



# ***Big Data and Knowledge: Are we doing enough to prevent Major Accident Events?***

Mario Alonso, BHGE

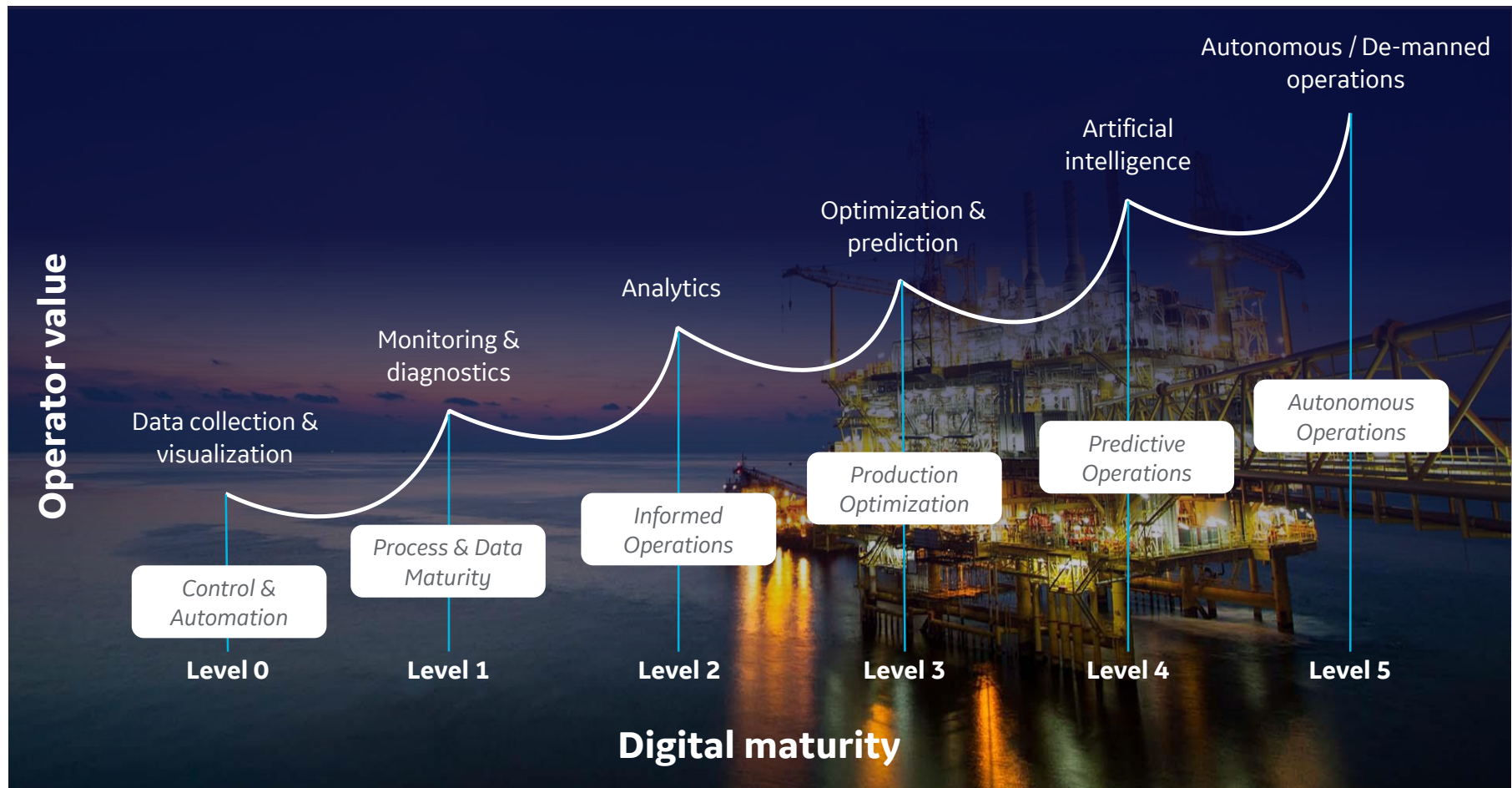
IRF/OGUK Safety 30 Conference

**June 7, 2018**

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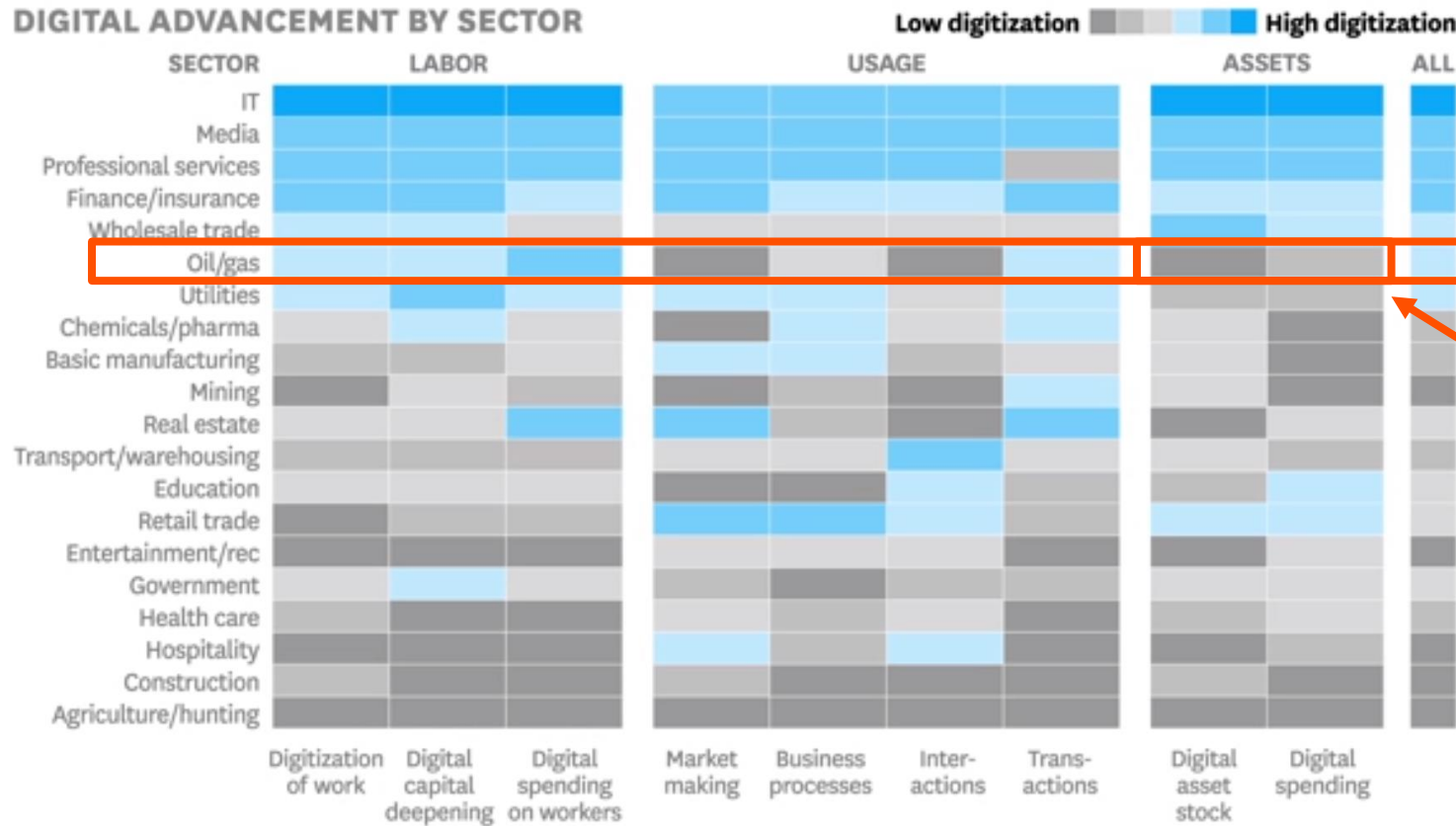
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# The Journey to Digital Value in Oil & Gas



# Are we doing enough?

## DIGITAL ADVANCEMENT BY SECTOR



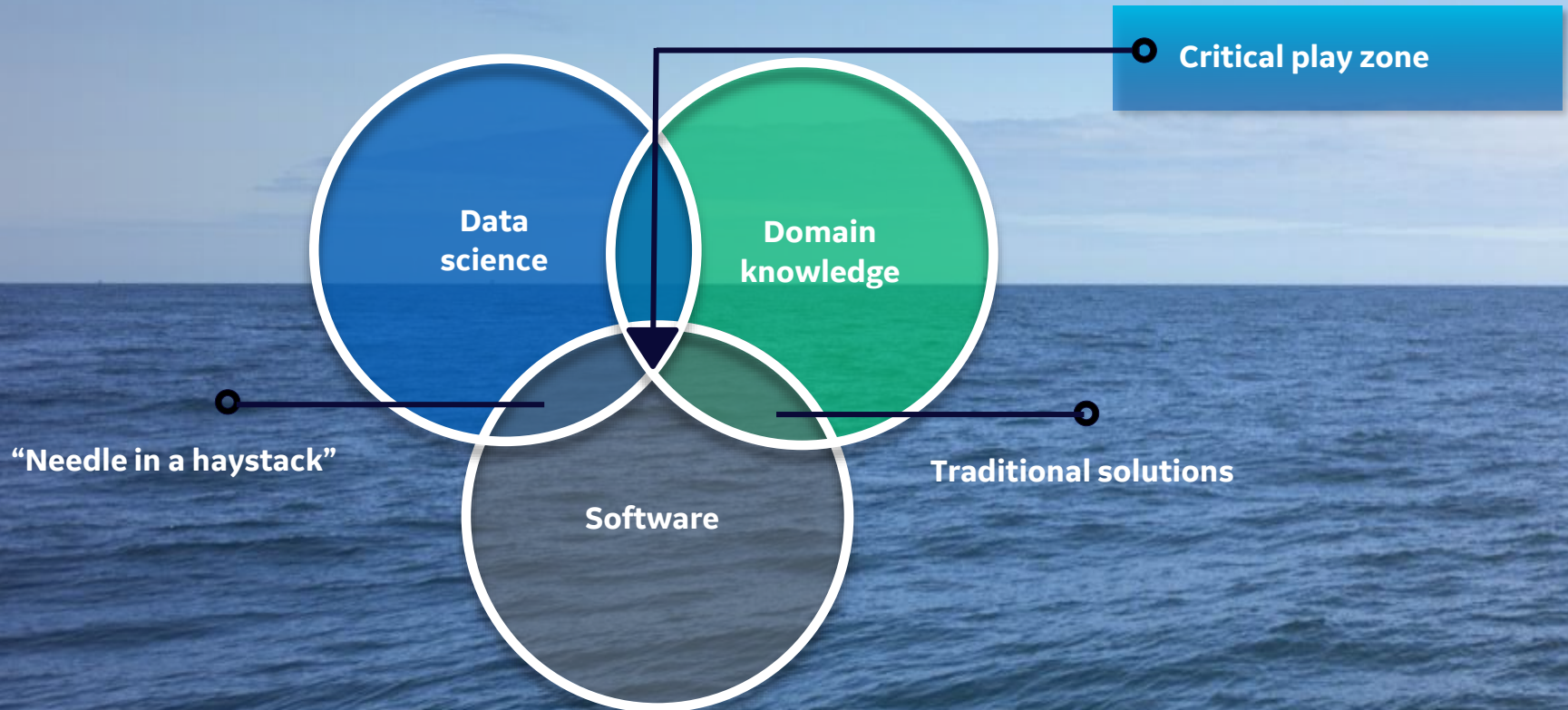
Prevention of Major Events requires digitization of critical assets!!!

<https://hbr.org/2016/04/a-chart-that-shows-which-industries-are-the-most-digital-and-why>

Which Industries Are the Most Digital (and Why)?

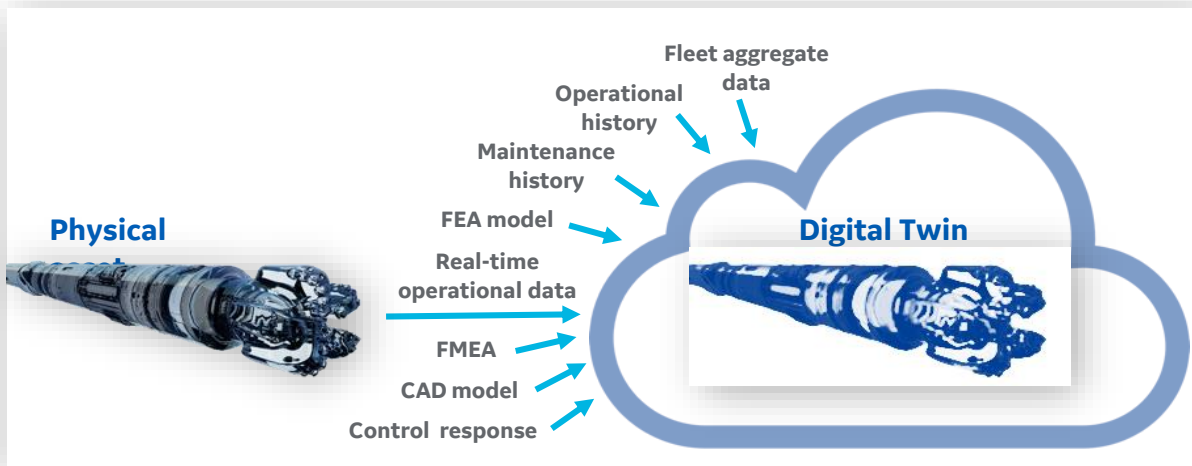
Harvard Business Review: By Prashant Gandhi, Somesh Khanna, and Sree Ramaswamy

# A Key Challenge for Oil & Gas: Predicting Equipment failure!



# Digital Twins... our Reliable Crystal Ball

A live up-to-date digital representation of an asset, system, or process



## Hybrid models

Physics based

Known Issues  
(Known Knowns)



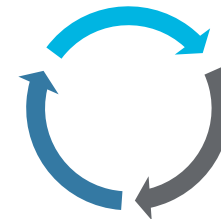
Probabilistic

Uncertainty  
(Known Unknowns)



Deep learning  
(AI)

Unknown Issues  
(Unknown Unknowns)



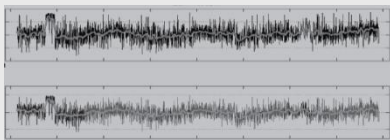
- Continuously tuned
- Scalable
- Adaptable



# Key Enabling Technologies for Digital Twin

## Domain Data Capabilities

### Automated Data Pre-Processing



### Inspection Capabilities

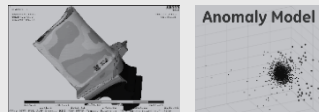


### Digital Thread

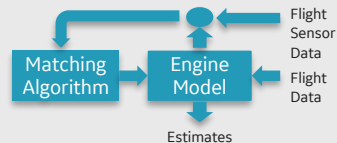


## Physical + Digital Engineering Models

### Life & Operational Behavior



### Performance

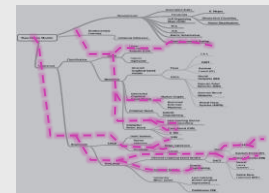


### Model Management

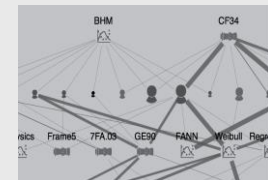


## Industrial Analytics

### Model Generation & Automation



### Knowledge Extraction



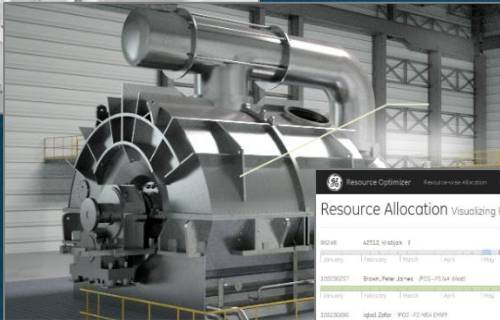
# Digital Twins: *Can we leverage technologies from other industries?*

# 1,183,547 Twins and Increasing!!!



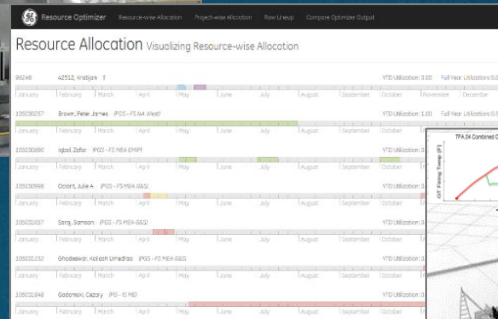
# Parts Twins

## Rotor failure prediction



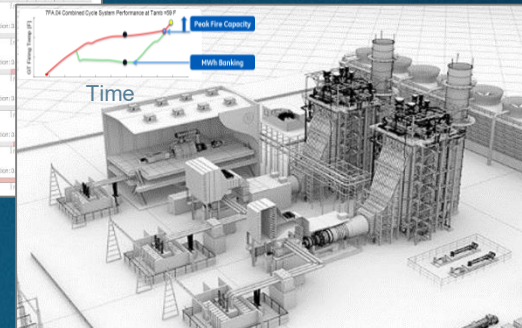
# Product Twins

# Steam turbine life optimization



# Process Twins

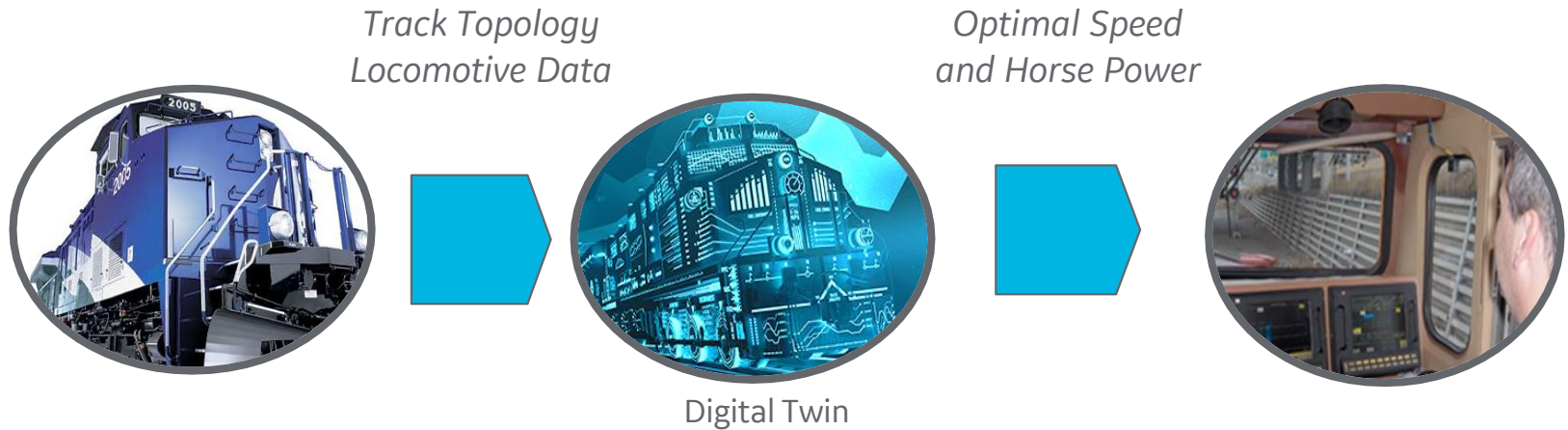
## Field engineer scheduling



## System Twins

## Model based optimizer

# Optimization Digital Twin – Locomotive



32,000 Gallons / Locomotive-Year Saved  
174,000 Tons Emissions Reduced/Year



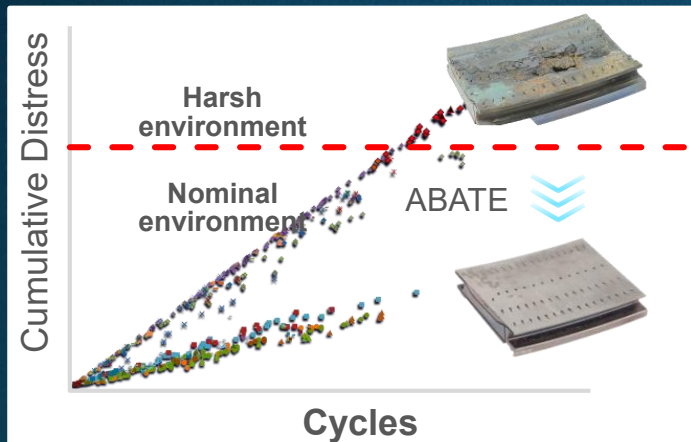
# Continuous Prediction Digital Twin: Aviation Engine



Environmental  
Conditions  
Per Flight Data  
Prior Condition



**Digital Twin**  
Physics + AI Models



**Optimized Inspection Time & Shop Time**



Increased Availability to Customer  
Saves Tens of \$MM in Unnecessary Service Overhauls

# Active Asset Performance Management

*Digitization of Oil & Gas assets facilitates active integrity management, enabling prevention of Major Accident Events!*



## Reliability Management

Less unplanned downtime by predicting equipment issues before they occur.

- Predictive analytics
- Case and collaboration management
- Knowledge management
- Production loss analysis
- Root cause analysis
- Reliability analysis



## Compliance and Integrity Management

Ensure asset integrity and compliance by monitoring changing risk conditions.

- Hazard analysis
- Safety lifecycle management
- Risk based inspection
- Inspection management
- Thickness monitoring



## Asset Strategy Optimization

Optimize across availability, reliability, risk, and costs through intelligent asset strategies.

- Reliability centered maintenance
- Failure mode effects analysis
- Strategy management
- Strategy library
- Lifecycle cost analysis
- Financial and risk simulation



## Machine and Equipment Health

Anytime, anywhere, unified view of your assets' current state, and health.

- Connectivity
- Data management
- CMMS integration
- Condition monitoring
- Data analysis and visualization
- Criticality analysis
- Event management
- Recommendation management
- Benchmarking

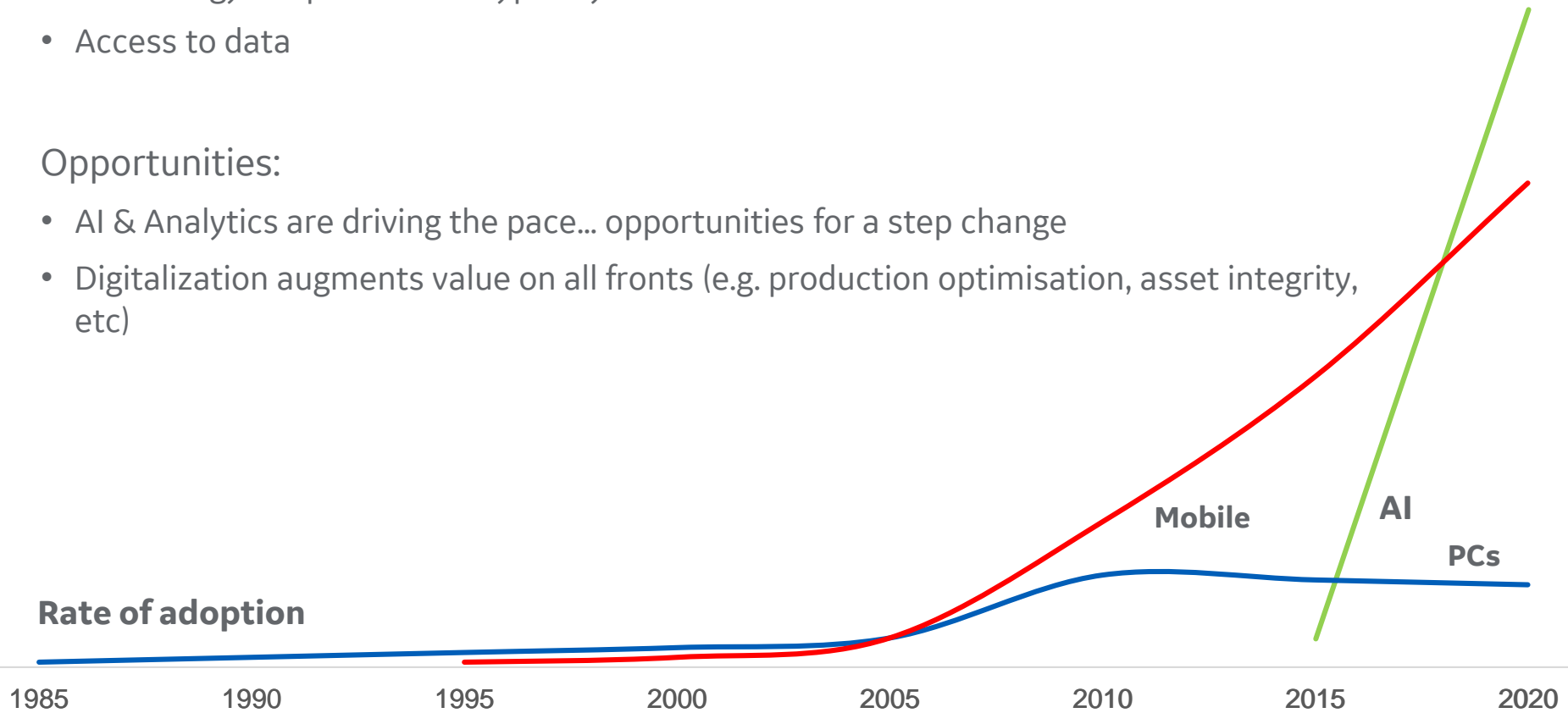
# Challenges and Opportunities

Key challenges within the Oil & gas industry include:

- Technology adoption rates (typically more evolution than revolution)
- Access to data

Opportunities:

- AI & Analytics are driving the pace... opportunities for a step change
- Digitalization augments value on all fronts (e.g. production optimisation, asset integrity, etc)



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