ADNOC Digital Oil Field
Strategic Framework & Roadmap project

ELFADL IBRAHIM
Advisor, Digital Oilfield
ADNOC HQ
AT A GLANCE

- Established in 1971
- 14 integrated operating companies across the value chain
- One of the world's largest energy producers
  - 3.5 million barrels of oil per day
  - More than 9.8 billion cubic feet of gas per day
- A primary catalyst for Abu Dhabi's growth and diversification
- More than 45 years of working in international partnerships
UPSTREAM

ADNOC Onshore

Al Yasat Petroleum

ADNOC Offshore

Al Dhafra Petroleum

ADNOC Drilling

ADNOC Sour Gas

20+ Assets

XXXX Wells
ADNOC Digital Centers

ADNOC Has established state of the art Technologies through multiple Digital Centers in its Premises. These Command & Decision Support Centers enabled to strengthen our Digital “Think Tank”, those are our Experts & SME’s to add more value to all aspects of our:

• Operations
• Development
• Production & Engineering

Profitability  People  Performance  Efficiency

THAMAMA SUBSURFACE COLLABORATION CENTER

Enhancing Production and Recovery

ADNOC PANORAMA

Unlocking solutions through big data

DRILLING RTMC

Optimizing drilling to drive down cost
ADNOC Digital & AI Vision

Harness Digital Innovation and a Future-Ready Workforce to Maximize Value and Boost the Competitiveness of Abu Dhabi

Delivering Value across 6 Key Strategic Dimensions, in line with ADNOC’s 4 key strategic areas

- **Profitability**: Growth & Shareholder Value
  - Maximize revenue generation

- **Efficiency**: Operational Efficiency
  - Optimize costs through ops. excellence

- **HSE**: Sustainability & HSE
  - Maximize safety & minimize env. impact

- **Performance**: Industry Leader
  - Drive the UAE modernization agenda

- **Digital & AI Innovation**
  - Empower the energy sector with tech. innovation

- **People**: Workforce of the Future
  - Enable a future-ready workforce
DIGITAL OIL FIELD
**WHAT IS DOF**

Industry terms:
- Digital Oilfield (DOF)
- Integrated Operations (IO)
- Asset Optimization (AO)

Client terms
- Field of The Future - bp
- *iField* – Chevron
- Smart Field – Shell
- *iField* – Saudi Aramco
- KwIDF - KOC

*but, .. Where should we start?*
Digital Oilfield Vs. AI

From data ... to analysis

From analysis ... to insights

From insights ... to decision support

From decision support .... to artificial intelligence

Source: Strategy&
ADNOC UPSTREAM Digital Oilfield

ADNOC Started the Journey since 2007
The concept of the “digital oilfield” has existed in oil and gas companies for nearly 20 years – although many have made substantial investments, few have yet to truly transform their operating models as a result of digital technology.

Convergence of the next wave of digital technologies on common platforms

Note: EA = edge analytics.
Source: IHS Markit
Overview:
In the evolving era of Digital Technology advancement, its vital to adapt state of the art Products, Services & best Practices of Digital Oil Fields solutions. Our aim to establish a DOF Technology Hub across multiple operation topologies to support all of ADNOC Value Chain

How do we generate value from DOF? [General Assumptions]

- Avoid unnecessary drilling (5% of 70% of CAPEX)
- Optimize production costs (10% of X.X$/bbl)
- Reduce unplanned shutdowns (30% of 3hrs/days)
- Avoid unnecessary development (10% of FDP CAPEX)
- Optimizing investments in Surveillance
- Sw/Hw efficiency
- People efficiency

<table>
<thead>
<tr>
<th>Profitability</th>
<th>• Increase production, Increase revenue or reduce costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>• Increase field productivity and project predictability</td>
</tr>
<tr>
<td>People</td>
<td>• Improve decision making and consistency, productivity</td>
</tr>
<tr>
<td>Efficiency</td>
<td>• Increase operations availability, reduce repetitive inefficient tasks</td>
</tr>
<tr>
<td>Safety</td>
<td>• Reduce human exposure by remote monitor and control</td>
</tr>
<tr>
<td>Risk</td>
<td>• Reduce probability of undesired event</td>
</tr>
<tr>
<td>Sustainability</td>
<td>• Maintain production, protect reserves, monitor and alert proactively</td>
</tr>
</tbody>
</table>
Pre Project Work

ADNOC Upstream Foundational Capability Assessment

**ADNOC ASSET CAPABILITY ASSESSMENT**

**FUNDATIONAL DOF CAPABILITIES**

1. **DATA MANAGEMENT**
   - Provided via direct connectivity/manual upload of data to EXPRIS solution.
   - Unstructured data not associated/analyzed.

2. **OIL FIELD CONNECTIVITY**
   - Industrial networks covering 80% of facilities/wellheads. Remote connectivity provided via 3G connected RTUs.

3. **INDUSTRIAL AUTOMATION**
   - Nearly all of ADNOC XX assets have 80% coverage of base monitoring and control capabilities.

4. **ASSET DIGITIZATION**
   - ADNOC has recently completed an as-built campaign across nearly 60% of its assets (XXX assets).
The objective of this ADNOC Upstream Global Level Exercise aims to:
Assess and evaluate ADNOC’s and OPCO’s various DOF practices and initiatives against industry best practice, to develop a strategic framework and roadmap while ensuring ADNOC strategic pillars (Profitability, Performance, People and Efficiency) across all relevant aspects [Examples below]

6 Streams of Business Impact with sub-streams to provide complete DOF coverage – Owner Appointed per Stream

- Reservoir Management
- Production Optimization
- Operation Management & Integrity
- Projects & Engineering
- Drilling Efficiency
- Logistics & Planning

3 aimed focus Areas

<table>
<thead>
<tr>
<th>DOF STRATEGY DEVELOPMENT</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New Projects/Fields</td>
<td>Mandated at Design Stage</td>
</tr>
<tr>
<td>Existing DOF Fields</td>
<td>Case By Case to Maximize Business Value + Potential Upgrade Plan</td>
</tr>
<tr>
<td>Existing Fields</td>
<td>Case By Case in Staggered investment aligned with Asset Replacement /Modernization</td>
</tr>
</tbody>
</table>
HIGH LEVEL PROJECT SCOPE

1. Performing an **Asset Specific Gap Analysis and Landscape Assessment**
2. Establishing governance through a **DOF Management Framework**
3. Development of an **OPCO specific 5 year DOF Master Plan**
4. Development of **Decision Support Packages (DSPs)**
WORK PACKAGE 1 SCOPE DELIVERY – GAP ANALYSIS & LANDSCAPE ASSESSMENT

Enterprise
- DOF maturity model
- DOF lessons learnt report
- DOF Benchmark and Technology
- DOF business value

Asset
- DOF performance management guidelines
- DOF inventory report
- DOF gap analysis and landscape report

Reservoir Management  Production Optimization  Operation Management & Integrity  Project & Engineering  Drilling Efficiency  Logistics & Planning

High level overview and recommendation report from DOF perspective and DOF business value
Review existing DOF project – Digital by design
Review opportunity for cross-discipline process automation
Review ongoing IAP initiative to align with DOF
WORK PACKAGE 2 SCOPE DELIVERY – DOF MANAGEMENT FRAMEWORK

- Reservoir Management
- Production Optimization
- Operation Management & Integrity
- Project & Engineering
- Drilling Efficiency
- Logistics & Planning

Enterprise:
- Develop DOF management system:
  - Review Digital Asset Transformation Policy
  - DOF organizational structure
  - DOF operating model

- Develop a unified DOF strategy
- RACI between organization and domains
- DOF high level business process

DOF standards:
- (1) Well requirement
- (2) Facilities requirement
- (3) Collaboration
- (4) Data reference architecture
- (5) Real time data mgmt
- (6) Change mgmt
- (7) Telecom & infrastructure

Asset:
- High level overview of existing standard and recommendation report to align with DOF standards
WORK PACKAGE 3 AND 4 SCOPE DELIVERY – 5Y MASTER PLAN & DECISION SUPPORT PACKAGES (DSPS)

Enterprise

- 5 years DOF Implementation roadmap
- DOF sustainability model
- Standardised Production & Reservoir management process solution DSP

Asset

- DOF instrumentation upgrade DSP
- DOF remote operations upgrade DSP
- DOF connected mobile worker DSP

Synergy and alignment
CAPTURING DOF VALUE THROUGH ADNOC 4 PILLARS

Having the technology alone does not guarantee value... More important is how a DOF solution is described, designed, and deployed.

**Profitability**
- Production improvement
- Recovery factor
- Reduce OPEX and CAPEX

**Performance & Efficiency**
- Process efficiency
- People performance
- Safety performance
- Reduced Losses

**People - Knowledge**
- Complex processes and Reservoirs
- Capture & Reuse (Advisory)
- Collaboration

Asset decision model
Simple DOF model
Structured implementation process

Having the technology alone does not guarantee value... More important is how a DOF solution is described, designed, and deployed.
Various *business process* for Asset decision making to meet the KPIs or overcome the challenges

Interconnected Technical workflows supporting every business processes

Maturity model for every technical workflows based on DOF model

Maturity model for other horizontal element such as telecom, network, governance etc.
DOF ASSESSMENT – APPLYING THE MATURITY MODEL

DOF System

Workflow Current State Capability

Current state Capability maturity

Future state Capability maturity

Future state Capability AI enabled
DOF MATURITY MODEL ....Need to be actionable

ASSET DOF maturity = \( \text{Fn (Reservoir, Wells, Networks, Facilities, Terminal : DOF Maturity)} \)

Interconnected Technical workflows supporting every business processes
DOF MATURITY.....Context of business value

More Profitable Upstream

Integrated Management of Assets

Reservoirs ➔ Wells ➔ Networks ➔ Facilities ➔ Terminals

Breaking Silos

Improving operational efficiency

Optimize cost

Improve recovery

Enhance Safety
# DOF Model.... Its evolution to the future

An integrated “Asset Decision Support, Advisory and Decision Making SYSTEM”, focused on...

Asset Management: Production Optimization & supporting functions... and...

Enabling business capability with digital technology

Managing the reservoir drainage system (the “flowstream”)

### Decision quality through....
- Information-driven decision making – reduced uncertainty
- Collaboration (multi-disciplinary, shared visualization & data)

### Decision speed (efficiency) through...
- Automation
- Integration

### Decision Advisory through...
- AI methods
- Data analytics and deep learning

### Decision Making through...
- AI methods
- Cognitive computing (e.g. driverless cars)
Project Governance

Steering Committee Team

- SIS Operations Manager
  - SLB EXECUTIVE
- ADNOC Upstream
  - OPCO Executive
- Project Sponsor
  - EXECUTIVE BUSINESS
- ADNOC Digital Advisory
  - HQ Team
- SIS Global Advisor
  - SLB GLOBAL

Program Manager
- ADNOC PM

SLB Project Manager
- SLB PM

ADNOC Project Manager
- ONSHORE PM
- OFFSHORE PM

SLB Project Team
- Schlumberger, Rockwell Automation, Booz Allen Hamilton, WIPRO, Huawei

ADNOC Project Team
- ADNOC HQ: Development, Thamama, CUIM, Digital Unit, Production Unit
  - ADNOC Offshore Assets
  - ADNOC Onshore Assets
AIMS & FUTURE GOALS
DRILL THE RIGHT WELL
Enhancing reservoir characterization & modelling
- Platform for data storage, analytics and modeling provides “single view of truth to develop an integrated earth model and linking technical decisions to asset economics in real-time
- Rapid subsurface analytics to high grade location inventory

DRILL THE WELL RIGHT
Optimizing well delivery execution and efficiency
- Realtime subsurface production analytics continuously feeding into D&C
- Accelerate completion design and candidate selection by combining geo science engineering and prescriptive analytics

OPTIMIZE UNIT PRODUCTION COST
Managing base declines & reducing production costs
- Predictive self-optimization of production rates using deep learning AI techniques to optimize for example ESP operating parameters
- Self injecting chemicals to optimize effective treatment to production rate
- Predictive and prescriptive identification artificial lift failures

OPTIMIZE RISK
Improving well and facility integrity
- Predictive optimized drilling parameters (drilling washouts, key-safety, maximization ROP)

More Profitable Upstream
- Increase Production Capacity
- Reduce cost /bl through Operational Initiatives
- Improve Recovery Efficiency in mature reservoirs
WHAT MIGHT A DIGITAL UPSTREAM BUSINESS LOOK LIKE?

Conventional O&G Business Cycle

Disruptive O&G Business Cycle

Exploration
- Automated subsurface modeling and insight
- Virtual simulation of "first oil" before final investment decision

Appraisal
- Autonomous drilling
- Autonomous onshore control and monitoring

Development
- Automated engineering, design, manufacturing, and fabrication
- Predictive maintenance software with robot-based inspections

Operations
- Automated real-time optimized production
- Automated subsurface modeling and insight
- Autonomous drilling
- Virtual simulation of "first oil" before final investment decision
- Automated engineering, design, manufacturing, and fabrication
- Predictive maintenance software with robot-based inspections
- Automated real-time optimized production

Augmented reality for improved decision making
- Digital twins to evaluate oil fields and platforms
- IoT to connect assets and centrally locate data

Digital Oilfield Concept Target State

Source: Aker BP; Cognite; Strategy& research, Accenture
OPERATIONAL AND BUSINESS VALUE

- Empowering Faster Decisions
- Creating a Single Version of the Truth
- Eliminating Data Silos
- Retaining Expert Knowledge
- Reducing time spent in searching for data
- Enabling efficient workflow automation
- Improving data quality through transparency
- Developing a foundation for Artificial Intelligence
- Ability to perform basic and intermediate data analysis
- Minimizing production deferment events
- Enabling cross-field and cross-function collaboration
- Responding faster to facilities upset
- Responding to business needs
  
  (New fields, new assets, etc…)

Schlumberger-Private
**Remote Real-Time Facility Monitoring and Control**  
The off-site control of facility process systems through the networking of SCADA (systems control and data analysis) and its transfer to onshore control rooms, enabling field data capture, set point control, and valve/pump manipulation.

**Real-Time Drilling**  
The collection and integration of real-time drilling data such as RPM, circulation solids, down-hole pressures captured through MWD, and remotely steerable down-hole tools.

**Real-Time Production Surveillance**  
The utilization of advanced alarm systems to trigger analysis of important production integrity trends to help optimize and maintain installed capacity levels.

**4-D Visualization and modeling**  
Successive 3-D seismic surveys track fluid movements, allowing for additional insight into production enhancement and redirecting enhanced recovery mechanism.

**Remote Communications Technology**  
Off-site facilities with real-time visual, voice, and data communication with the field allow more rapid, analytical responses by a mix of off-site and on-site staff.

**Integrated asset models**  
Applications that model complete production system performance from the producing horizon, through the well-bore, through the production facility, and onto the export/sales point across disparate data sources and multisite work teams.

**Workflow and Knowledge management Systems**  
Robust historical data and document-management solutions that allow assets and functions to quickly execute workflows and routines by calling up complete historical analyses quickly and accurately, with applied collaborative working environment consideration.

**Production Volume management Systems**  
Standardized production data and production allocations, allowing more efficient real-time production decisions that result in reduced deferment and improved operational integrity.