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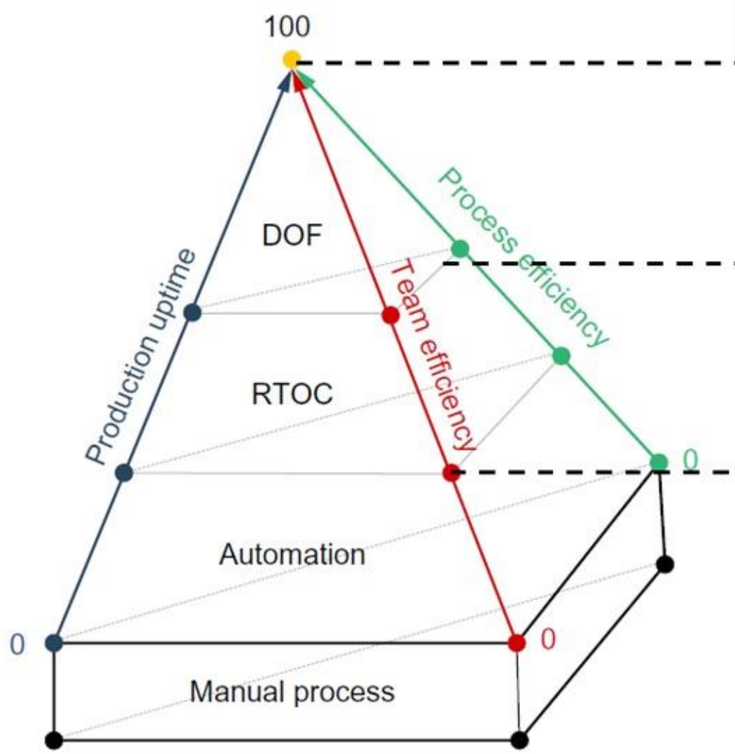


DIGITAL OIL FIELD INTRO

Payk e Farzaneh Pooyan
Farzaneh Daneshmand

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DOF OPERATIONAL LEVELS AND LAYERS

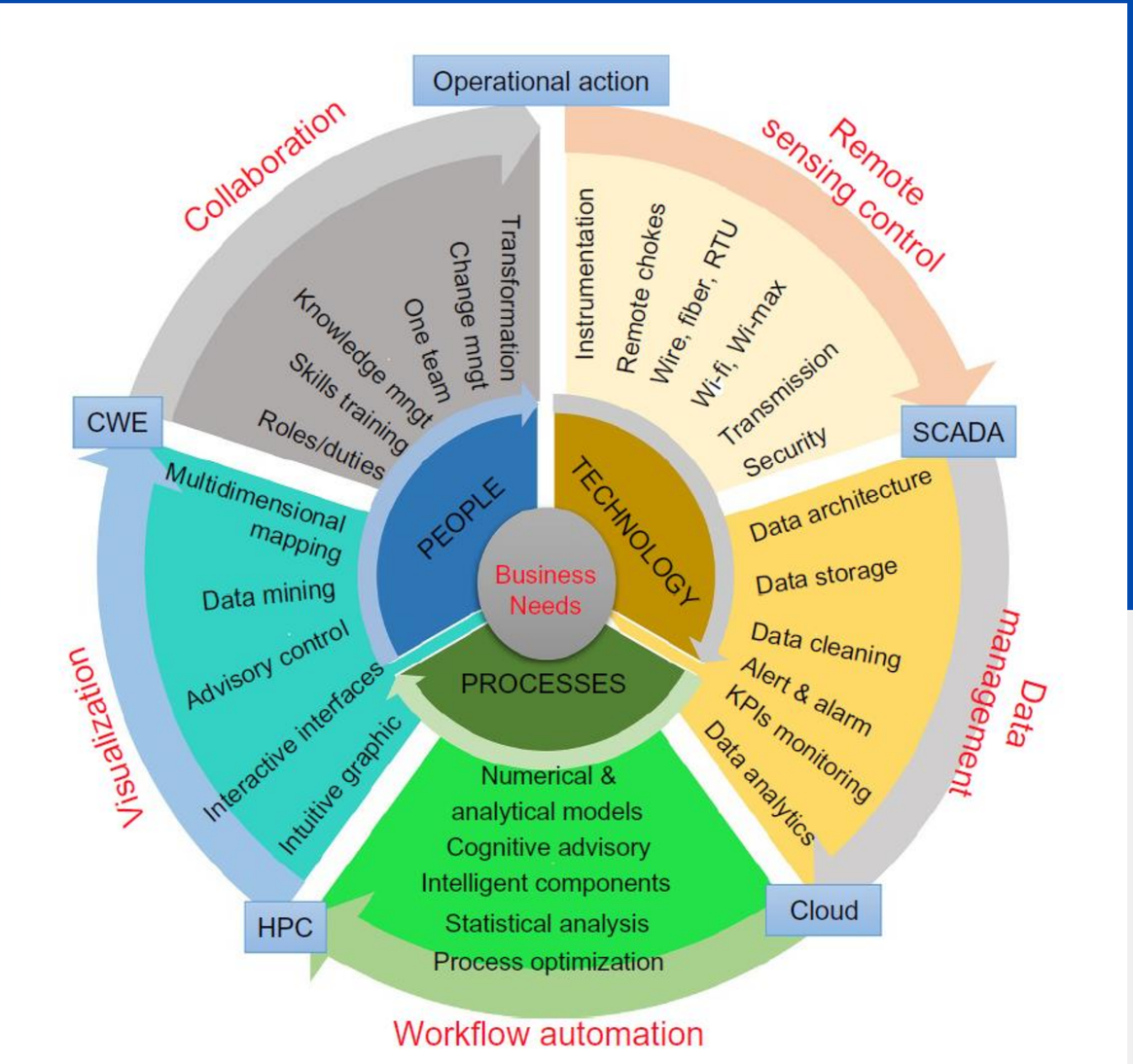


Infrastructure	*Working environment*	*Benefits*
• Multiple P, T, Vol, downhole real-time data (RT) • Diagnostic and optimization in RT • Smart and fit-for-purpose workflows • Automated controls • Integrated data systems	• Collaborative working environment CWE • Mobile apps	• Improved production • Downtime mitigation • Optimized performance
• SCADA sensors – P, T • Virtual metering, real time • Diagnostic and operations actions weekly • Some automated workflows • Mostly manual controls/intervention • Structured data environment	Operations center (RTOC)	• Production increase • OpEx reduction • Downtime management
• Basic SCADA sensors – P, T • Well test data monthly • Diagnostics and well actions monthly • Nonintegrated data transfer • Manual processes	Situational room/office desktop	• OpEx reduction
100% manual intervention; poor efficiency poor integration – little collaboration		

DOF pyramid showing the four operational levels of O&G business units with the three key performance indicators (KPIs) (production uptime, and team and process efficiencies) that generate value to business. The pyramid is correlated with a table that describes the infra-structure, working environment, and benefits of each operational level.

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MAIN COMPONENTS OF THE DOF



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OIL AND GAS INDUSTRY

12 Key Functions of the Digital Oil field



1.Real-Time Monitoring and Control



2. Predictive Maintenance



3.Enhanced Reservoir Management

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OIL AND GAS INDUSTRY

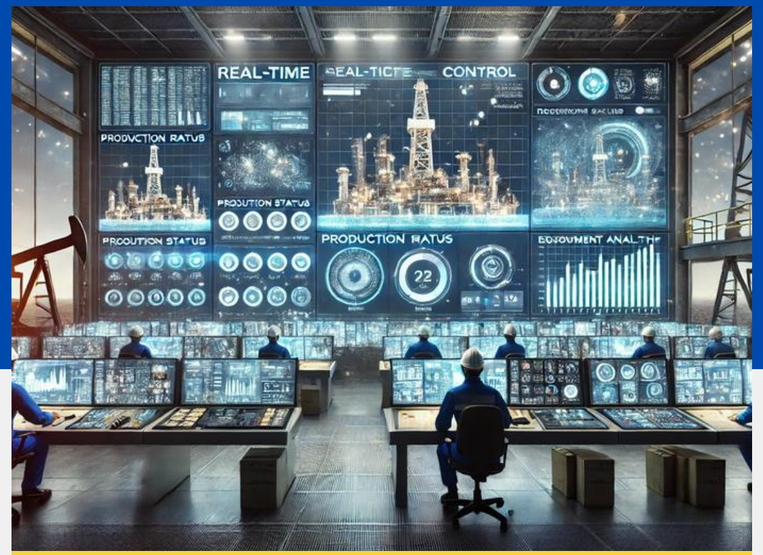
12 Key Functions of the Digital Oil field



4.Production Optimization



5.Drilling Automation



6.Asset Integrity Management

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12 Key Functions of the Digital Oil field



7.Remote Operations



8.Energy Efficiency & Carbon Reduction



9.Supply Chain Optimization

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12 Key Functions of the Digital Oil field



10.HSE Monitoring



11.Enhanced Compliance and Reporting



12.Field Collaboration and Knowledge Sharing

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OIL AND GAS INDUSTRY

Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

1. Seismic Data Analysis and Interpretation

AI processes large volumes of seismic data to detect subsurface structures and identify potential hydrocarbon reservoirs.

- **AI Techniques:** Machine learning and deep learning algorithms identify patterns in seismic reflections, predict stratigraphic features, and delineate faults.
- **Benefits:** Faster and more accurate seismic interpretations, reduced reliance on manual data processing, and improved identification of drilling targets.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

2. Reservoir Characterization

AI combines geological, geophysical, and petrophysical data to create detailed reservoir models.

- **Applications:** AI analyzes porosity, permeability, fluid saturation, and other key reservoir properties.
- **Benefits:** More accurate estimation of reserves, better well placement, and enhanced recovery strategies.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

3. Drilling Optimization

AI improves the efficiency and safety of drilling operations by analyzing real-time data.

- **Key Functions:**
  - Optimize drilling parameters such as weight-on-bit and rotary speed.
  - Predict and mitigate issues like stuck pipes or kicks.
- **Benefits:** Reduced non-productive time, lower operational costs, and enhanced safety.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

4. Production Forecasting

AI uses historical production data to predict future performance and optimize production strategies.

- **Methods:** Machine learning models identify production trends and estimate decline rates.
- **Benefits:** Improved production planning and decision-making, maximizing hydrocarbon recovery.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

5. Well Logging and Formation Evaluation

AI automates the interpretation of well log data, speeding up the evaluation process.

- **Use Cases:**
  - Lithology classification.
  - Identification of hydrocarbon-bearing zones.
  - Calculation of formation properties such as resistivity and acoustic velocity.
- **Benefits:** Reduced human error and faster decision-making during exploration.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

6. Automated Decision Support Systems

AI-driven systems assist engineers and geologists in making data-driven decisions.

- **Capabilities:**
  - Economic feasibility assessments.
  - Risk evaluations and project planning.
- **Benefits:** Improved accuracy and efficiency in exploration and production planning.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

7. Reservoir Simulation and Modeling

AI enhances traditional reservoir simulations by optimizing computational workflows.

- **Applications:**
  - History matching.
  - Real-time updates to simulation models using live production data.
- **Benefits:** Faster simulations, reduced computational costs, and improved reservoir management.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

8. Predictive Maintenance

AI analyzes sensor data to predict and prevent equipment failures.

- **Use Cases:**
  - Monitoring critical equipment like pumps, compressors, and turbines.
  - Detecting anomalies in vibration, temperature, or pressure data.
- **Benefits:** Reduced downtime, lower maintenance costs, and increased operational reliability.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

9. Environmental Monitoring and Risk Management

AI helps ensure environmental compliance and manage operational risks.

- **Applications:**
  - Monitoring emissions, leaks, and spills.
  - Identifying drilling hazards such as blowouts or subsurface anomalies.
- **Benefits:** Enhanced safety and reduced environmental impact.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

10. Data Integration and Big Data Analytics

AI integrates and analyzes data from multiple sources to provide a unified view of the oil field.

- **Capabilities:**
  - Combining seismic, well, production, and reservoir data.
  - Extracting actionable insights from big data.
- **Benefits:** Improved decision-making and streamlined workflows.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

11. Enhanced Safety

AI-driven systems enhance safety by monitoring operations and detecting hazardous conditions in real time.

- **Examples:**
  - Gas detection and fire monitoring.
  - Autonomous robots and drones for inspections in hazardous areas.
- **Benefits:** Reduced risk of accidents and enhanced worker safety.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

12. Economic Evaluation and Cost Optimization

AI evaluates the economic viability of projects and optimizes resource allocation.

- **Applications:**
  - Analyzing market trends and production costs.
  - Identifying cost-saving opportunities.
- **Benefits:** Improved project profitability and resource management.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

13. Geo steering

AI supports real-time geo steering to ensure accurate well placement.

- **How It Works:**
  - Analyzing real-time data from measurement-while-drilling (MWD) and logging-while-drilling (LWD) tools.
  - Adjusting the well trajectory to maximize reservoir contact.
- **Benefits:** Enhanced recovery and reduced drilling risks.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

14. Carbon Capture, Utilization, and Storage (CCUS)

AI supports sustainability efforts by optimizing carbon capture and storage operations.

- **Applications:**
  - Identifying suitable storage sites.
  - Monitoring CO_2 injection and ensuring storage integrity.
- **Benefits:** Reduced carbon footprint and compliance with environmental regulations.

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Applications of AI in Oil and Gas Well Exploration for Developing a Digital Oil Field

15. Digital Twin Technology

AI enables the creation of digital twins—virtual replicas of physical assets.

- **Capabilities:**
  - Simulating oil field operations.
  - Monitoring and optimizing performance in real time.
- **Benefits:** Improved operational efficiency, reduced downtime, and enhanced decision-making.

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IN OIL AND GAS

Data Exchange Standards....

In the oil and gas industry, the exchange of data for wells, well-related operations, and objects follows certain standardized protocols to ensure smooth communication, consistency, and integration across different systems and organizations



WITSML (Wellsite Information Transfer Standard Markup Language)

for the exchange of real-time well data and information. It is widely used in the oil and gas industry for the exchange of wellsite data, particularly during drilling operations



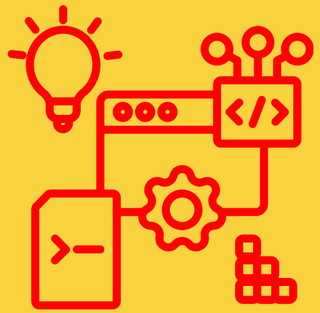
Energistics Data Standards

for defining and promoting data exchange standards in the oil and gas sector data: For production-related data, For reservoir data, exploration to production

exchange geographic data such as well locations and field boundaries

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Data Exchange Standards.... IN OIL AND GAS



PPDM (Professional Petroleum Data Management)

is a comprehensive data model used for managing upstream oil and gas data, including wells, reservoirs, drilling, production, and geological information. It is an open industry standard that ensures efficient data exchange and management



ODBC (Open Database Connectivity) and API Integration

ODBC is a standard API for accessing database management systems (DBMS). In the context of the oil and gas industry, ODBC is used for connecting well data repositories (such as PPDM databases) to business intelligence and analytics tools



RESQML (Reservoir Data Markup Language)

RESQML is a standard developed for the exchange of reservoir-related data in the oil and gas industry. It focuses on reservoir modeling, simulation, and management



OGC (Open Geospatial Consortium) Standards

The OGC defines standards for geospatial data, which is crucial for well location and mapping in the oil and gas industry.

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IN OIL AND GAS

Other data exchange standard....

Conclusion

The oil and gas industry employs a range of data exchange standards to ensure that well-related information can be transferred, integrated, and managed effectively. These standards facilitate interoperability across different systems and vendors, ensuring data consistency and improving decision-making. By adopting standards like WITSML, PPDM, RESQML, and others, companies can improve the efficiency of their operations, reduce costs, and ensure better collaboration across the entire value chain



ISO 15926 (Integration of Life-cycle Data for Process Plants Including Oil and Gas Facilities)

ISO 15926 is an international standard for data integration and exchange across the life cycle of a facility. It provides a framework for the standardization of engineering and operational data, including well and facility data, across different stages such as design, construction, operation, and decommissioning



Other Key Standards

OGC WCS (Web Coverage Service)
DLMS (Data and Logging Management Standard)
ISO 13628

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IMPLEMENTATION

DOF Implementation Strategy

The successful implementation of DOF i requires a structured approach that ensures technology integration, workforce readiness, and infrastructure development



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DOF Implementation Strategy



Required Technology and Infrastructure

- Hardware Requirements
- Software and AI Platforms
- Networking Infrastructure
- Data Storage and Management



Training and Skill Development

- AI Literacy Programs
- Partnerships with Educational Institutions
- Continuous Learning Initiative
- Change Management Programs

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PROJECT PLANNING

Timeline and Milestones

A phased approach to AI implementation ensures that each stage is carefully monitored and optimized before progressing to the next. deployment plan includes four phases, each with specific milestones that measure progress and ensure that AI integration aligns with the goals of the mining companies



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PROJECT PLANNING

Phase 1:	Foundation Building	(Months 1–6)
Phase 2:	Pilot Implementation	(Months 7–12)
phase 3:	Scaled Deployment	(Months 13–24)
phase 4:	Advanced Integration	(Months 25–36)

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RISK ASSESSMENT

Risk Assessment is essential!

A thorough risk assessment is essential for ensuring the successful implementation and sustainability of the AI-driven mining project. The risks associated with technological integration, market conditions, regulatory compliance, and operational challenges must be identified and mitigated to minimize potential setbacks



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RISK MIGRATION

7 Key Risk Mitigation Strategies

1.Phased Implementation
2.Continuous Monitoring and Evaluation
3.Diversification of AI Applications
4.Strategic Partnerships
5.Robust Testing and Validation
6.Adaptive Governance Framework
7.Comprehensive Training Programs

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Thanks For Your Attention…

Any Question ?