Smart 4.0 Upstream

أدنوك ADNOC

ADNOC Digital Oil Field
Strategic Framework & Roadmap project

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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
- ADNOC Offshore
- ADNOC Drilling
- Al Yasat Petroleum
- Al Dhafra Petroleum
- ADNOC Sour Gas (H_2S)

20+ Assets

XXXX Wells

ADNOC DIGITAL TRANSFORMATION JOURNEY

ABU DHABI NATIONAL OIL COMPANY

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

Key Inputs

- *ADNOC's 2030 Business Strategy*
- *UAE's 2031 AI Strategy*
- *UAE 2050 Energy Strategy*
- *UAE 2021 Strategy*
- *Abu Dhabi 2030 Vision*
- *15+ ADNOC Leadership Interviews*

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	Efficiency	HSE	Performance		People
Growth & Shareholder Value	Operational Efficiency	Sustainability & HSE	Industry Leader	Digital & AI Innovation	Workforce of the Future
Maximize revenue generation	*Optimize costs through ops. excellence*	*Maximize safety & minimize env. impact*	*Drive the UAE modernization agenda*	*Empower the energy sector with tech. innovation*	*Enable a future-ready workforce*

DIGITAL OIL FIELD

ABU DHABI NATIONAL OIL COMPANY

WHAT IS DOF

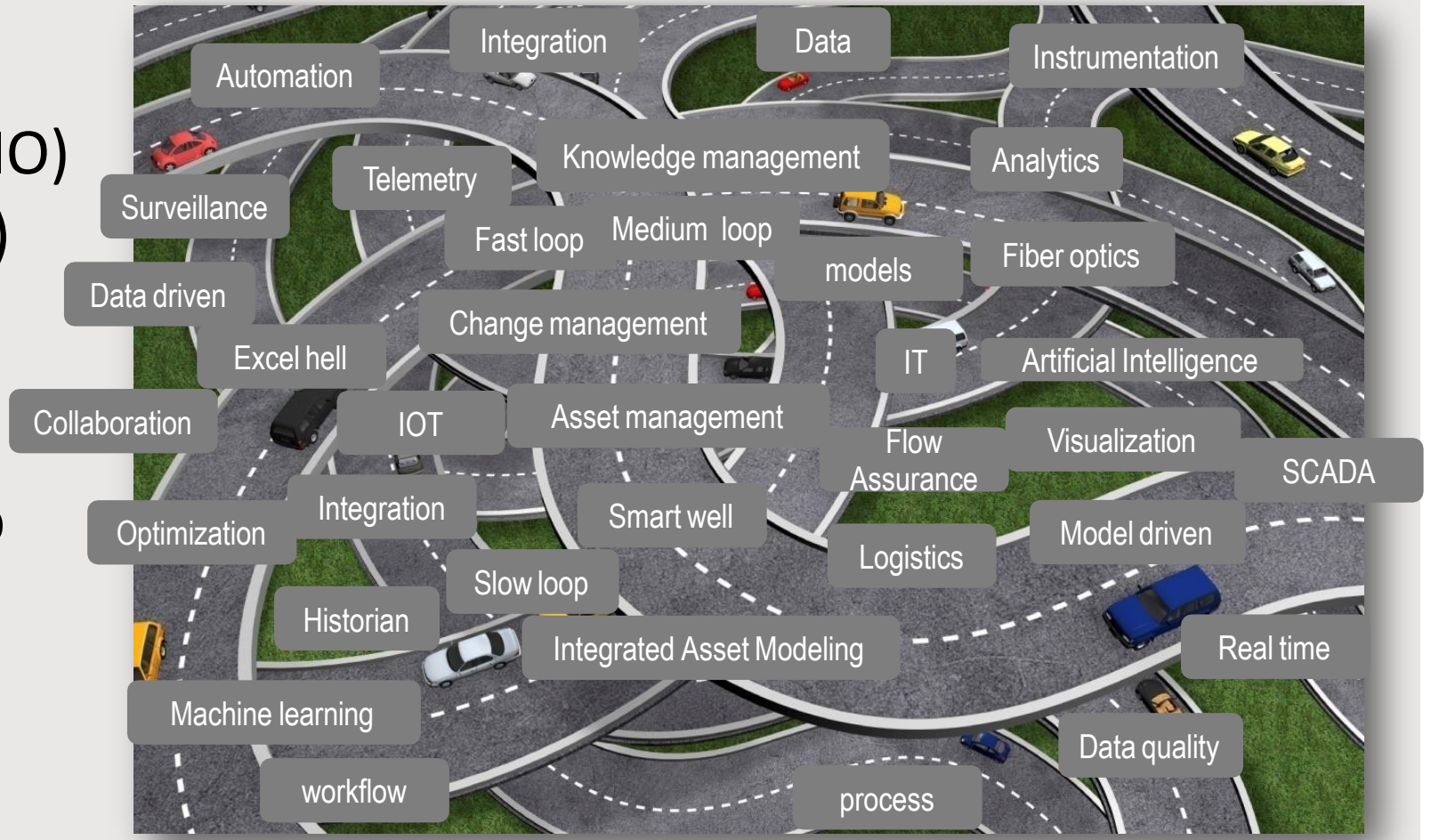
but, .. Where should we start?

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



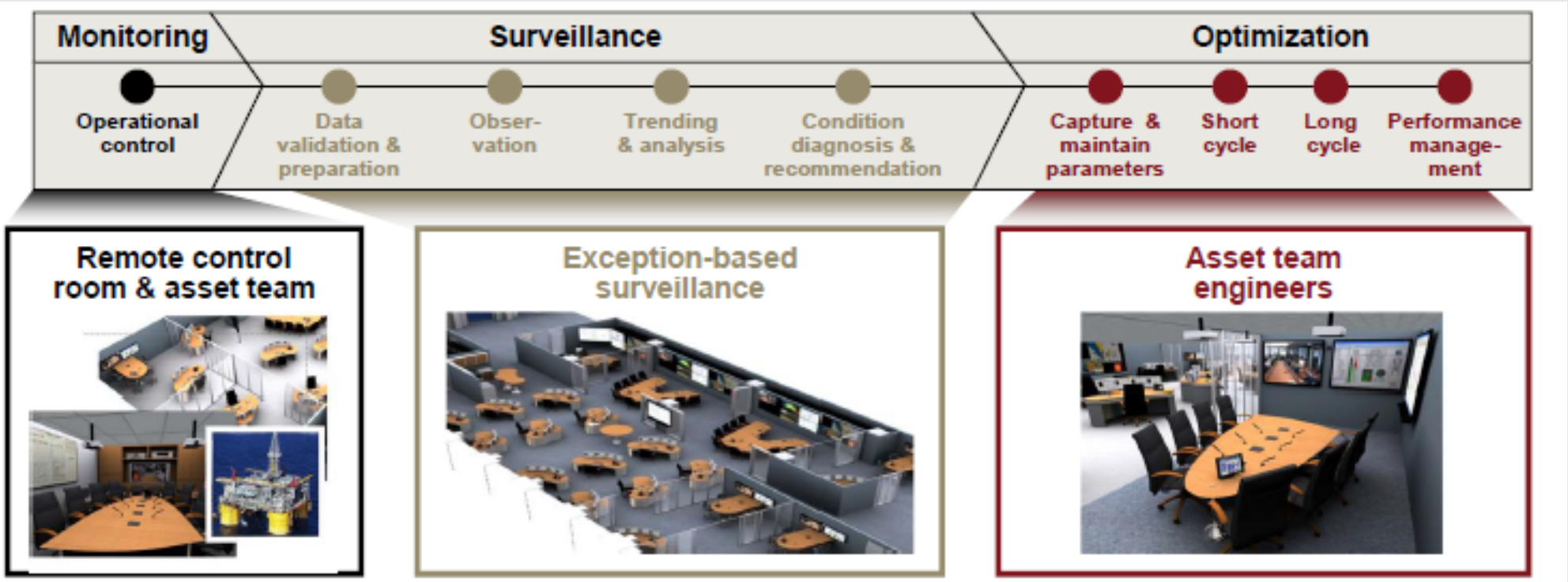
Digital Oilfield Vs. AI

From data … to analysis

From analysis … to insights

From insights … to decision support

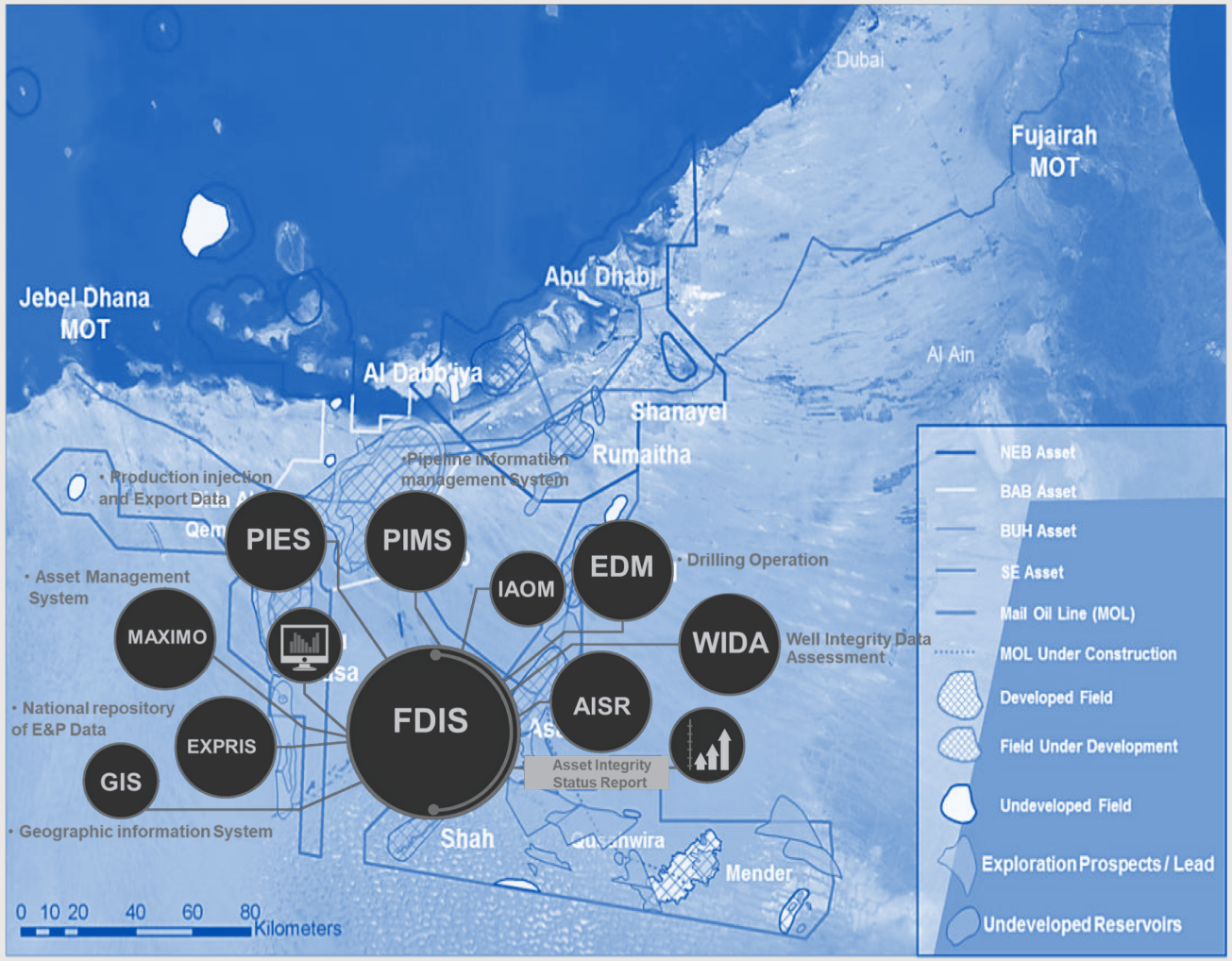
From decision support …. to artificial intelligence



Source: Strategy&

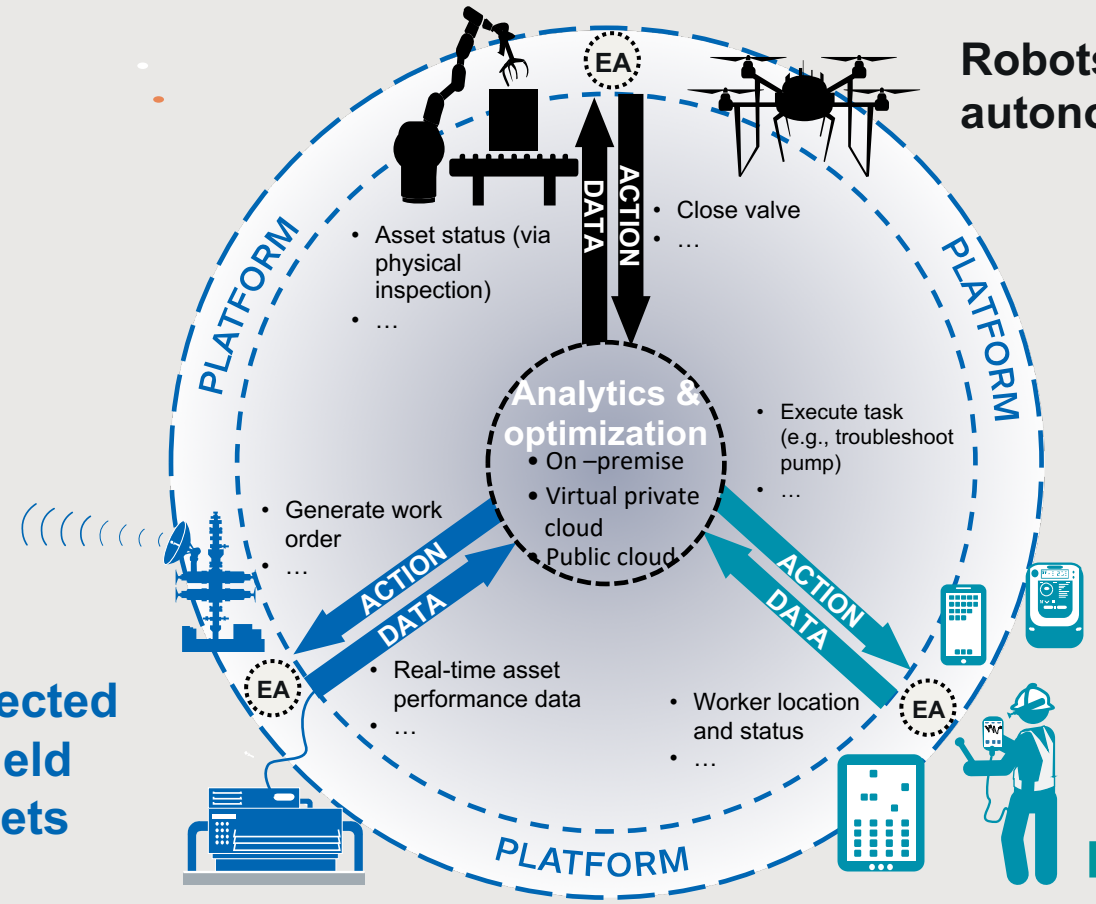
ADNOC UPSTREAM Digital Oilfield

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

ADNOC UPSTREAM DOF Potential Business Value

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

Profitability	• Increase production, Increase revenue or reduce costs
Performance	• Increase field productivity and project predictability
People	• Improve decision making and consistency, productivity
Efficiency	• Increase operations availability, reduce repetitive inefficient tasks
Safety	• Reduce human exposure by remote monitor and control
Risk	• Reduce probability of undesired event
Sustainability	• Maintain production, protect reserves, monitor and alert proactively

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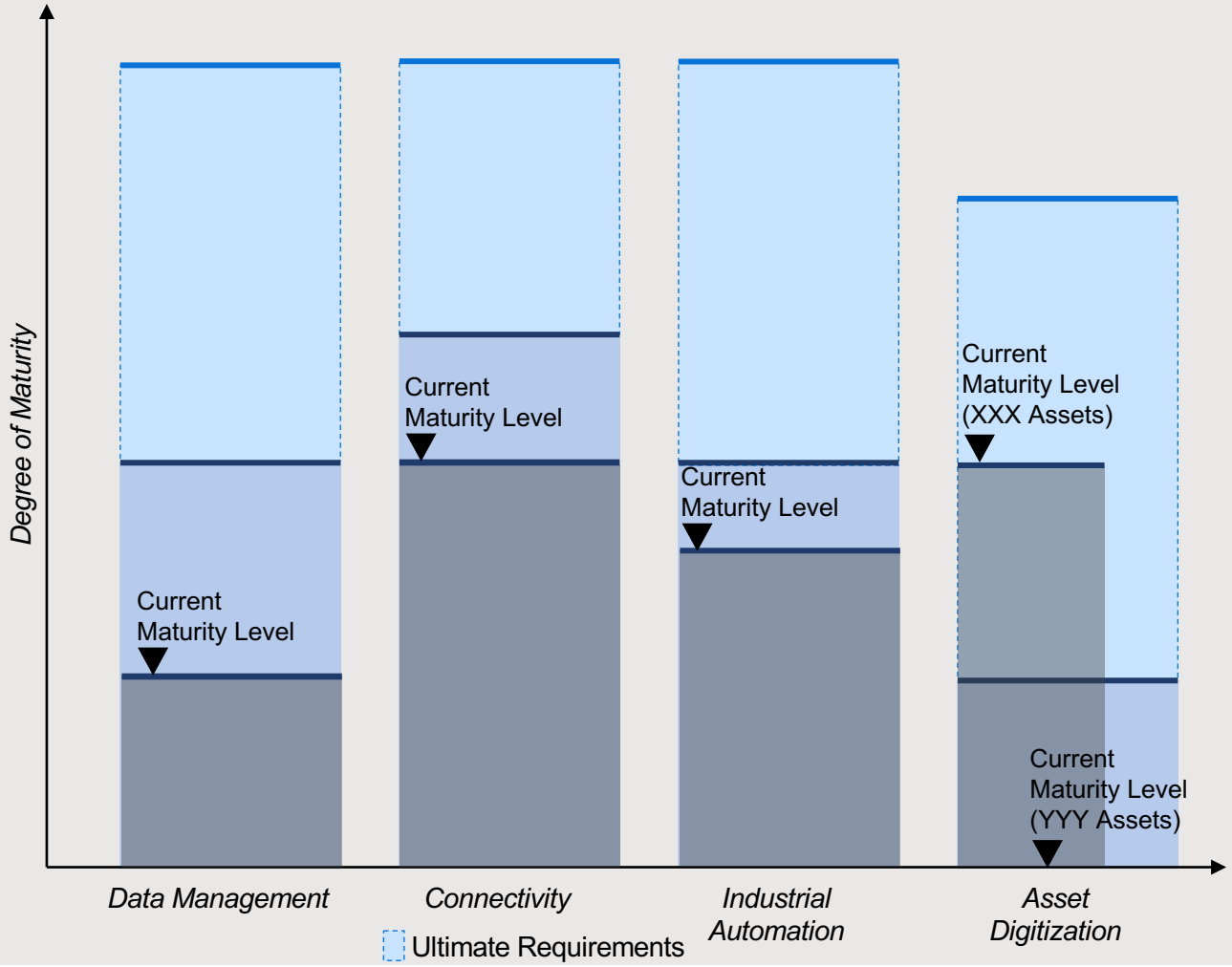
ADNOC

Smart 4.0 Upstream

Pre Project Work

ADNOC Upstream Foundational Capability Assessment

ADNOC Asset Capability Assessment



Foundational 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).

Minimum Requirements
Current Capability
Ultimate Requirements

ADNOC SMART UPSTREAM

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]

DOF STRATEGY DEVELOPMENT

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

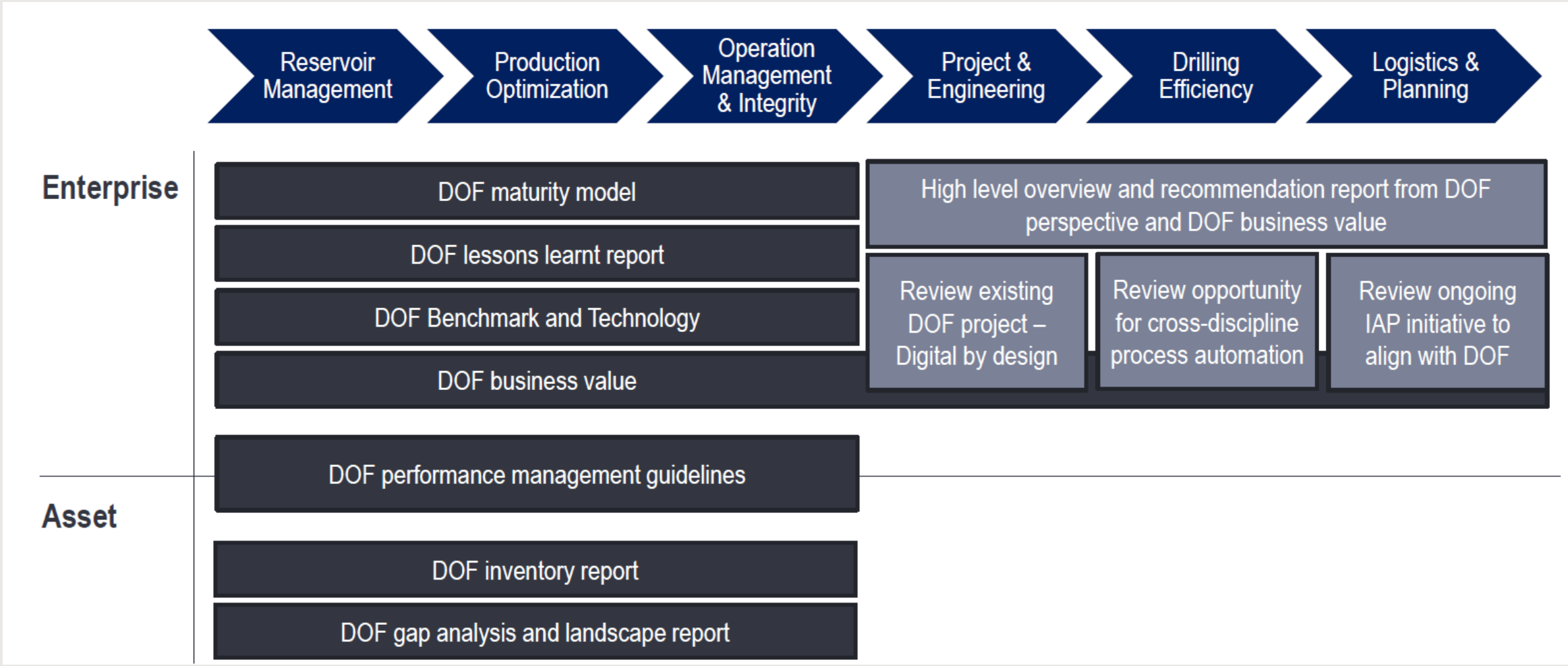
3 aimed focus Areas

New Projects/Fields	Mandated at Design Stage
Existing DOF Fields	Case By Case to Maximize Business Value + Potential Upgrade Plan
Existing Fields	Case By Case in Staggered investment aligned with Asset Replacement /Modernization

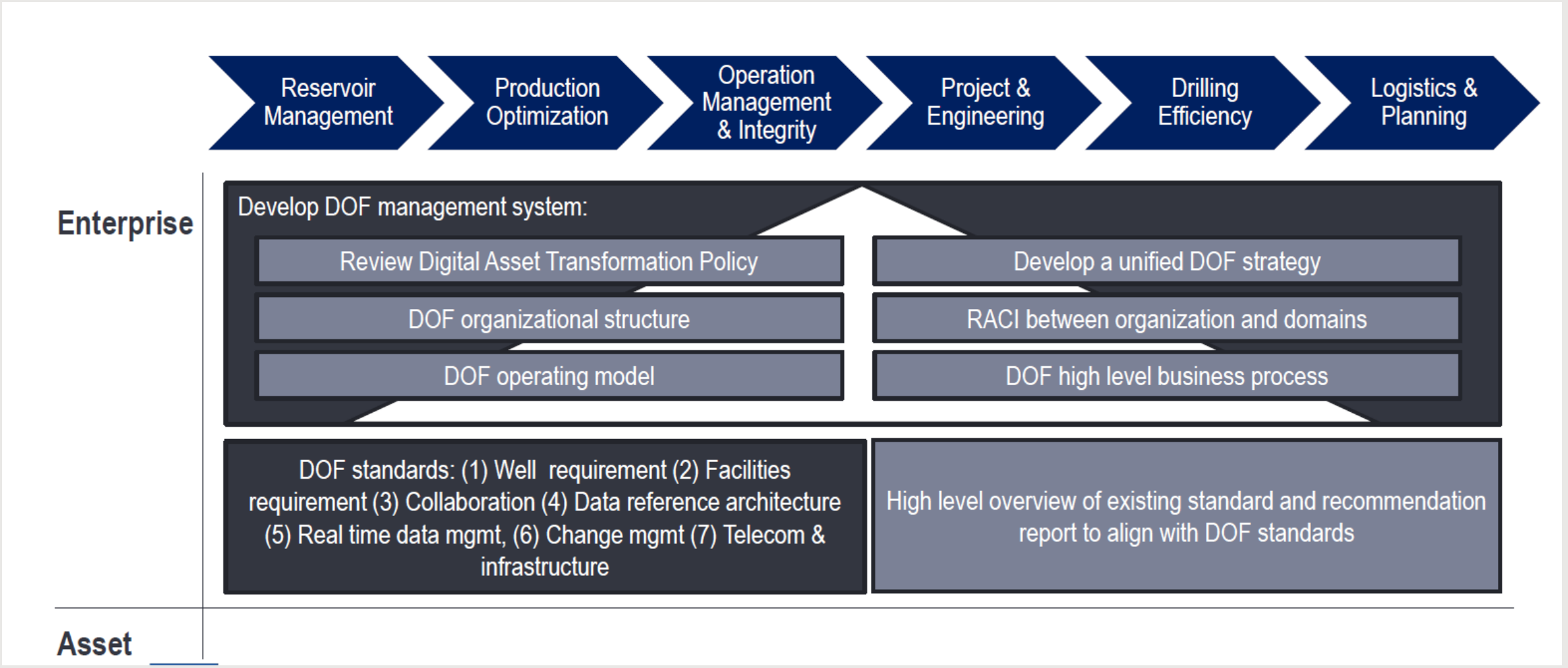
HIGH LEVEL PROJECT SCOPE

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)**

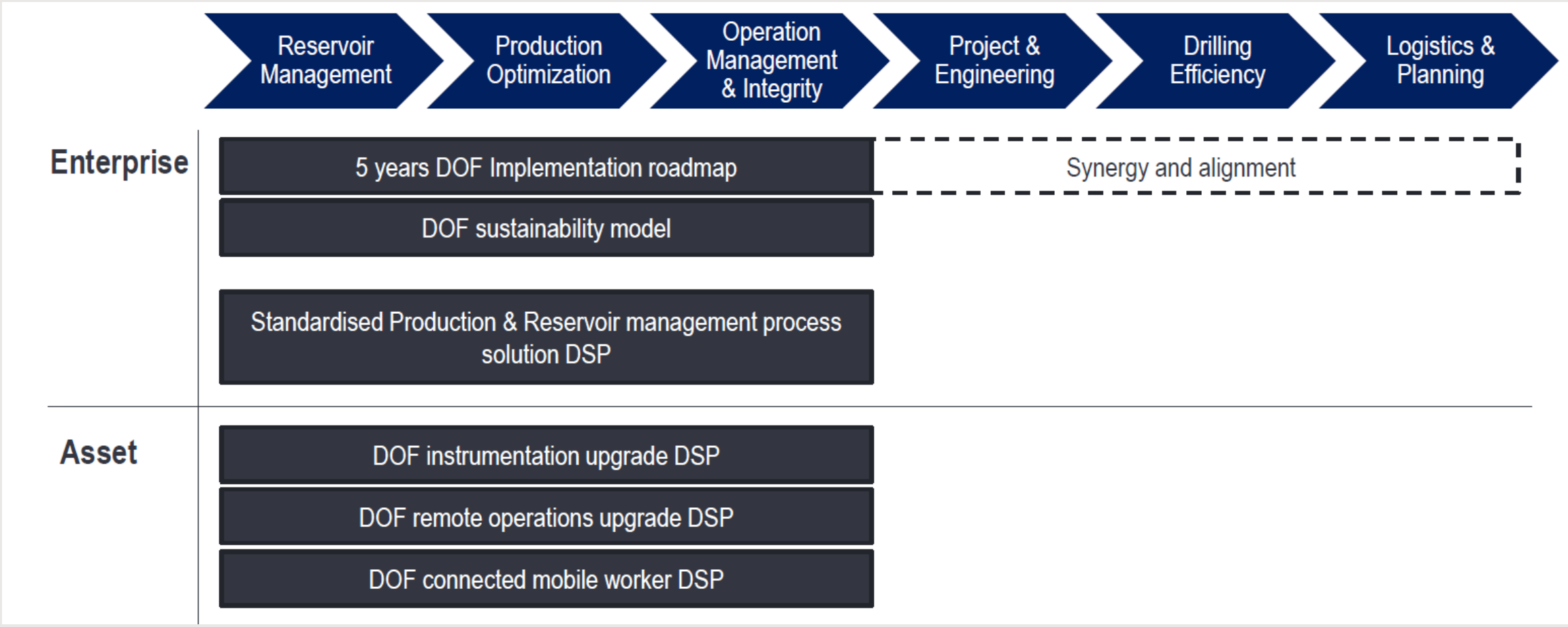
WORK PACKAGE 1 SCOPE DELIVERY – GAP ANALYSIS & LANDSCAPE ASSESSMENT



WORK PACKAGE 2 SCOPE DELIVERY – DOF MANAGEMENT FRAMEWORK



WORK PACKAGE 3 AND 4 SCOPE DELIVERY – 5Y MASTER PLAN & DECISION SUPPORT PACKAGES (DSPS)



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

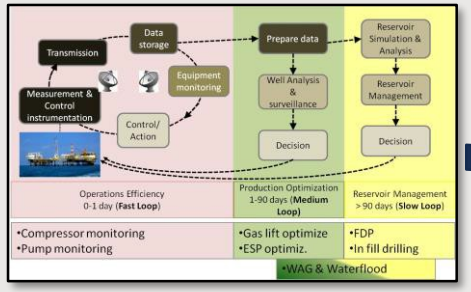
- Production improvement
- Recovery factor
- Reduce OPEX and CAPEX

Performance & Efficiency

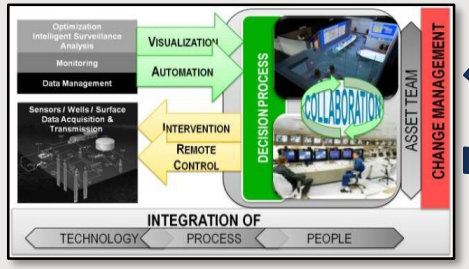
- Process efficiency
- People performance
- Safety performance
- Reduced Losses

People - Knowledge

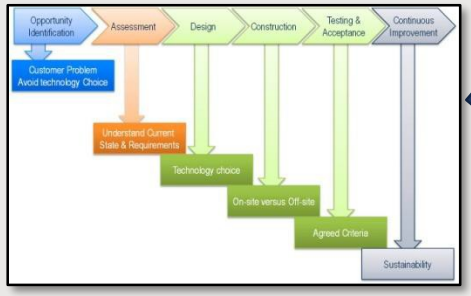
- Complex processes and Reservoirs
- Capture & Reuse (Advisory)
- Collaboration



Asset decision model



Simple DOF model

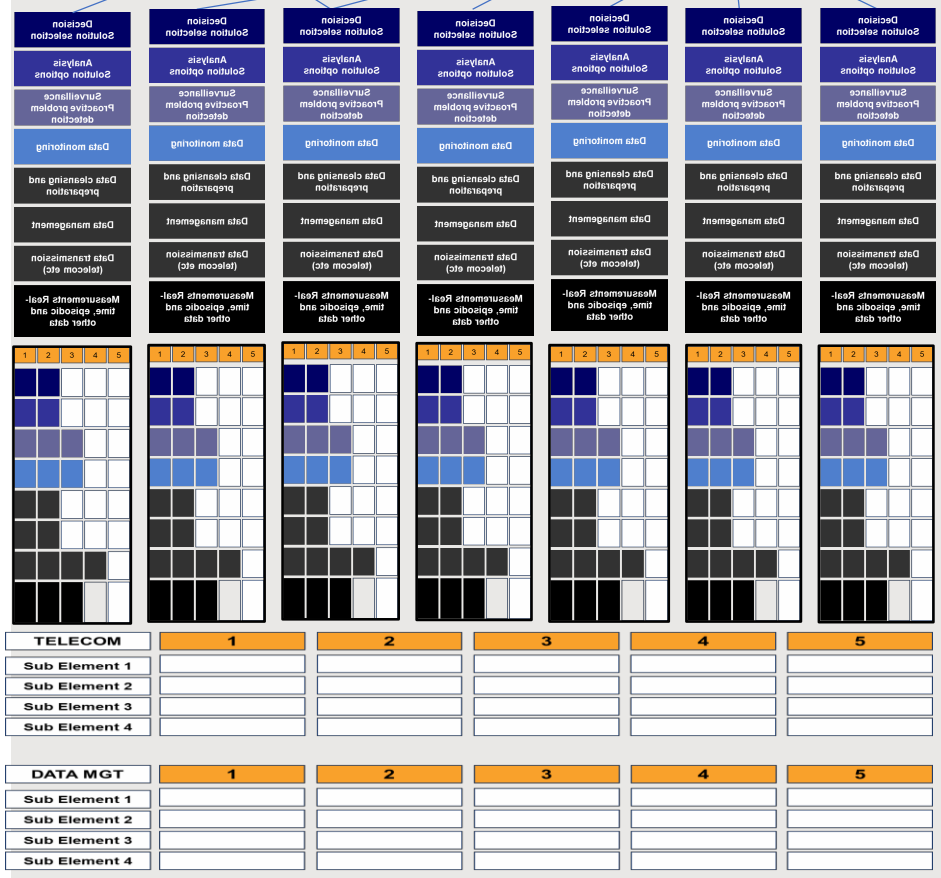


Structured implementation process

DOF MATURITY MODEL SYSTEM

KPIs and Asset Challenges

Various **business process** for Asset decision making to meet the KPIs or overcome the challenges

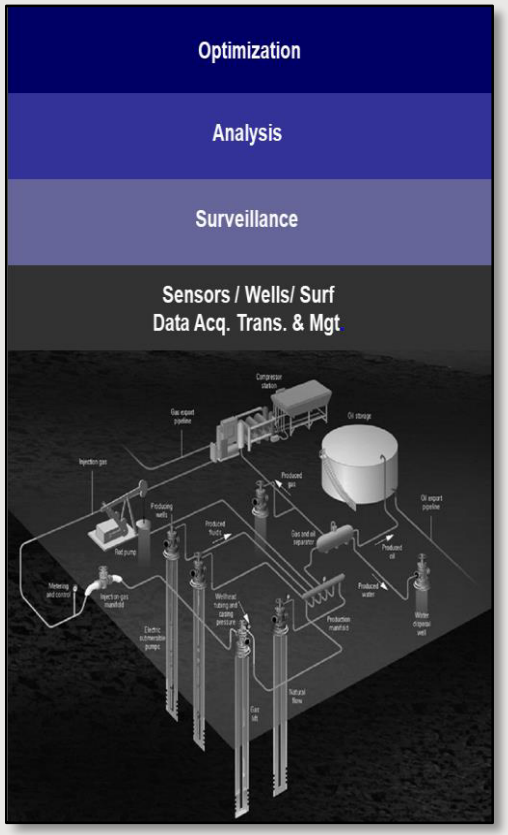


Interconnected Technical workflows supporting every business processes

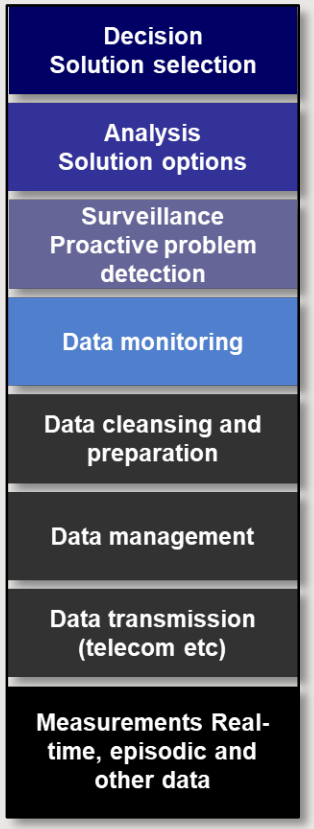
Maturity model for every technical workflows based on DOF model

Maturity model for other horizontal element such as telecom, network, governance etc.

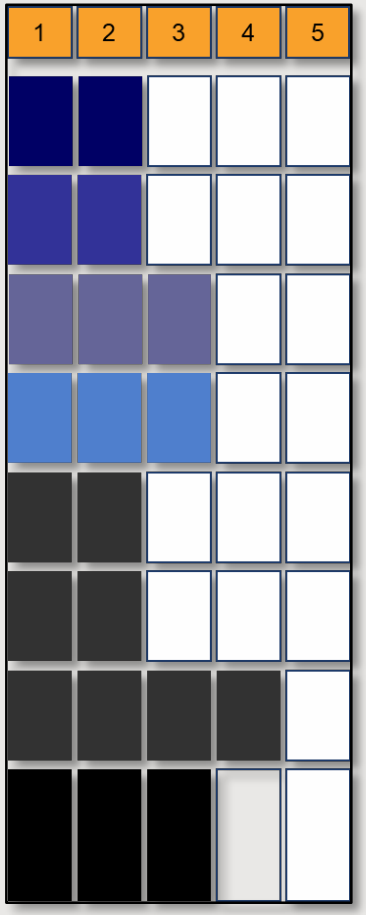
DOF ASSESSMENT – APPLYING THE MATURITY MODEL



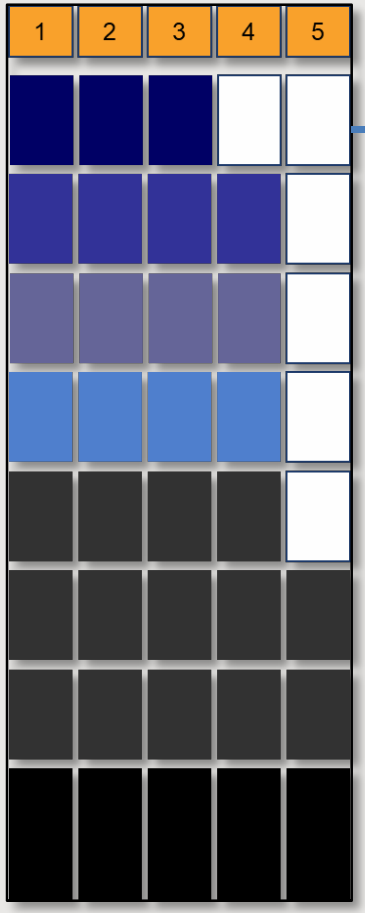
DOF System



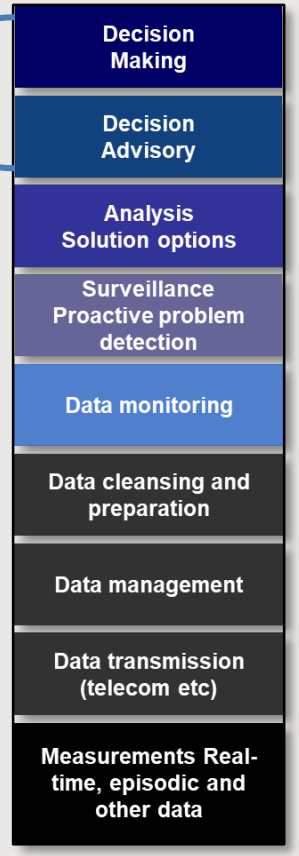
Workflow
Current State
Capability



Current state
Capability
maturity



Future state
Capability
maturity



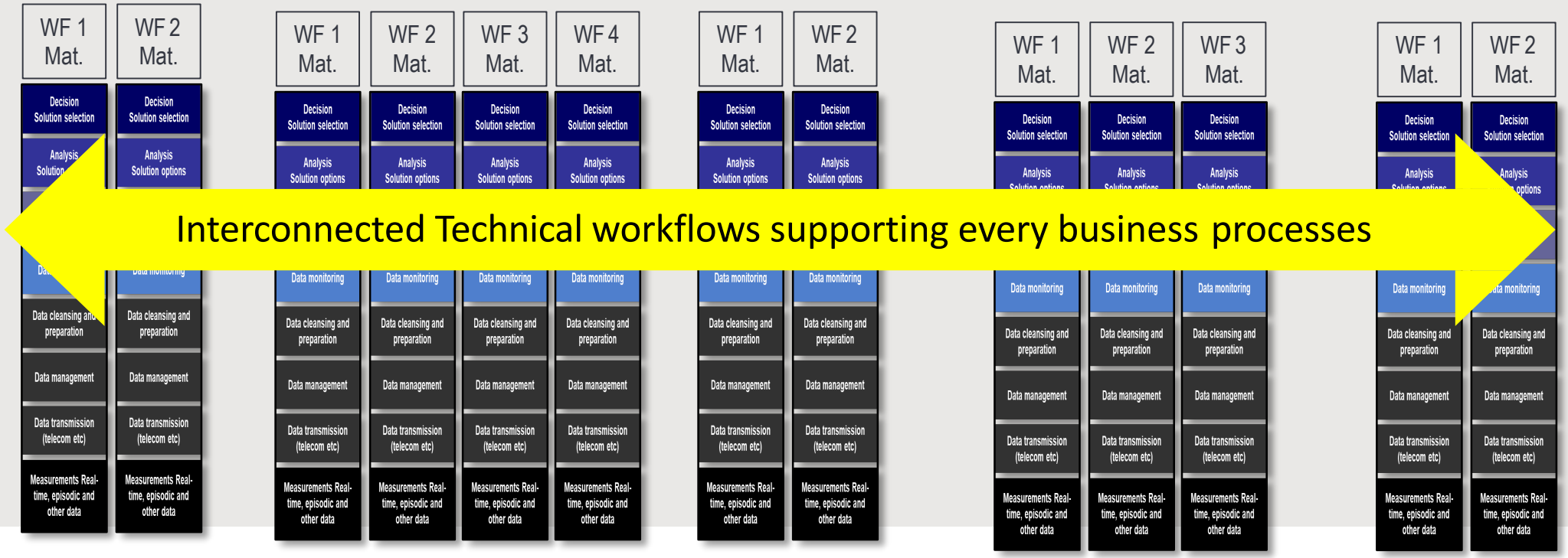
Future state
Capability
AI enabled

DOF MATURITY MODEL ….Need to be actionable

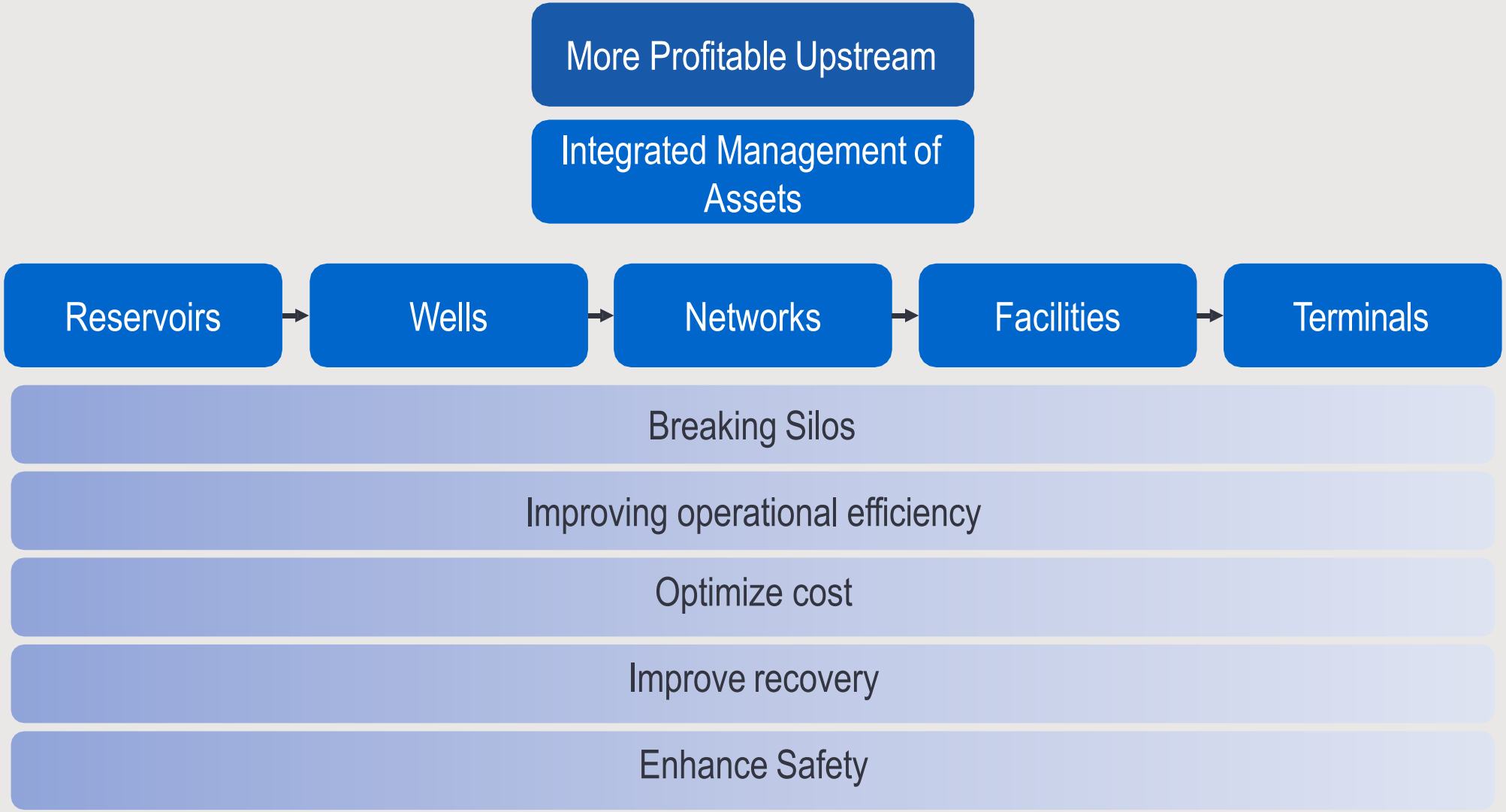
ASSET DOF maturity = Fn (Reservoir, Wells, Networks, Facilities, Terminal : DOF Maturity)

Integrated Management of Assets

Reservoir DOF maturity Fn (WF maturity)	Wells DOF maturity Fn (WF maturity)	Networks DOF maturity Fn (WF maturity)	Facilities DOF maturity Fn (WF maturity)	Terminal DOF maturity Fn (WF maturity)
Reservoirs →	Wells →	Networks →	Facilities →	Terminals



DOF MATURITY….Context of business value



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

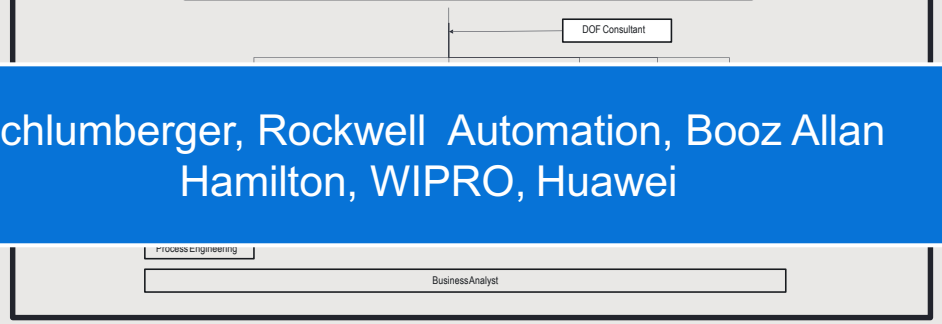
Steering Committee Team

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

Program Manager
ADNOC PM

SLB Project Manager	ADNOC Project Manager
SLB PM	ONSHORE PM OFFSHORE PM

SLB Project Team



Schlumberger, Rockwell Automation, Booz Allan Hamilton, WIPRO, Huawei

ADNOC Project Team

ADNOC HQ: Development, Thamama,
CUIM, Digital Unit, Production Unit
ADNOC Offshore Assets
ADNOC Onshore Assets

AIMS & FUTURE GOALS

LINKING DOF TO ADNOC 2030 STRATEGY

More Profitable Upstream

Increase Production Capacity

Reduce cost /bl through Operational Initiatives

Improve Recovery Efficiency in mature reservoirs

WHAT	EXAMPLES	Intelligent Asset	Smart Supply Chain	Intelligent Operations	Connected Worker
		Digital Disruptors			
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		✓	✓	✓
OPTIMIZE RISK *Improving well and facility integrity*	▪ Predictive and prescriptive identification artificial lift failures	✓	✓	✓	✓
	▪ Predictive optimized drilling parameters (drilling washouts, key-safety, maximization ROP)	✓	✓	✓	

WHAT MIGHT A DIGITAL UPSTREAM BUSINESS LOOK LIKE?

Conventional O&G Business Cycle

Exploration → Appraisal → Development → Operations

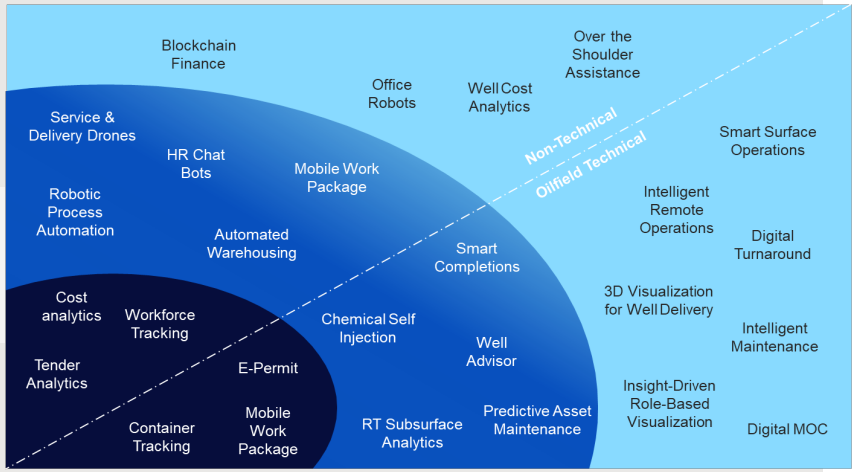
Disruptive O&G Business Cycle

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

Applicable Technologies

- 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…)

DOF TECHNOLOGY BOUNDARIES - EXAMPLES

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