. Inaccurate fluid properties can lead to errors in estimating production volumes.
<b>Geological and Reservoir Data QC Rules</b>	Production Time Series Gaps	Detailed QC Rule: Identify and address gaps or missing data in production time series to ensure completeness and accuracy in production reporting.
	Geological Interpretation Consistency	Detailed QC Rule: Validate consistency between different geological interpretations and models, ensuring that interpretations align with well data and seismic information.
	Reservoir Simulation Accuracy	Detailed QC Rule: Assess the accuracy of reservoir simulation results by comparing simulated production with actual production data. Identify and correct discrepancies.
	Fluid Property Data Anomalies	Detailed QC Rule: Check for anomalies in fluid property data, such as unrealistically high or low values. Investigate and correct any issues that may impact reservoir simulation.
	Connectivity and Flow Simulation	Detailed QC Rule: Validate connectivity and flow simulation in reservoir models to ensure that reservoir behaviour aligns with geological and production data.
	Petrophysical Data Consistency	Detailed QC Rule: Check for inconsistencies in petrophysical data, including porosity and permeability. Ensure that petrophysical properties are coherent with well log and core data.
<b>Geospatial Data QC Rules</b>	Spatial Accuracy	Detailed QC Rule: Validate the spatial accuracy and alignment of geographic features with reference coordinates. Check for any positional errors that may affect spatial analysis.
	Metadata Completeness	Detailed QC Rule: Ensure completeness of metadata for geospatial datasets, including information on coordinate systems, projection methods, and data sources.
	Attribute Data Consistency	Detailed QC Rule: Validate the consistency and accuracy of attribute data associated with geographic features. Check for errors or discrepancies in attribute values.
	Spatial Interpolation Accuracy	Detailed QC Rule: Assess the accuracy of spatial interpolation methods used for generating continuous surfaces (e.g., contour maps). Validate that interpolation results align with observed data.
	Spatial Relationships	Detailed QC Rule: Confirm the correctness of spatial relationships between different layers in a GIS dataset. Ensure that overlay operations and spatial queries produce accurate results.

# OPEN TOOLS FOR QA/QC RULES REPOSITORY

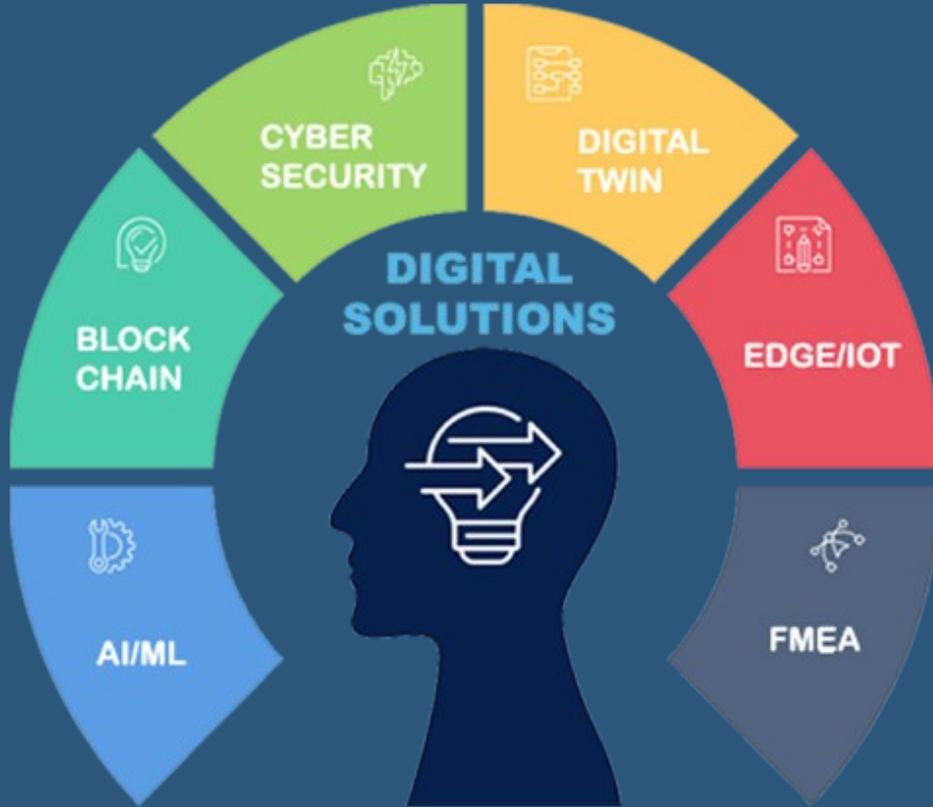


**OpendTect** : An open-source seismic interpretation software for geophysical data analysis. It's used in the upstream E&P sector for seismic data QC and interpretation.

**VTK (Visualization Toolkit)** : VTK is an open-source, cross-platform software system for 3D computer graphics, image processing, and visualization. It can be used for visualizing and analysing geospatial and subsurface data

**ODS (Open Subsurface Data Universe)**: An open-source data platform initiated by The Open Group and supported by major oil and gas companies.

# Managing Production Datasets for National Data Repository (NDR)



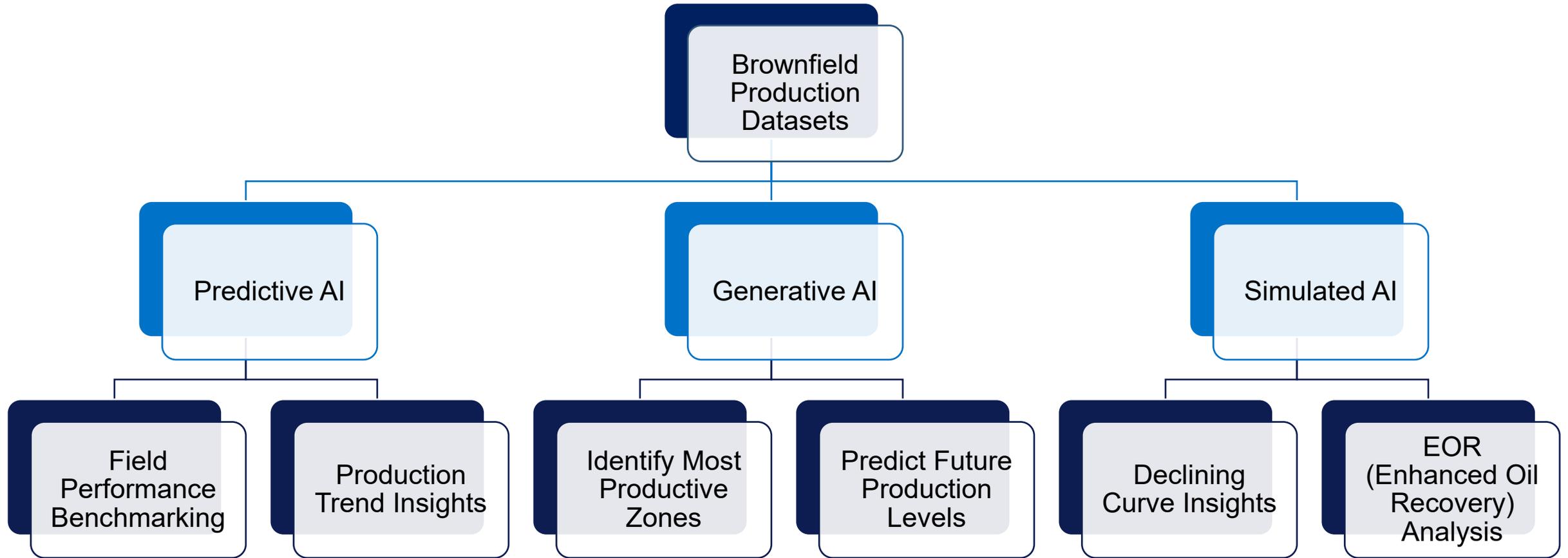
## CASE STUDY 4

### Applying AI – Managing Brownfield Production Datasets

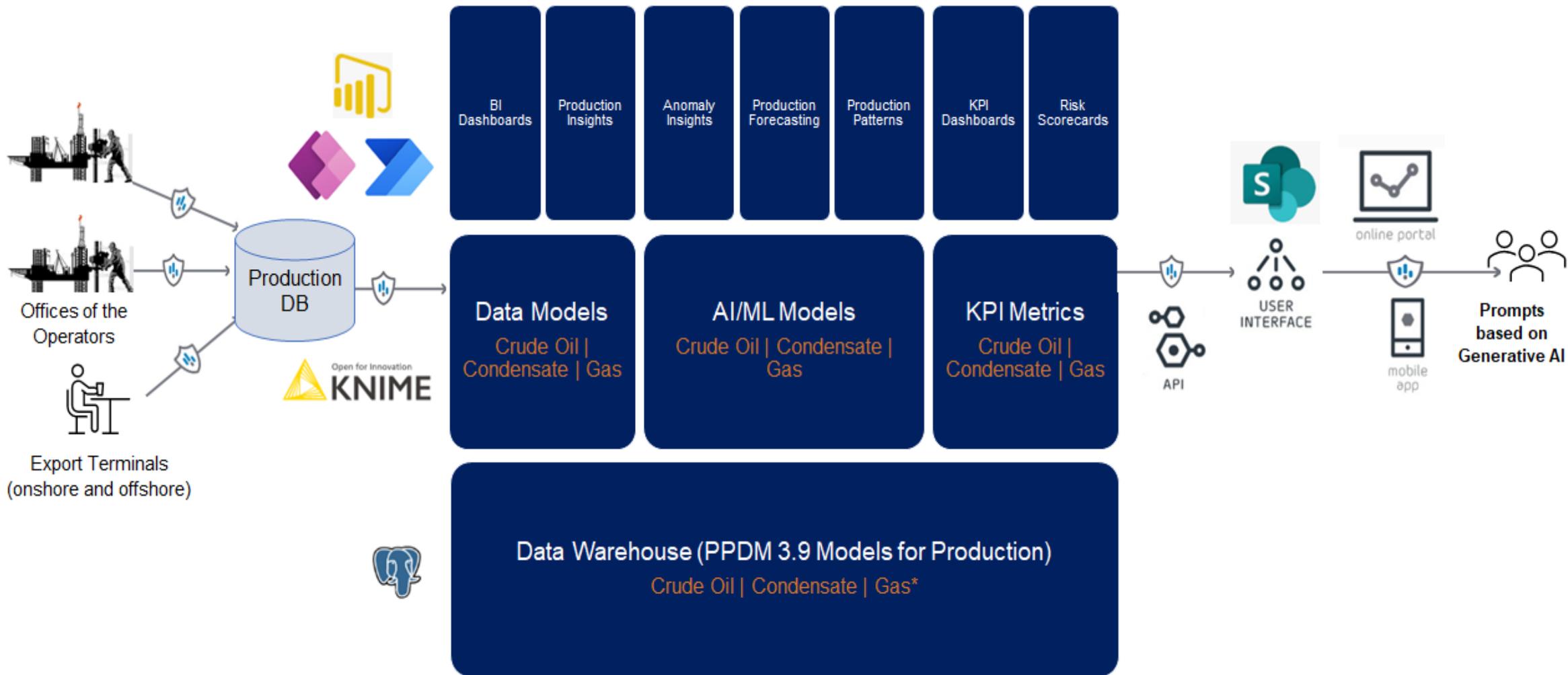
# OIL & GAS PRODUCTION INSIGHTS - INDUSTRIAL AI



# APPLYING AI - INSIGHTS FROM BROWNFIELD PRODUCTION

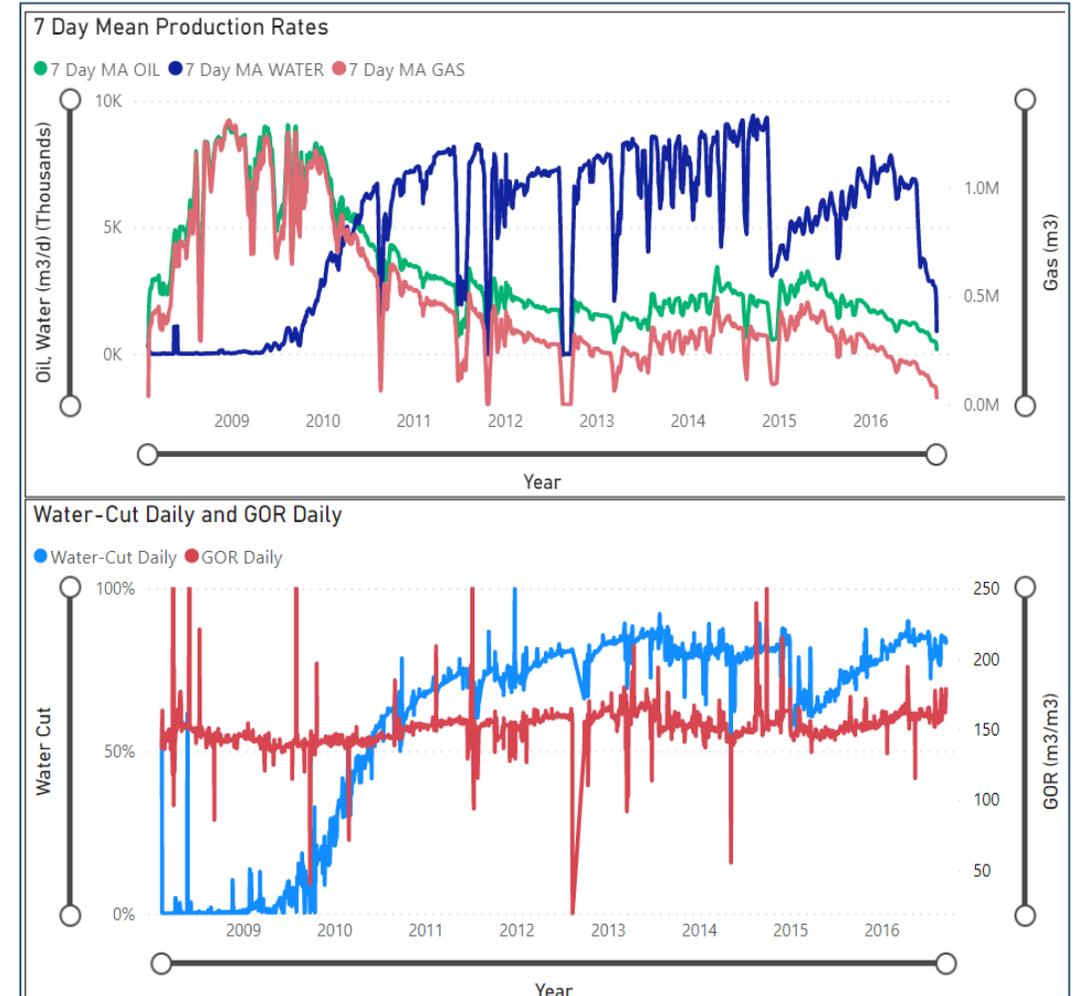


# DIGITAL STACK - PRODUCTION DB ANALYTICS



# APPLYING AI - BROWNFIELD PRODUCTION DATASETS

Focus Areas	Applicable Research based AI/ML Models
Production Forecasting – Oil/Condensate/Gas	ARIMA, Artificial Neural Networks (ANN), Random Forest (RF)
Field Performance & Benchmarking	Cost Benchmarking, Production Efficiency, Production Losses, GHG Emissions Ranking
Production Anomalies/ Outliers	KNN(K's Nearest Neighbor), SVM (Support Vector Machine)
Production Trend Insights – Oil/Condensate/Gas	Regression, Autocovariance, Autocorrelation
Declining Curve Insights	Exponential, Harmonic, Hyperbolic, Reciprocal, Quadratic
EOR (Enhanced Oil Recovery) Analysis	Artificial Neural Networks (ANN), Naive Bayes (NB), Decision Tree (DT), Random Forest (RF)

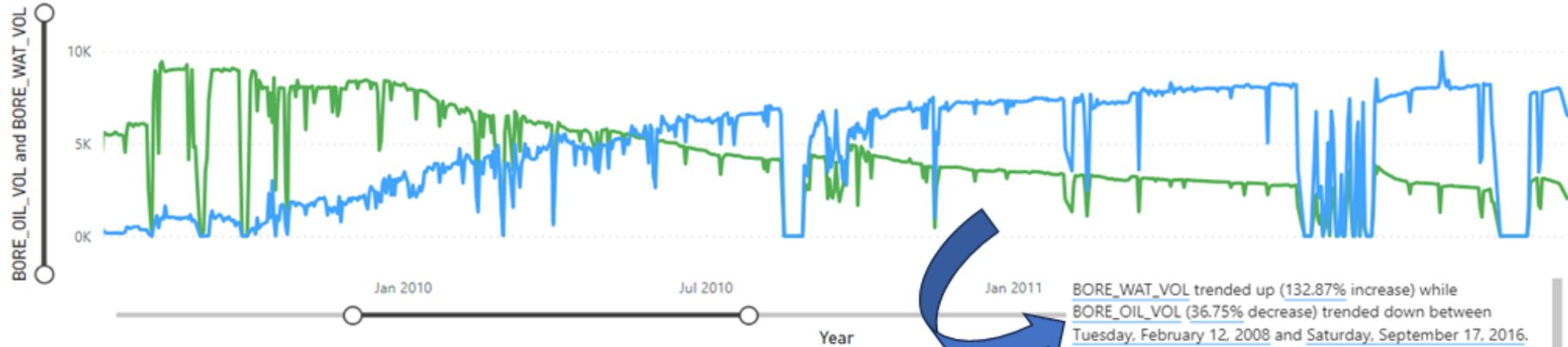


# GENERATIVE AI - SMART NARRATIVES ON PRODUCTION DB

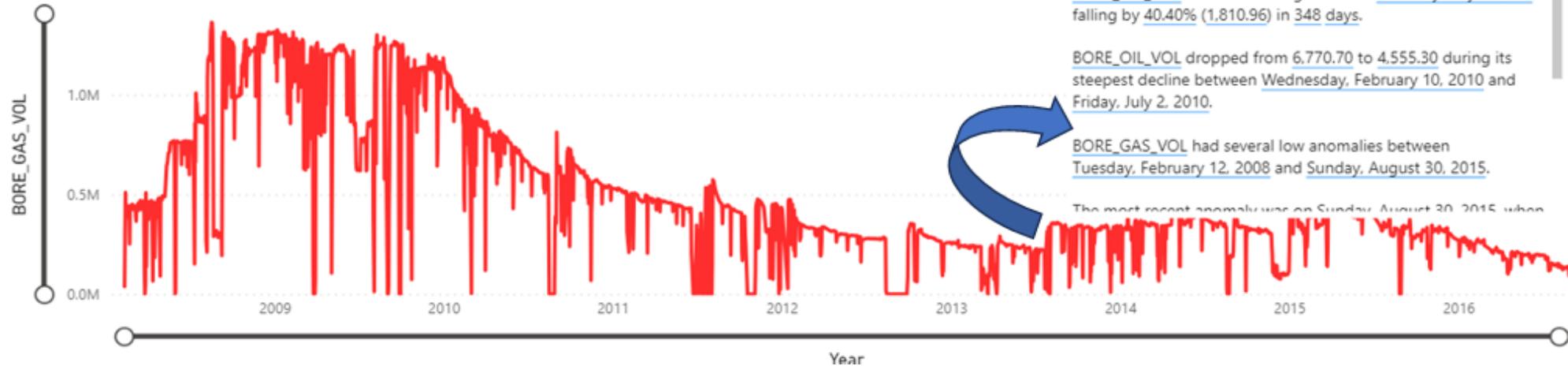
## DAILY PRODUCTION HISTORY

BORE\_OIL\_VOL and BORE\_WAT\_VOL by Year, Quarter, Month and Day

● BORE\_OIL\_VOL ● BORE\_WAT\_VOL



BORE\_GAS\_VOL by Year, Quarter, Month and Day



# GENERATIVE AI - Q&AS ON PRODUCTION DB

## DAILY PRODUCTION HISTORY

Help Q&A understand people better by adding synonyms.

Add synonyms now

Ask a question about your data

Try one of these to get started

what is the base MD  
minus top MD by per  
type

top well bore codes by  
gor

what is the base MD  
minus top MD by status

what is the base MD  
minus top MD by purpose

what is the base MD  
minus top MD by content

what is the base MD  
minus top MD by current  
status

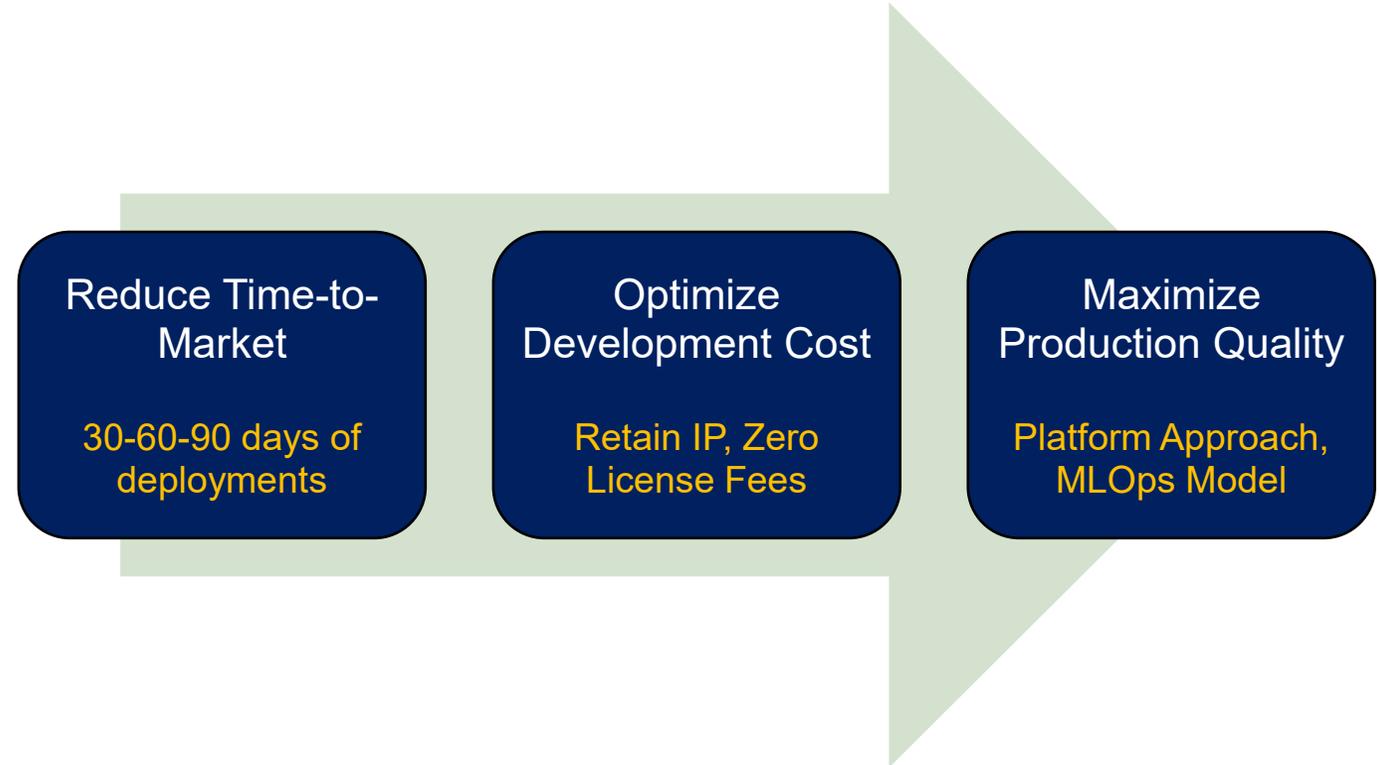
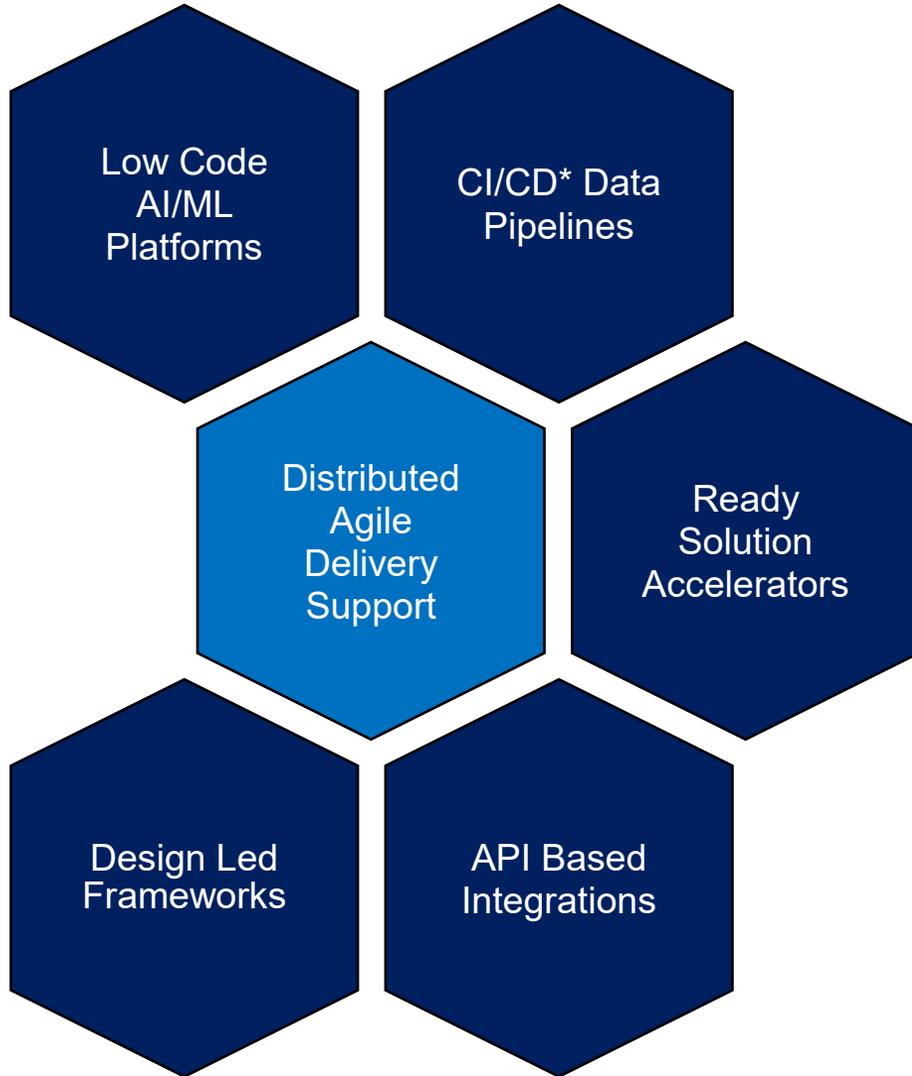
top well bore codes by gor

Showing results for *Top 10 well bore code of daily production data by gor of monthly production data*



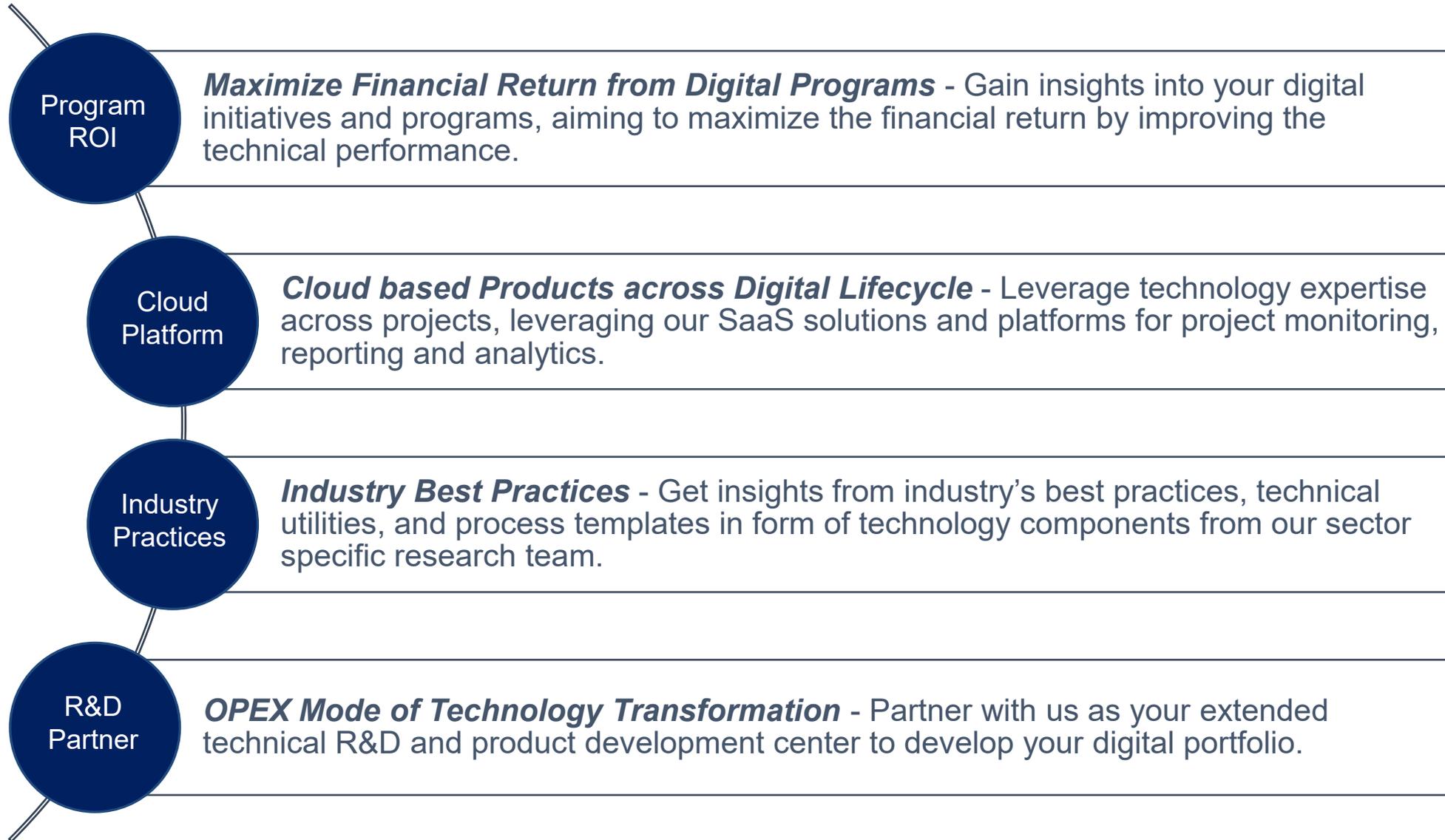
GOR = Gas/Oil Ratio

# PROJECT DELIVERY APPROACH



\*Continuous integration (CI)/Continuous delivery (CD)

# PARTNERSHIP BENEFITS



# GREENOJO ADVANTAGE

- ❑ **Proven Expertise:** Extensive track record in the upstream oil and gas industry, showcasing our deep understanding of Exploration and Production (E&P) data management.
- ❑ **Specialized Knowledge:** Unparalleled expertise in the intricacies of E&P processes, including seismic interpretation, well data management, and various E&P domains.
- ❑ **Comprehensive Approach:** Integration of 3rd party, in-house, and open-source tools for a holistic and tailored QA/QC solutions.
- ❑ **Automated Workflows:** Implementation of automated workflows designed to streamline QA/QC processes and minimize manual intervention. We support setting up real-time insights into data quality metrics, enabling prompt identification and resolution of issues.
- ❑ **Scalability and Flexibility:** Solutions designed with scalability in mind, ensuring adaptability to the evolving needs of your E&P projects.
- ❑ **Reliability and Trustworthiness:** Rigorous validation processes that minimize errors, ensuring the reliability and trustworthiness of your E&P data.

Implementation Experience on deploying NDR Data Management Models such as **PPDM, Energetics and OSDU**

Designing and Development Experience in setting up **Center of Excellences for E&P Data Analytics**

Domain Experience in integrating **open-source platforms for QA/QC of E&P/Upstream datasets**

Expertise in setting up **trading portals for E&P datasets, Data Catalogues and Analyst Reports**

**greenoj**

smart n sustainable solutions



Geenojo specializes in designing and developing next-generation digital platforms that harness the power of cutting-edge technologies such as AI, digital twin, big data, blockchain, cybersecurity, edge/IoT, and more. Our focus is on delivering solutions that help our clients stay ahead of the curve in their industries.

# THANK YOU



[sales@greenojo.com](mailto:sales@greenojo.com)



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