Digital Transformation
Digitization Strategies coming to the Oil & Gas Industry

Biju George
Energy, Utilities, Mining, Industrial Products

pwc

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Our focus will be on

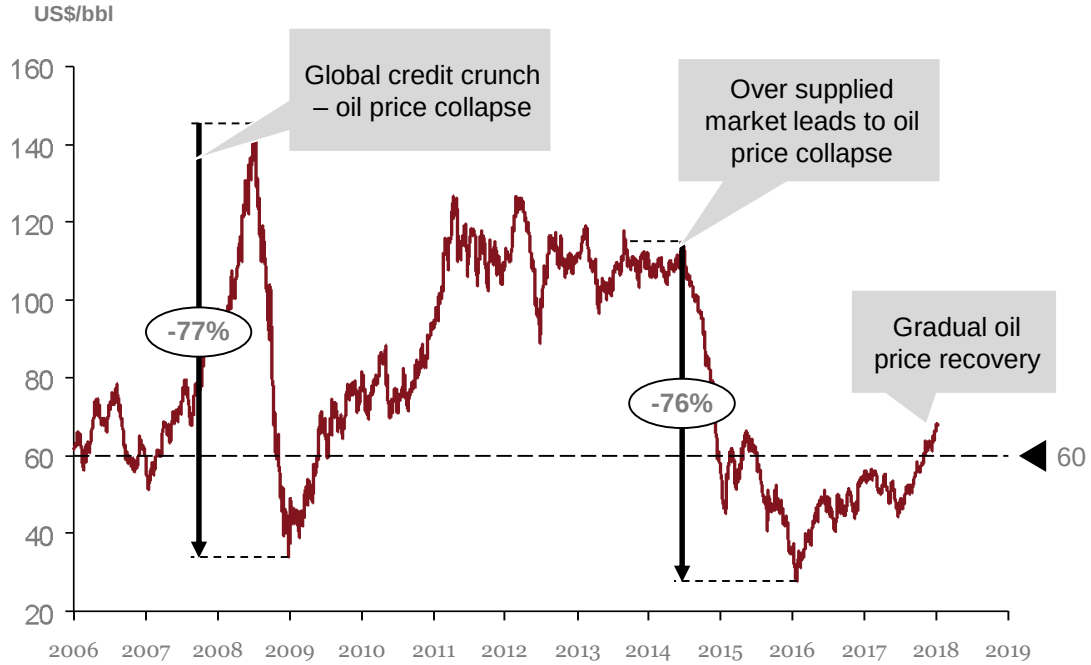
- 01 Dynamics of the Oil & Gas Industry
- 02 Digitization in Oil & Gas
- 03 Essential Eight
- 04 Principles for Digital Transformation
- 05 What does ‘Good’ look like?

01

Dynamics of the Oil & Gas Industry

The oil and gas sector is emerging from a turbulent period, to face an array of short and long term challenges…

Brent Oil Price (2008 – 2018)



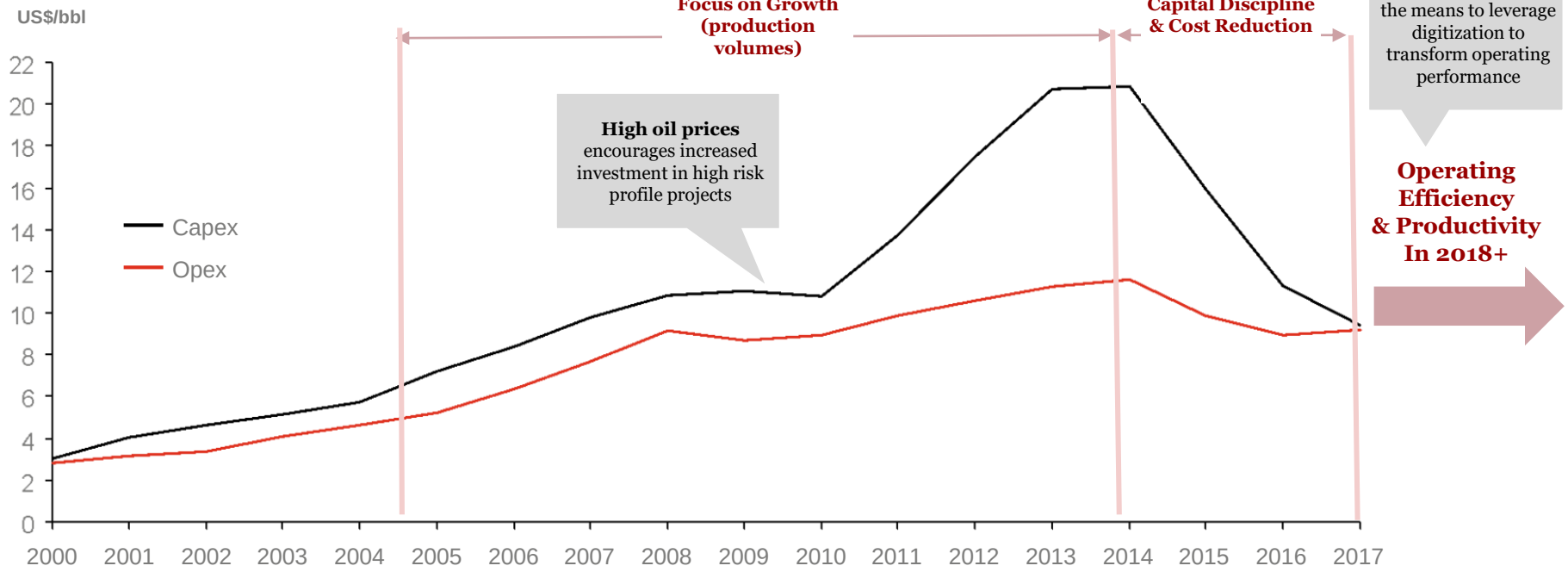
Source: Bloomberg; Strategy& analysis

Industry Challenges

- **Short term volatility in oil prices as a result of supply and demand disruptions**
- **Ongoing pressure for cost reduction (through standardisation and collaboration)**
- **Greater complexity (reservoirs, remote operations, capabilities)**
- **Rapid technological advances transforming organisation culture and 'ways of working'**
- **Increasing competition in a low carbon world (gas, renewables and EVs)**

…having gone from a focus on just ‘growth’, to capital discipline and cost reduction and now improved productivity

Leading IOCs Capex / Opex Productivity (2000 – 2017)



Note: IOCs include Exxon, Chevron, Shell, Total, BP, ConocoPhillips and Eni
Source: Rystad; Strategy& analysis

Prolonged low oil prices and technological advances are giving a new impetus to digital transformation…

Key Drivers for Oil & Gas Digital Transformation

Need to improve operational efficiency

- Prolonged low oil prices are forcing O&G players to focus on cost and investment discipline, exploring different levers of efficiency improvements

Emergence of mainstream digital technologies

- Emerging digital technologies are quickly becoming mainstream with costs steadily reducing, hence allowing for their wide adoption

"Our industry needs a transformation. The biggest lever we have today is digital. I think of digital as one technology that offers you everything."

Ahmed Hashmi, BP Global Head of Upstream Technology

"Digital technology has a major part to play in the next stage of structural cost reduction."

Wood Mackenzie

"Big data for example has the potential to significantly reduce costs and save engineering hours on every major project. But digitalization could have a major impact on people and jobs too. I believe that the winners in the coming years will be those companies that are able to use new technologies and develop new business models without losing the flexibility to ride continuous waves of innovation."

Ben van Beurden, CEO Shell

"My priority and my true goal is to change the organisation into a digital enterprise…That means integrating business processes and IT capabilities and becoming an agile company that can handle its business in a digital way, in a much faster and in a more intelligent and efficient style. We have to think digital from the beginning, unleashing the potential that is hidden in some unknown areas."

Gianluigi Castelli, CIO of Eni

Source: Strategy& Analysis

…so digital increasingly presents a potential opportunity for the industry to address some of its most pressing challenges

Digital Opportunities for the Industry

- **Big Data** – captured from a variety of data sources (sensors, environmental, machine design) to optimise operations and supply chain, as well as 'freeing up' time for engineers
- **Rapid Data Conversion** - applying physics based modelling techniques to geological data to quickly create surface models and machine learning to remotely foresee developing fault (predictive maintenance)
- **Automating Remote Operations** – remote, centralised monitoring, carrying out preventative maintenance, minimising planned downtime, minimise human involvement in diagnosis and repairs
- **Replace specialised software with industrial internet platforms** - to improve reliability, uptime, mobility and speed
- **Improve Human Operations** - giving engineers information relevant to complete tasks in real time through mobile devices and augmented reality

*According to WEC, digital transformation could unlock between **US$1.6 – 2.5tm** over next decade in value*

Net benefits: Cost reduction through improved productivity, transformation of business processes and improving HSE

02

Digitization in Oil & Gas

Drilling operations have remained very similar for decades…

1950s Drilling Operation

- A (dangerous) job for roughnecks
- Heavy reliant on Drilllers expertise
- Drawworks and heavy equipment – very limited support from technology

2000s Drilling Operation

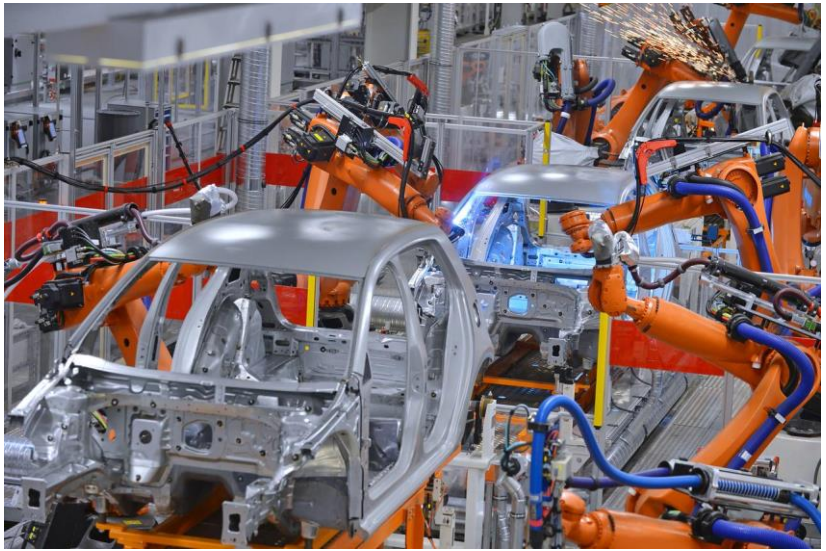
- Still a job for roughnecks
- Drillers expertise still key for safety and success
- Some support from digital technology (controls, surveillance, …)

…especially compared with the automotive sector

1950s Automotive Assembly

- A labour intensive production line
- Time consuming process
- Heavy, bulky equipment used by operators

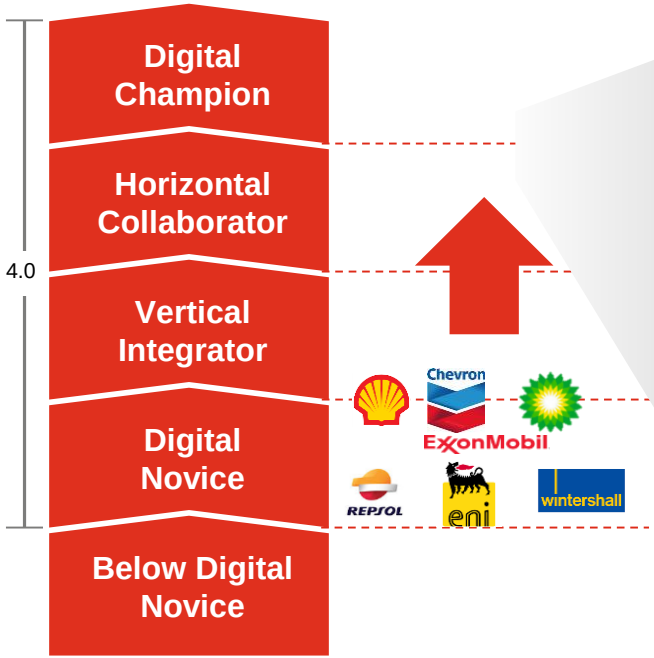
2000s Automotive Assembly



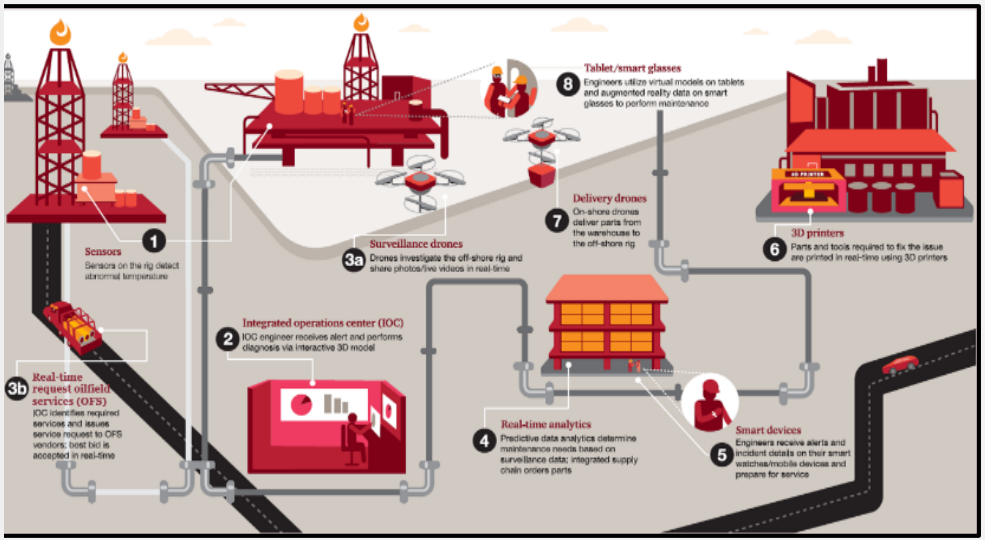
- Robotics
- Time efficient
- Lean and agile production line

Today, oil and gas companies are still at the beginning of their digital transformation towards an envisioned digital oil field…

<u>Today:</u> oil and gas companies still in the early stages of digital maturity

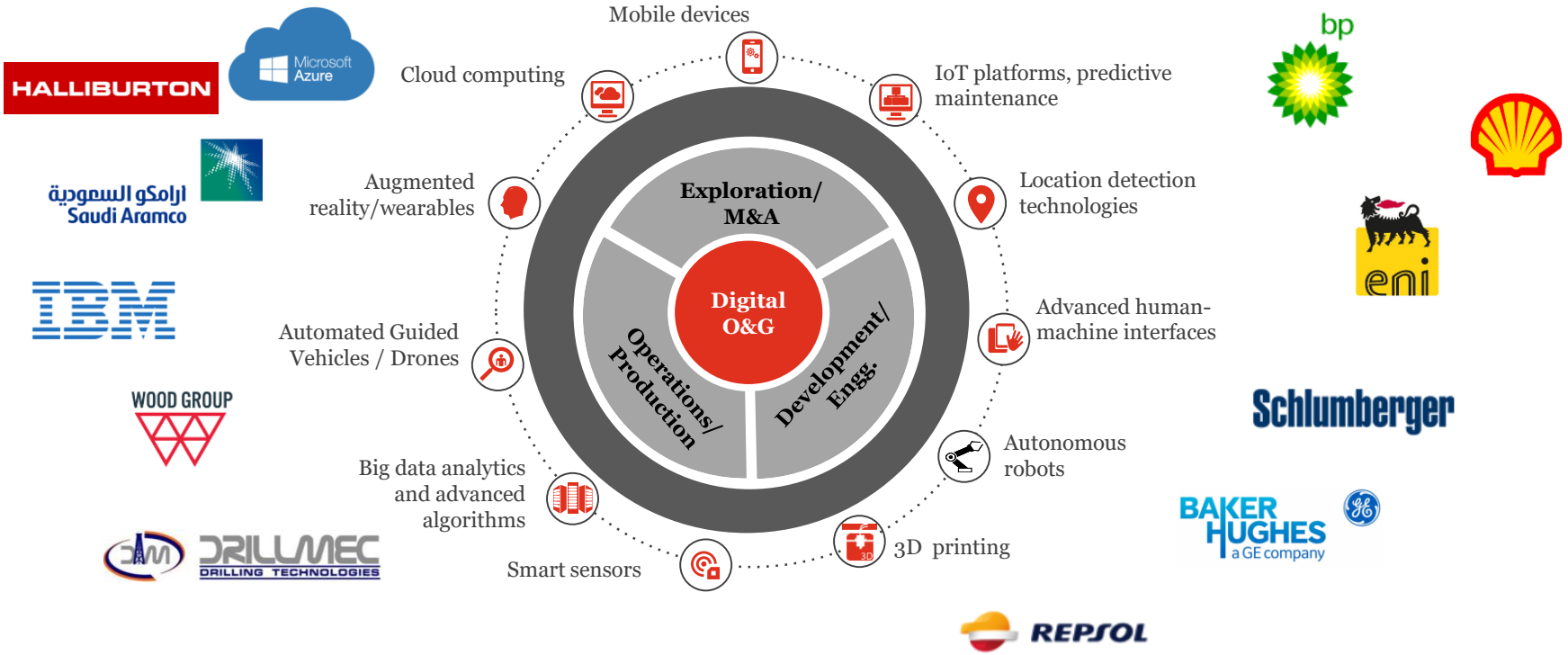


<u>Tomorrow:</u> oil and gas companies incorporating digital into most aspects of their operations ("making real an old concept")



Source:Strategy& analysis

…and various technologies are being adopted by major producers and suppliers



Source: IDC, Gartner, Strategy& analysis

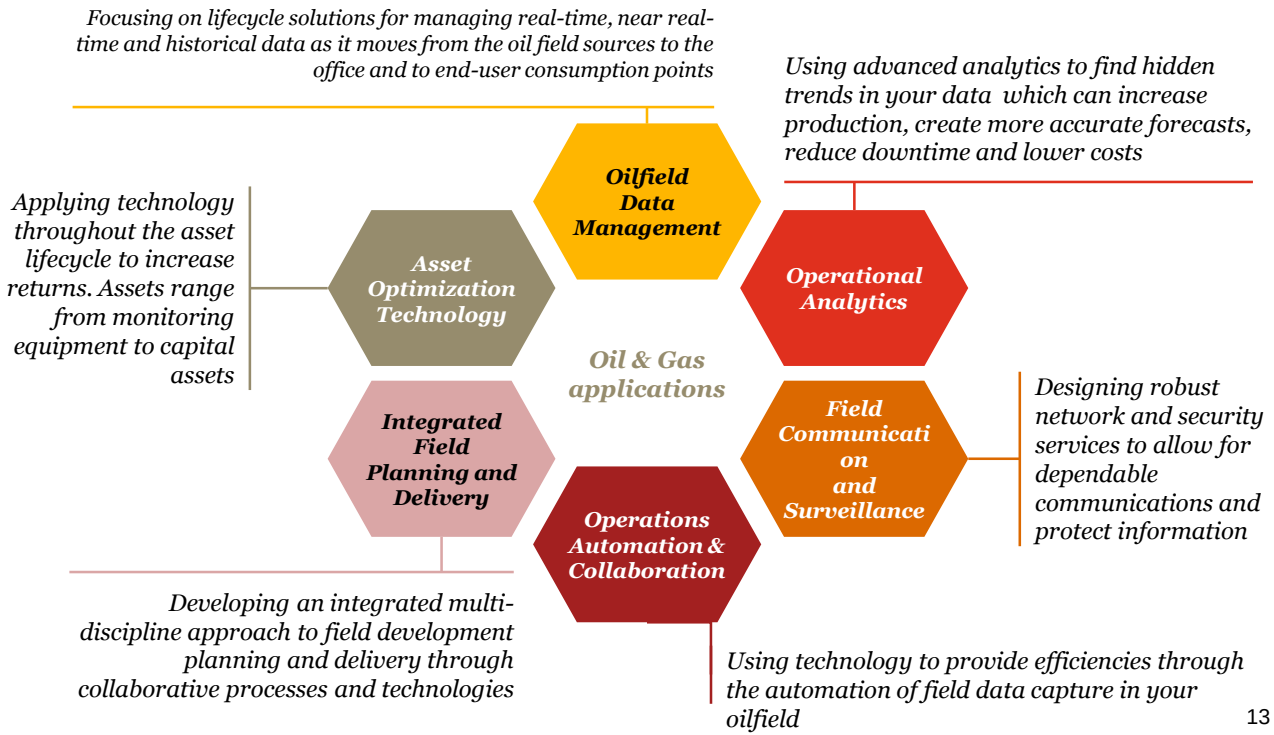
These emerging digital technologies can have a significant impact on the oil and gas industry

Key Digital Technologies

- Big data analytics and cloud
- IoT and connected devices
- Wearable computing and augmented reality
- Robotics and drones
- Collaboration platforms
- Custom manufacturing and 3D printing
- Artificial Intelligence

Application to the Oil and Gas Industry

NOT EXHAUSTIVE

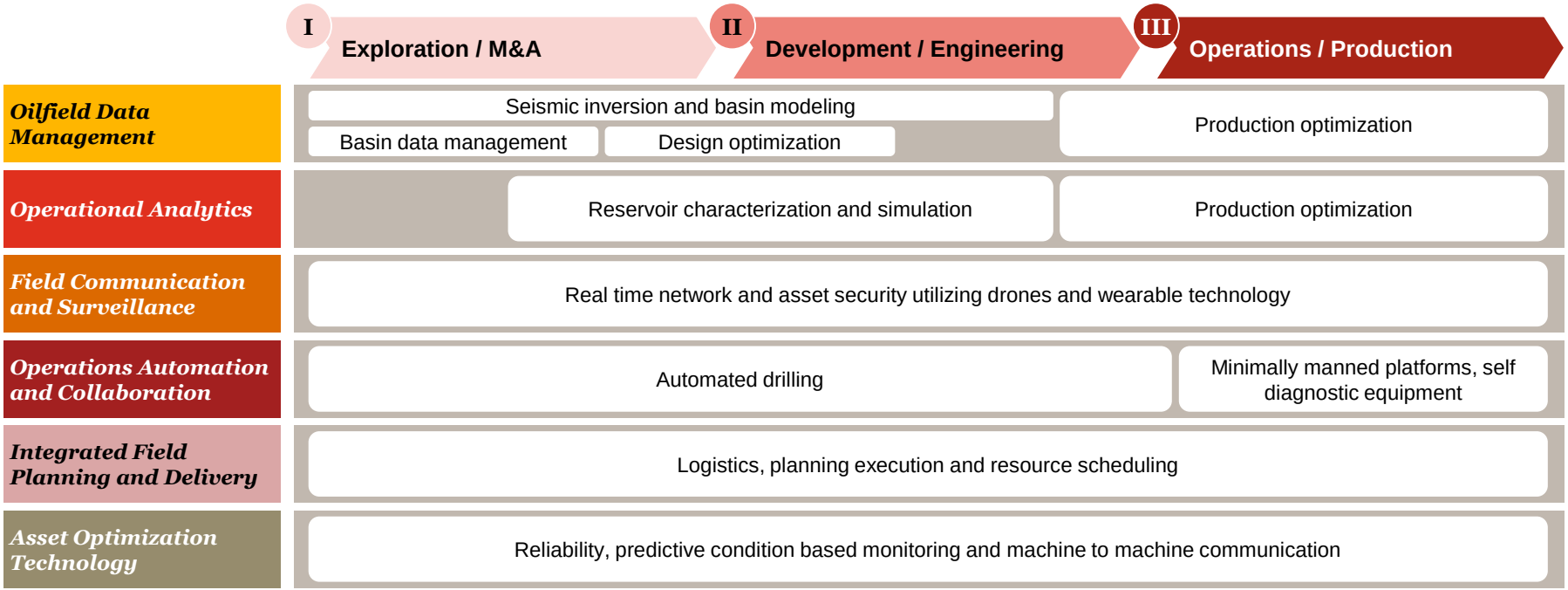


Source:Strategy& analysis

As a consequence, digital will reshape the whole upstream value chain…

Capability Imperatives of Digitalization Along the Upstream Value Chain

NOT EXHAUSTIVE



Source:Strategy& analysis

...and can be a catalyst for efficiency improvements

Digitization Impact on Efficiency

Operational Excellence

- **Improve the ultimate recovery and economics of assets** through integrated evergreen asset simulation.
- **Efficiently maintain and operate assets** applying robotics, machine automation and human device interaction (Augmented Reality, Drones & Robots, Human machine interface, predictive maintenance).
- **Automate internal processes** (RPA)

Supply Chain Excellence

- **Collaborate** across the end-to-end supply chain (Cloud Solutions, Artificial Intelligence).
- Procure **commodities using digital tools** and access **standalone services via platforms** (Platform Solutions).

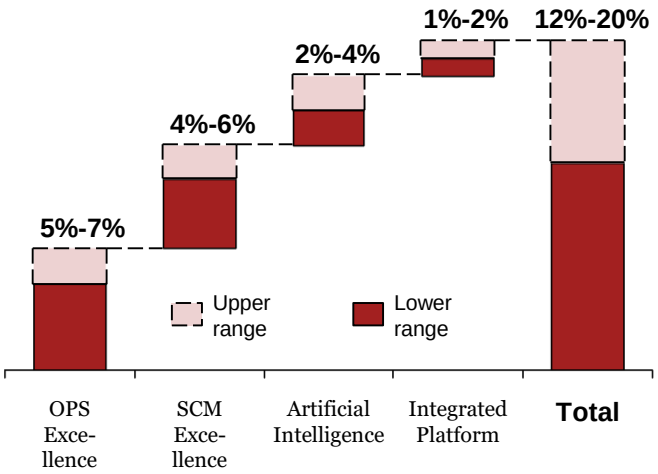
Artificial Intelligence

- **Faster and more accurately assess** and engineer improvement opportunities using Artificial Intelligence and Advanced Analytics, Smart Data Science.
- Optimize operations efficiency and quality through smart algorithm improvement.

Integrated Platforms

- **Improve collaboration** and strengthen relationships with internal and external partners through **digitally enabled platforms**, exchanging data, information and knowledge.

Efficiency Increase from Digitization
(% saving on total OPEX)



Achieving the full benefits will require investments and 3+ years

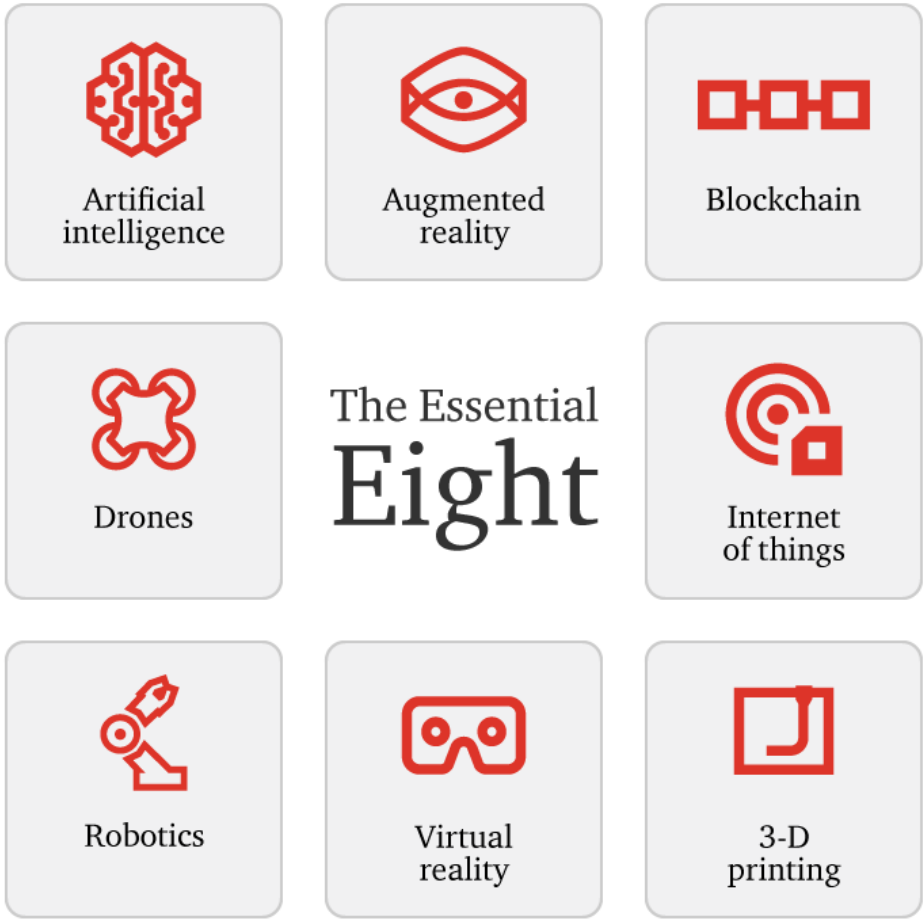
Source:Strategy& analysis

We think there are some key learnings from what is happening in the industry

- In a lower and more volatile oil price world, where there is ongoing focus on cost reduction, ‘digital’ will play an important role in making O&G companies **leaner** and more **agile** organisations
- Digital will be part of wider business transformations, allowing for improved **connectivity** and **collaboration**, optimising decision making and providing more accurate and useable data
- Oil majors prioritising digital investments in some key areas: Robotics and Drones, Artificial Intelligence and Wearable Technology; with expectations that gains can be realised from improved **worker productivity**, as well as improving **safety** and **optimizing** head count
- Applications of digital technology solutions are varied ranging from drones, to smart ‘wearables’ to AI and RPA. **Sensor technology** installed on offshore infrastructure to monitor conditions, thus removing humans from **high risk** environment

03
Essential Eight

PwC analyzed 250+ technologies to short list the **eight** having the biggest business impact across industries right now.



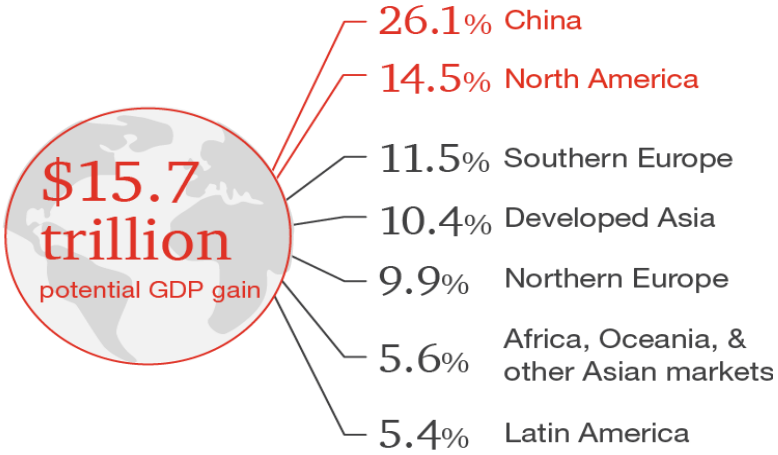
Artificial intelligence

AI is an umbrella term for “smart” technologies that are aware of and can learn from their environments to assist or augment human decision making.

In practice:

- machine learning
- recommendation engines
- predictive analytics
- image recognition

China and North America will see biggest AI gains by 2030



Source: PwC Global Artificial Intelligence Study, 2017

Virtual reality

Virtual Reality (VR) is a simulation of a 3-D image or complete environment where a user can interact in a seemingly realistic way.

In practice:

- User experience
- virtual operations
- training and simulation
- prototyping and design

7%

of companies are making significant investments in VR today; 15% in three years.

Source: PwC 2017 Global Digital IQ Survey

Augmented reality

Augmented reality (AR) is a data or information "overlay" on the physical world that uses contextualized digital information to augment the user's real-world view.

In practice:

- data visualization (digital twins)
- facility safety
- customer experience
- manufacturing operations

24%

of companies will make significant investments in AR in three years; 5% think it will be the most disruptive tech to their industry.

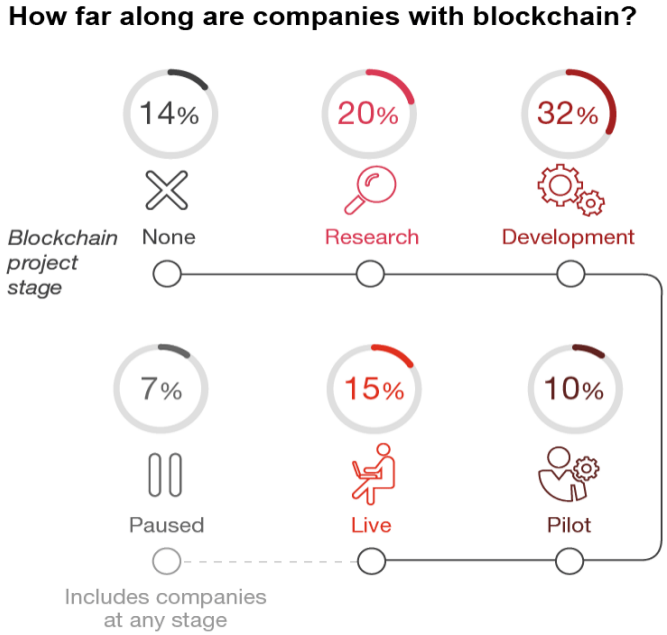
Source: PwC 2017 Global Digital IQ Survey

Blockchain

Blockchain technology is a distributed shared ledger where transactions are recorded and confirmed without the need for a central authority.

In practice:

- asset traceability
- streamlined financial processes
- identity verification
- smart contracts



Note: Numbers are rounded (sum does not equal 100 due to rounding).
Source: PwC Global Blockchain Survey, 2018

Drones

Drones are devices that fly or move without the presence of a pilot and can be used to collect a wide range of data or execute tasks remotely.

In practice:

- monitoring of infrastructure
- remote delivery
- deployable security and surveillance
- capture video and data (digital twins)

of businesses are making significant investments in drones today; 14% will in the next three years.

Source: PwC 2017 Global Digital IQ Survey

Internet of Things

The Internet of things (IoT) extends network connectivity and enables a diverse range of devices to collect, process, and send back data.

In practice:

- real-time location tracking
- smart metering
- autonomous product operation
- environment sensing

73% of companies are making IoT investments today;

47% say it will be the most important tech for cutting costs.

Source: PwC 2017 Global Digital IQ Survey

Robotics

Robotics is the combination of engineering and computer science to create, design, and operate mechanical devices or processes, i.e., robots and Intelligent Process Automation (IPA).

In practice:

- industrial manufacturing
- back and front office automation
- transportation operations
- product fulfillment

31% of businesses will make significant investments in robotics in three years;

13% say it will be the most disruptive tech to their business model within the next five years.

Source: PwC 2017 Global Digital IQ Survey

Robotic Process Automation (RPA)

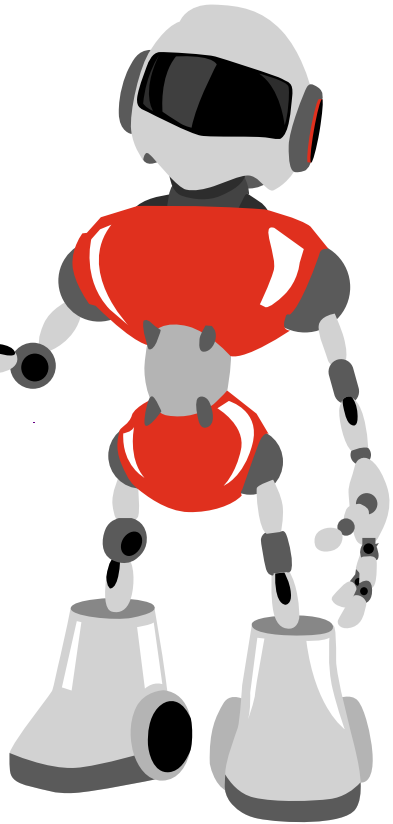
A humanoid robot
(not C3PO or R2D2)

Something that can entirely replace humans

Mechanical tooling, physical machinery, 'traditional' robotics

Purely just another "cost play"

RPA is <u>not</u>...



What processes and functions can RPA be deployed in?

Shared Services

Finance

- General Ledger Accounting
- Fixed Asset Accounting
- General Ledger Close
- Account Reconciliation
- Accounts Payable
- Payment Processing
- Reimbursement
- Accounts Receivable
- Legal Entity Reporting
- Expense/Revenue Allocations
- Financial Control

Shared Services

HR

- Onboarding
- Time & Attendance Management
- Benefits administration
- Payroll
- Compliance Reporting
- Recruitment
- Personnel Administration

Operations

- Sequencing & Materials Management
- Production Reporting

Safety

- Safety/Incident Reporting/Near Miss

IT

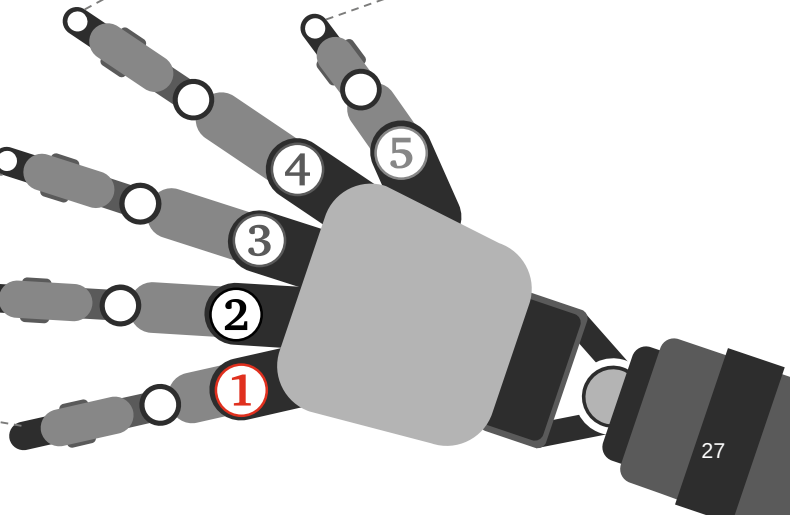
- IT Service Management
- Support
- Self Service

Procurement

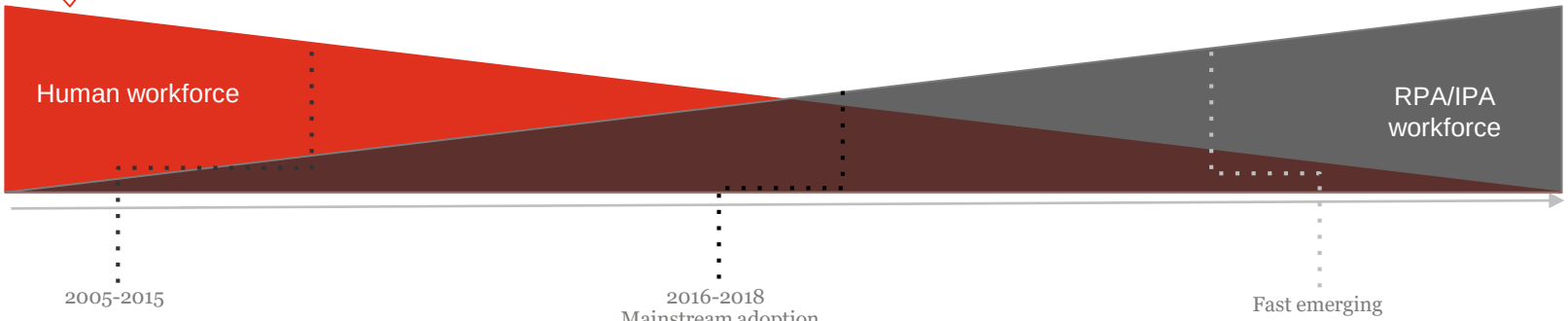
- Data aggregation for planning
- Payments and funds management
- Trade and foreign exchange (FX)

Other

- Workflow management
- Fraud detection
- Document & record management



RPA is now becoming Intelligent Automation



Offshoring & shared services

- Labor arbitrage savings 20-30%.
- Process improvement initiatives drive additional 5-15% efficiency.

Robotics Process Automation (RPA)

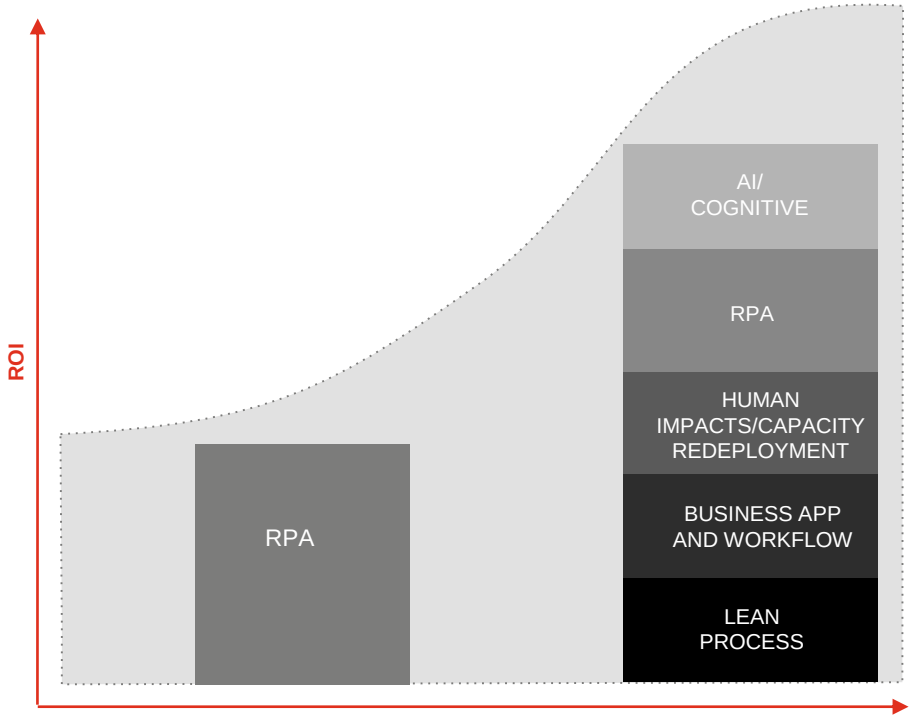
- Logic driven, software executes pre-programmed tasks as defined by the robot designer.

Intelligent Process Automation (IPA)

- Introduces the usage of past data to optimize decision making points and provide recommendations.

Intelligent Process Automation (IPA) is the application of cognitive intelligence to execute tasks and update rules based on “learned” trends, requiring minimal human oversight. It is simply a paralleled application of AI and Robotic Process Automation, also often known as Cognitive Robotics. It allows knowledge workers to be tasked with more complex tasks.

Approach Intelligent Automation as a *Business Transformation*



A holistic view of your processes

- Best process candidate(s)
- “Lean Process Improvement” lens
- Both functional and technical team members

Automation beyond 'just' RPA

- Select the 'best fit' for your requirements: AI, workflow automations, business apps, macros
- Diverse cross-industry and cross-business-line experience

Cognitive and machine learning

- Address more complex situations and optimize the decision points for your automation solution
- Includes predictive models and deep learning algorithms that provide recommendations

3-D printing

3-D Printing is the process of creating a three-dimensional object by successively printing layers of materials on one another until an object is formed.

In practice:

- rapid prototyping
- spare parts manufacturing
- R&D projects
- complex manufacturing

Top industries making 3-D printing investments over next three years

35%
of automotive companies

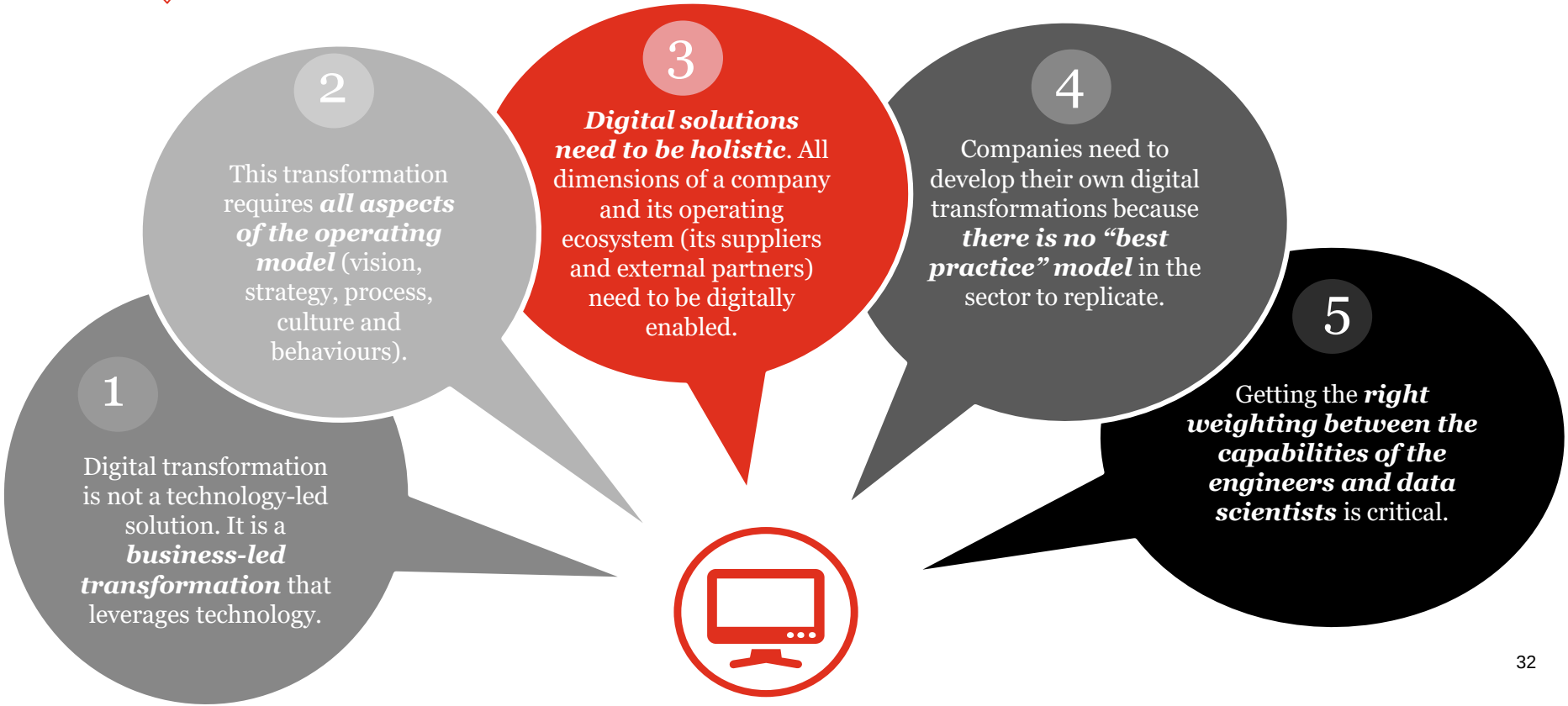
29%
of industrial product companies

29%
of healthcare companies

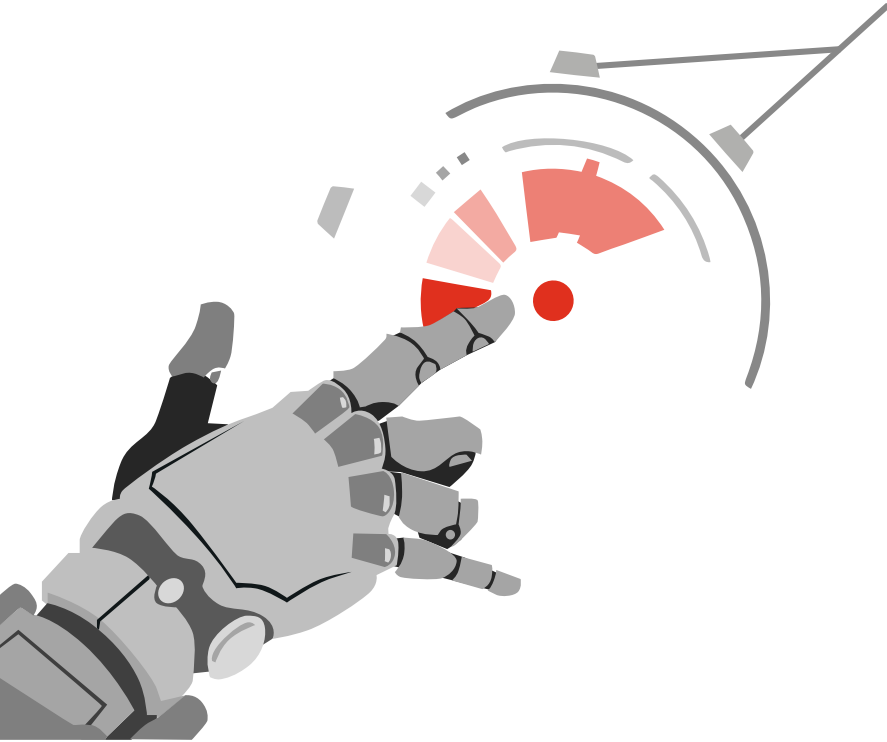
Source: PwC 2017 Global Digital IQ Survey

04
Principles for Digital Transformation

Digital disruption in the global energy, utilities and resources industry is led by five guiding principles



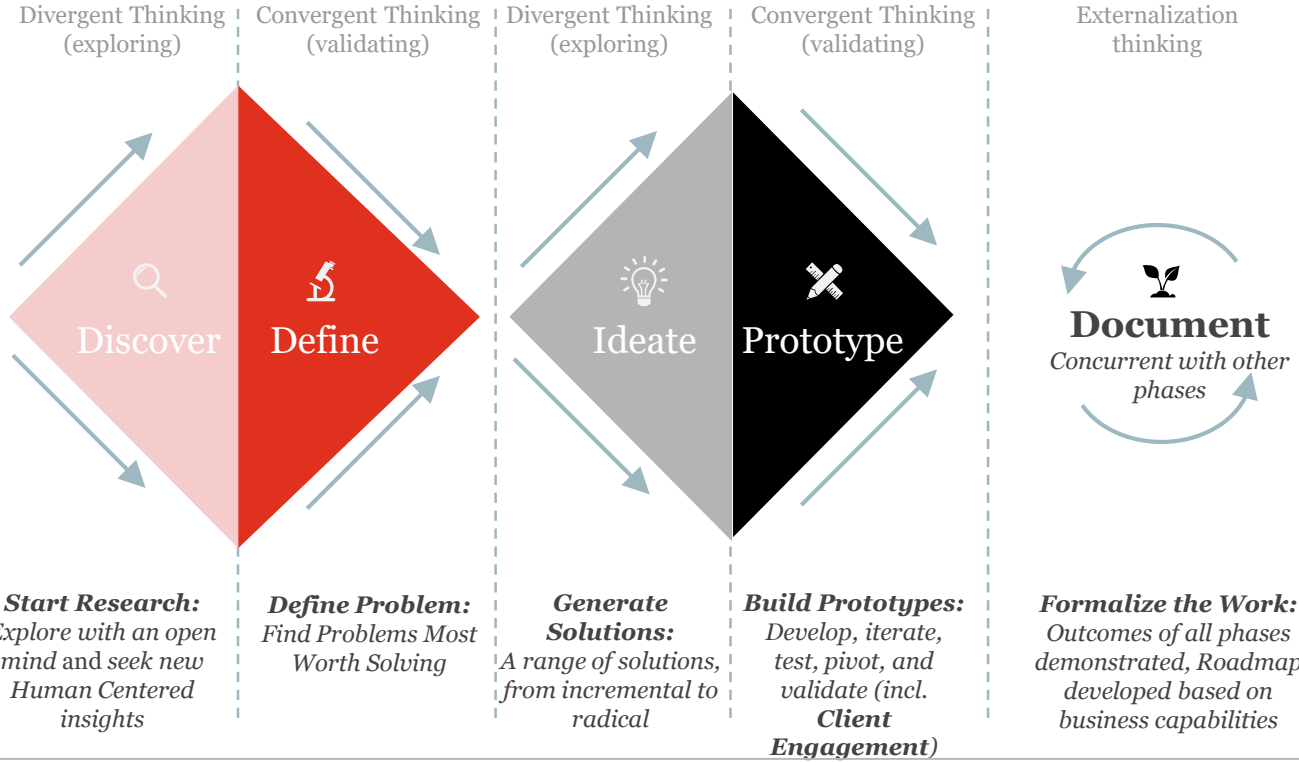
How do organizations choose the best process candidates for digital transformation?



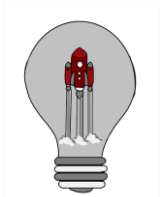
High Volume/Low Complexity	*"Swivel Chair" Processes*
Stable Environment	*High Internal and/or External Impact*
'Good' Data	*Defined Workflow*
Limited Exception Handling	*Highly rules-based Processes*

The Acceleration Hub Process

The five phase immersive co-creation process uses collaboration, human centered design and iteration to accelerate outcomes and consensus. Fast cycles with a focus on the minimum viable product will ensure all parties see momentum and get results in weeks, not months.

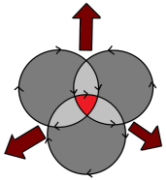


Key Tenants for the Transformation Journey



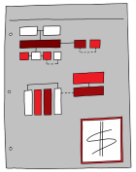
Learn fast, be more risk tolerant

The future is closer than we think



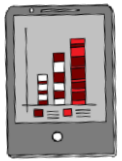
Iterative value delivery

Strategic and digital vision meet on same trajectory

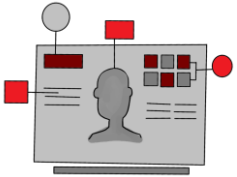


Digital = Applied Data = $

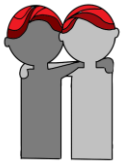
Data driven Business (mode 2)



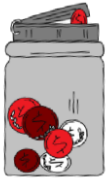
Data driven insights decision making



User experience design



Importance of cultural change



Self funding portfolio manageme

Many digital solutions are already available

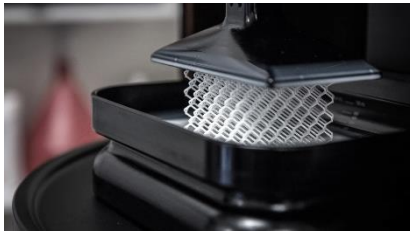
05
What does ‘Good’ look like?

Leading in digital requires to master a broad range of digital capabilities – companies choose different priorities and build up approaches

Digital Capability Examples

Digital Tech Scouting

Business Innovation



Customer Engagement

Digital Partnership Mgmt.

Digital Operations

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Data Analytics

...

Digital Platform Mgmt.

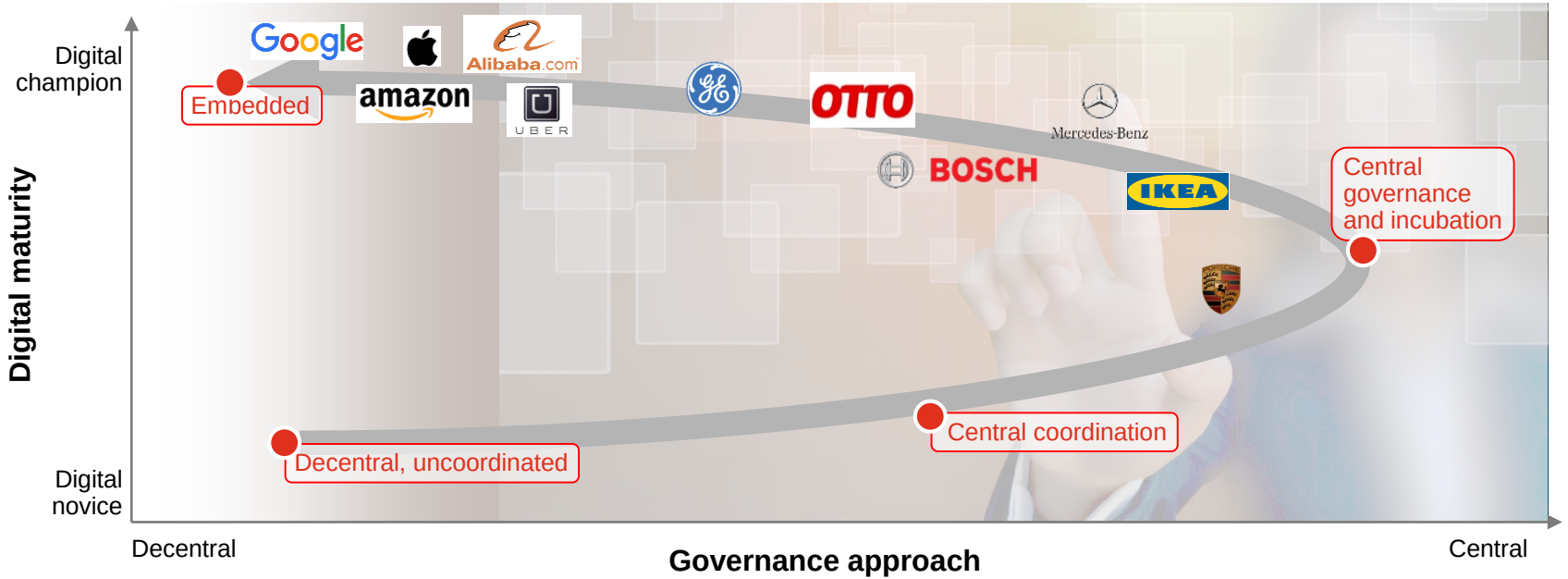
...

Digital Culture

...

There is a typical operating model evolution for digital capability build-up - digital champions aim for embedded governance approaches

Digital Operating Model Evolution




Digital is not just about technologies.
Digital is about creative problem solving to accelerate business performance.
To Reimagine the Possible

Thank you!

Contact:
Biju George
PwC | Energy, Utilities, Mining, Industrial Products
T: +1 403 441 6212 | C: +1 587 892 6733
Email: biju.george@pwc.com
https://www.linkedin.com/in/bijuthomasgeorge/
http://www.pwc.com/ca