

Libra Technology Portfolio

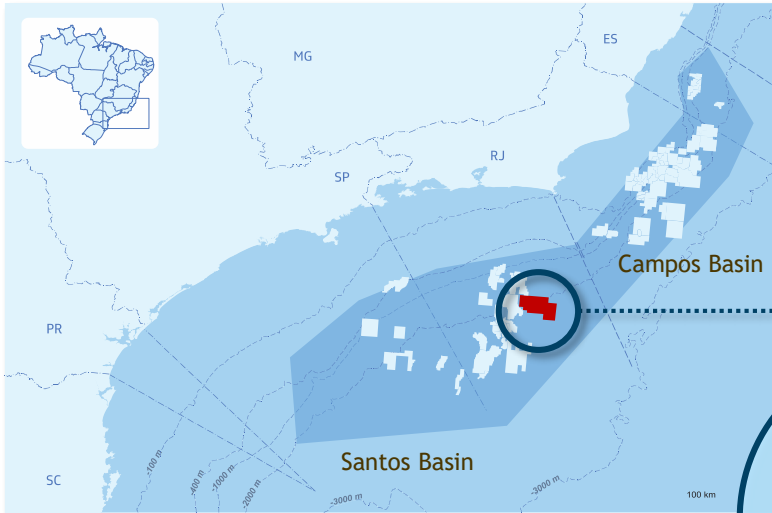
Unlocking the Future

Fabio Passarelli, Libra Project, Petrobras

Joint Venture Operator



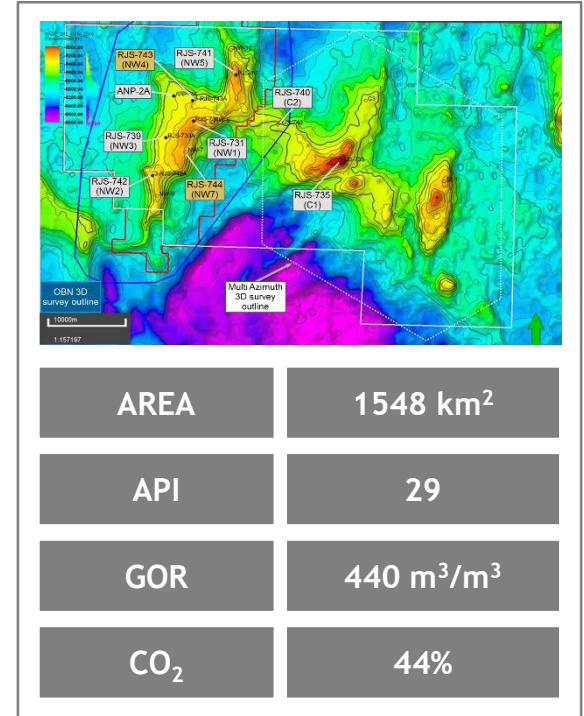
LIBRA IS A DEEP-WATER PRE-SALT PROJECT IN A GIANT STRUCTURE



LOCATED IN SANTOS BASIN

164 KM OFFSHORE RIO DE JANEIRO

WATER DEPTH: 2100 M



LIBRA PARTNERS

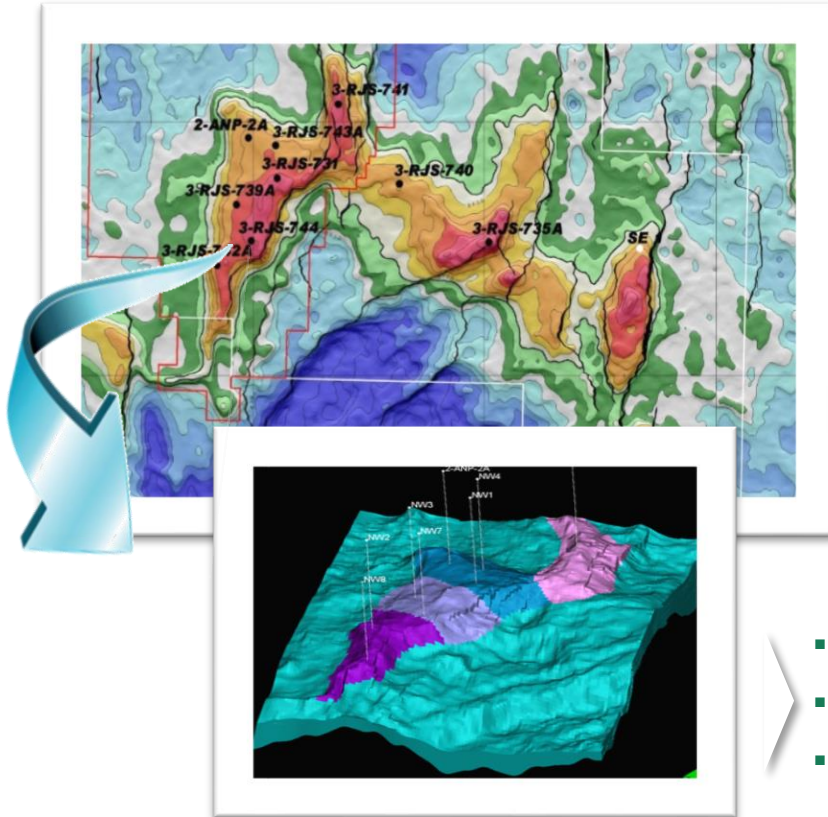
AN INNOVATIVE WAY OF WORKING

Six different companies from different parts of the world with different backgrounds and different philosophies for project development and operations working together as a fully integrated team



LIBRA NW AREA

OUR INTEGRATED DEVELOPMENT PLAN



- NW Area under **Development**
- CE & SE Areas under **exploration**

- Current base case: **4 FPU**s (WD = 2,100m)
- Objective: **anticipation**, with an acceptable level of risk
- Sequence based on **availability of reservoir information**

TECHNOLOGY APPROACH

Libra is a **Joint Industry Project** in terms of Project Based Technology Development. Creating:

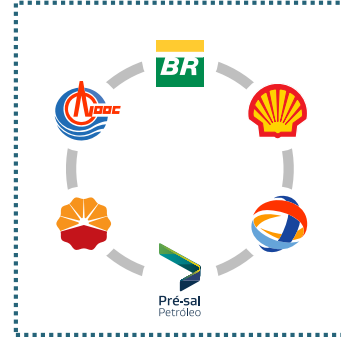
Global Technology Transfer

Technology Pull

Ownership for the Technology

Direct Application Link

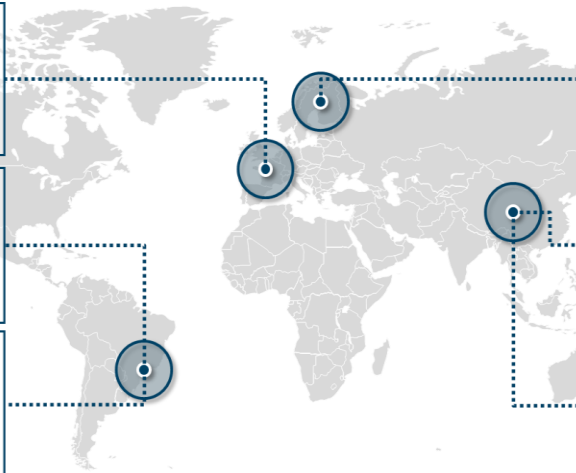
Easy Assessment of Technology Value




TOTAL
Slogan: "Committed To Better Energy"
Integrated Oil Company - Major Shares on Paris and New York Stock Exchange
Foundation: 1924
Headquarters: Paris, France


PRÉ-SAL PETRÓLEO
PRÉ-SAL PETRÓLEO S.A. (PPSA)
State Company (100% gov.)
Brazilian Government Representative
Foundation: 2013
Headquarters: Rio de Janeiro, Brazil


PETROBRAS
Slogan: "The Challenge is Our Energy"
National Oil Company (64% gov.)
Shares on São Paulo and New York Stock Exchange
Foundation: 1953
Headquarters: Rio de Janeiro, Brazil



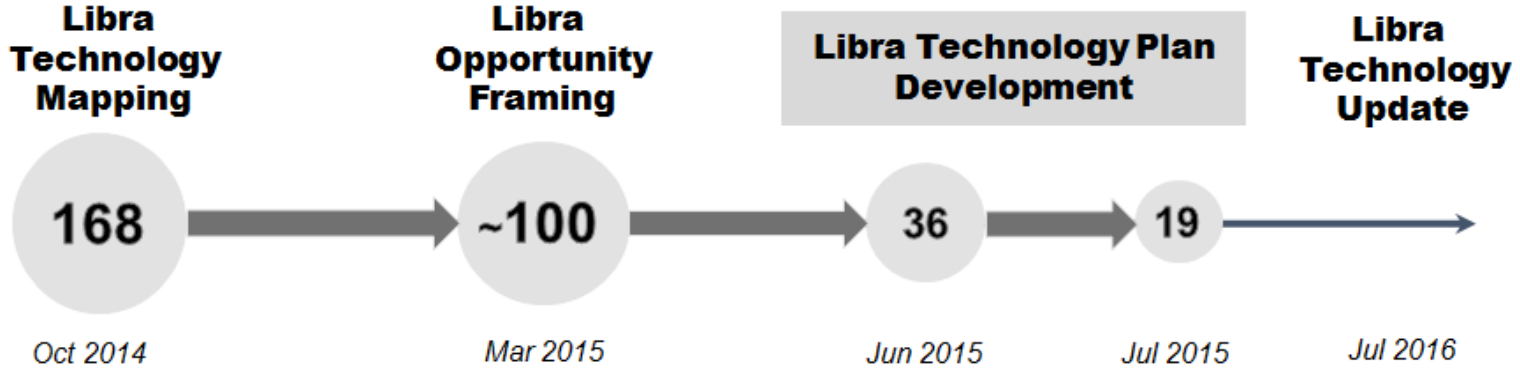

ROYAL DUTCH SHELL
Slogan: "Let's Make The Future"
Integrated Oil Company - Major Shares on Euronext, London and New York Stock Exchange
Foundation: 1907
Headquarters: The Hague, Netherlands


CHINA NATIONAL OFFSHORE OIL CORPORATION
National Oil Company (64,44% gov.)
Shares on Hong Kong, New York and Toronto Stock Exchange
Foundation: 1982
Headquarters: Beijing, China


CHINA NATIONAL PETROLEUM CORPORATION
Slogan: "Energize • Harmonize • Realize"
National Oil Company (100% gov.)
Foundation: 1955
Headquarters: Beijing, China

Libra leverages existing technology and aims to identify and close technology gaps in an integrated approach to maximize project value

LIBRA TECHNOLOGY PLAN (LTP) DEVELOPMENT

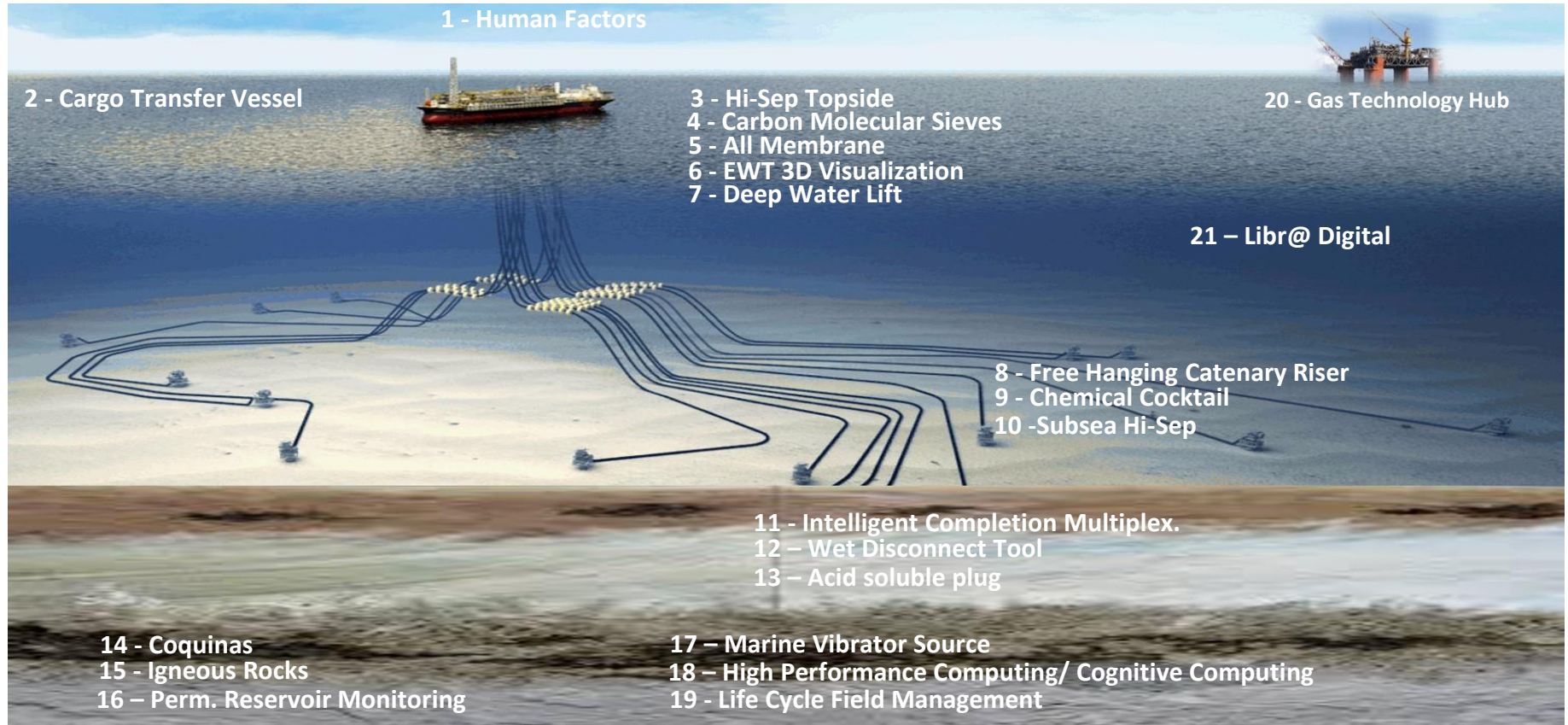


Technology	Description	Technology specifications		Availability	Notes
		Model number	Year of release		
Technology A	General purpose	Model A1000	2010	Available	
	Specialized for data processing	Model A1000	2010	Available	
	Specialized for image processing	Model A1000	2010	Available	
	Specialized for signal processing	Model A1000	2010	Available	
	Specialized for control systems	Model A1000	2010	Available	
Technology B	General purpose	Model B1000	2010	Available	
	Specialized for data processing	Model B1000	2010	Available	
	Specialized for image processing	Model B1000	2010	Available	
	Specialized for signal processing	Model B1000	2010	Available	
	Specialized for control systems	Model B1000	2010	Available	
Technology C	General purpose	Model C1000	2010	Available	
	Specialized for data processing	Model C1000	2010	Available	
	Specialized for image processing	Model C1000	2010	Available	
	Specialized for signal processing	Model C1000	2010	Available	
	Specialized for control systems	Model C1000	2010	Available	

Assessed as a single group, as these technologies are complementary

HSE	Integrated Subsurface and Field Management Technologies	Wells	Subsea	Topsides
Human Factors	Subsurface Studies	Wet Disconnect Tool (WDT)	Dense Phase CO ₂ Separation – Hi-Sep™	
Assessed as a single group, as these technologies are complementary	Reservoir EOR Studies	Acid Soluble Plug (ASP)	Hybrid Composite Flexible Riser	CO ₂ Removal
	Reservoir Performance Monitoring		Hydrate Mitigation for Single WAG Line	Gas Dehydration
	High Performance Computing (HPC and Giga Models		Chemical Cocktails for Simplified Subsea Umbilicals	Blowdown and Flare for High CO ₂ strings
	Permanent Reservoir Monitoring (PRM)			Alternative Crude Offloading
	Marine Vibrator Source			
	IC MUX - Multiplex Intelligent Completions			
Life Cycle Field Management				

LIBRA TECHNOLOGY SOLUTIONS FROM RESERVOIR TO OFFLOADING



HUMAN FACTORS

Description & Objective

- Develop a Human Factors and Resilience Engineering program to enhance HSE performance and integrated operational efficiency.

Partnership with:



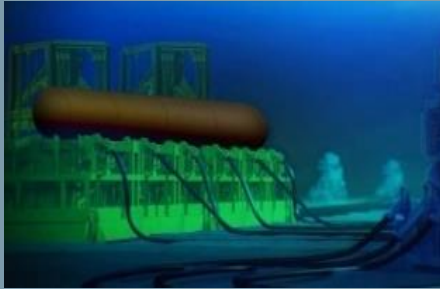
Expected products

- Mapping of essential non-technical abilities for specific functions/activities (for recruiting and training);
- Recommendations related to social, non-technical and organizational aspects to increase system resilience;



Processing Technologies

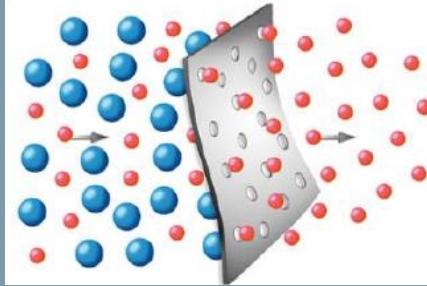
Dense Phase CO₂ Separation Hi-Sep™



Takes advantage of CO₂ in liquid state under certain pressure and temperature providing a Gas Oil Ratio Reduction.

Partners:
Aker, FMC, GE, OneSubsea,
and Saipem

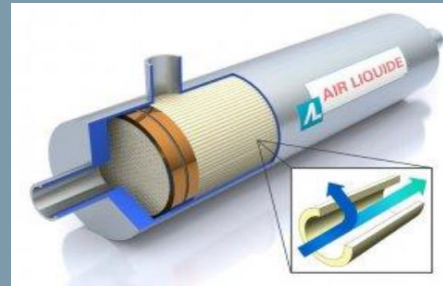
Carbon Molecular Sieve Membranes



High performance membranes for CO₂ separation from natural gas allowing smaller processing plants with higher capacity

Partner:
Shell

All Membrane Technology



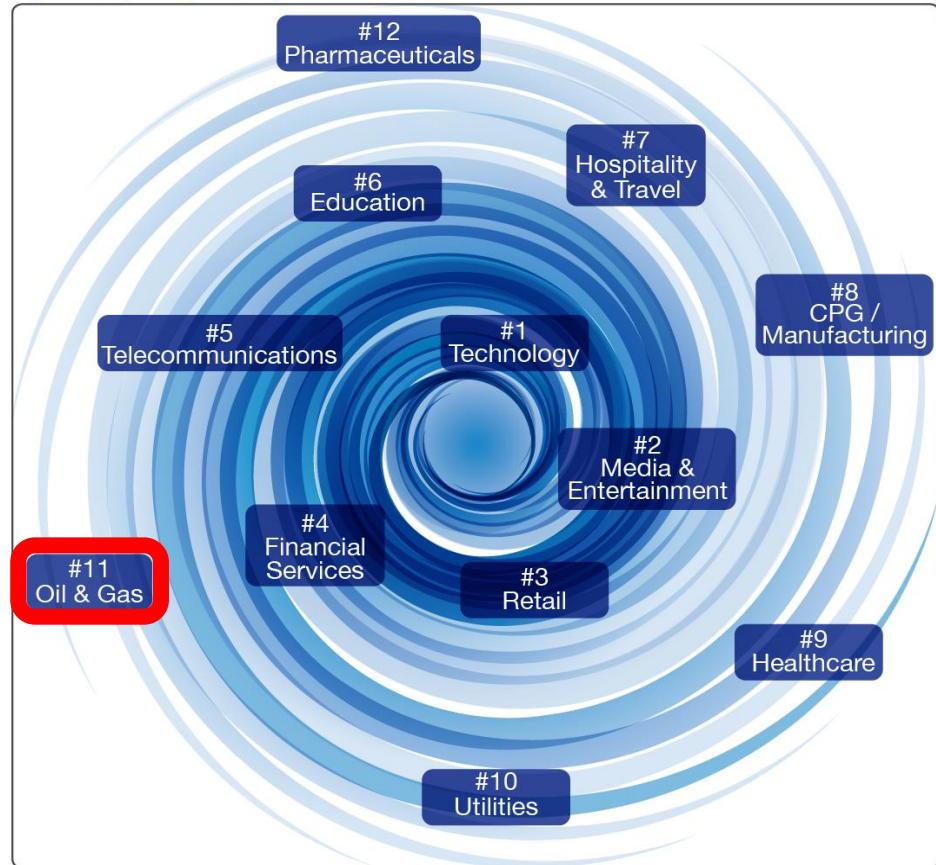
Compact gas treatment system based on membranes capable of removing H₂S and water, reducing topside weight and FPSO costs

Partner:
Air Liquide

DIGITAL VORTEX

How Digital Disruption is Redefining Industries

Industries Ranked by Potential for Digital Disruption	
Technology Products & Services	#1
Media & Entertainment	#2
Retail	#3
Financial Services	#4
Telecommunications	#5
Education	#6
Hospitality & Travel	#7
CPG & Manufacturing	#8
Healthcare	#9
Utilities	#10
Oil & Gas	#11
Pharmaceuticals	#12



Source: Global Center for Digital Business Transformation, 2015



COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

White Paper

Digital Transformation Initiative

Oil and Gas Industry

McKinsey & Company

Oil & Gas

Commentary

August 2016

The next frontier for digital technologies in oil and gas

By Harsh Choudhary

Focused Conference and Exhibition

Data Driven Production Conference

June 6-7 2017 • Doubletree by Hilton Hotel, Houston

gas players globally.



data
is the new oil

accenture>strategy

Digital disruption

Bold times for the oil
and gas industry

Oil and Gas CAPEX Scenarios and Impact on Digital Transformation

Dynamic industry changes are forcing the industry to retool for the future



SPE Workshop: The Internet of Oilfield Things - Creating New Value in Information from Upstream to Downstream

7 - 8 Aug 2017 | Kuala Lumpur, Malaysia



Digital platform for ConocoPhillips

The Norwegians are often ahead of the pack, and they have known this technology for years. Other oil nations now also have it on their agenda to make use of it to operate and maintain offshore installations. It is called Integrated Operations.

The Norwegian Oil Industry Association, that represents oil companies and suppliers in

Norwegian waters, said in 2006



Home > Blog > Statoil outlines digitalization strategy toward 2020, spearheads E&P effort

World Oil  Blog

Sponsored by 

Statoil outlines digitalization strategy toward 2020, spearheads E&P effort

Alex Endress, World Oil
6/12/2017



Digitalisation and Advanced Analytics @ Shell

BP Technology Outlook

Technology choices for a secure, affordable and sustainable energy future



DIGITAL @ TOTAL

EXXONMOBIL: LESSONS FROM A SHARED DATA LAKE ADOPTION

by Tom Hastain

With the [San Jose DataWorks Summit](#) (June 13-15) just two months away, we're busy finalizing the lineup of an

Data analytics
Creating value from vast data sets

Automation via robotics
Enabling safe and reliable operations



LIBR@ DIGITAL

The O&G industry has an unique opportunity to develop a digital revolution

Transformation of Libra's strategy, culture and processes through the use of Digital Technologies to significantly increase project performance:

- Improve **existing processes** & promote **awareness**/training;
- Create new results through improved **data sharing and integration**;
- Develop future high impact **Digital Creation** (disruptive).



Digital Impact Assessment

Reduce Cost

- Maintenance
- Operational Efficiency

Increase Production

- Production optimization
- Plateau Maintenance
- Gas management

Increase Recovery

- Reservoir optimization
- Well Placement
- Gas management

Improve HSE

- Less people at risk
- Reduce enviromental risk

Increase Support Efficiency

- Simplify legal/contract
- Optimize PSC management

Data Integration



FROM INNOVATION TO SUCCESS



$$S = \frac{\sum_1^n (I_n \times A_n)}{(C) \times (\text{Time to Imp})}$$



Thank you!