Intelligence.
Beautifully engineered.

QUANTUMBLACK
A MCKINSEY COMPANY

1896 Olympic Games, Athens – 100m

2016 Olympic Games, Rio – 100m

In elite sport the smallest edge makes the difference, and the best teams exploit this to outlearn their rivals

Arms race in innovation

Data has emerged as a fundamental element of competitive advantage

Data driven entertainment

Why now?

Better algorithms

Cloud

More data

Technology revolutions tend to involve an important activity becoming much cheaper
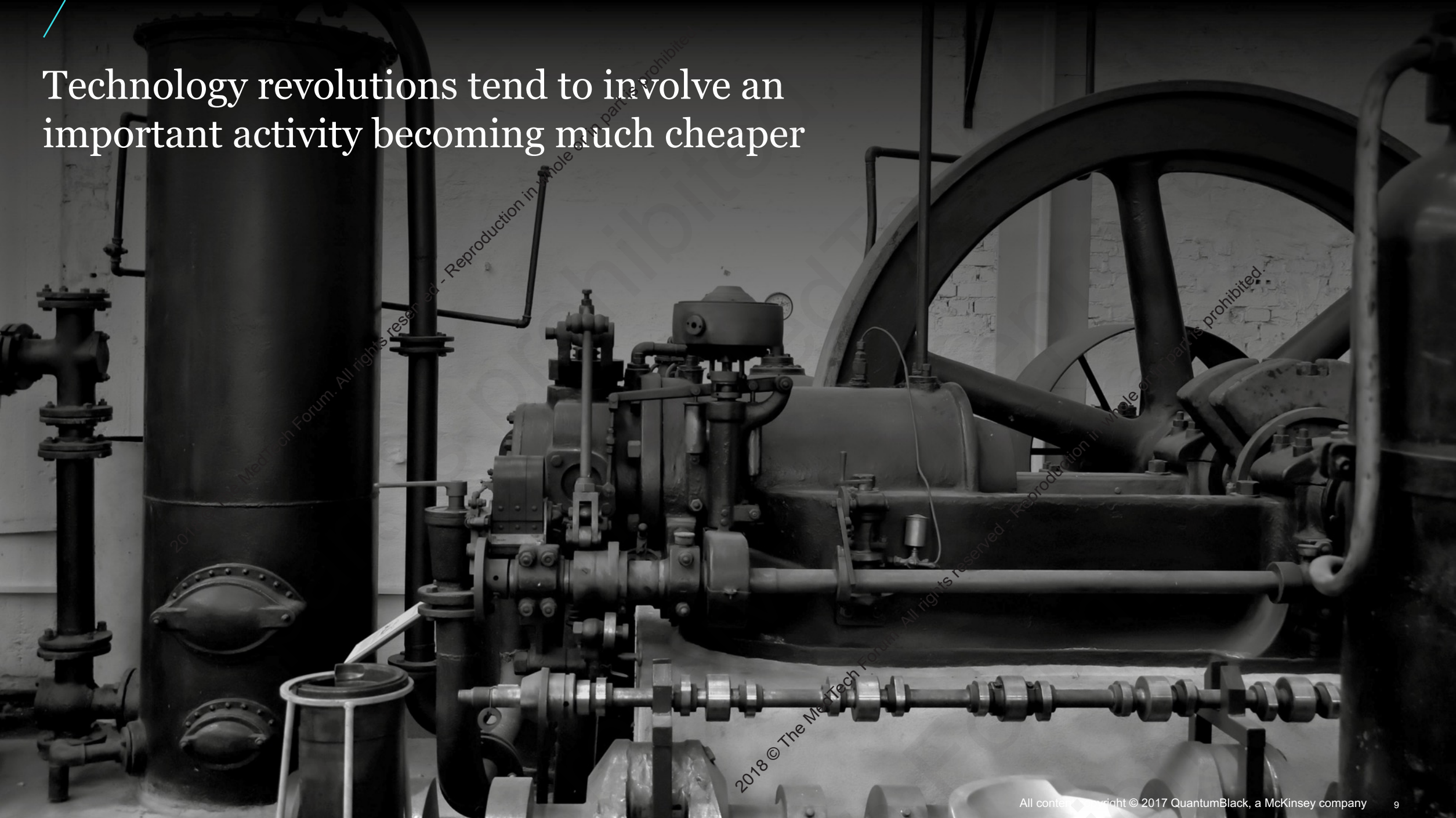
Machine intelligence radically reduces cost of discovery
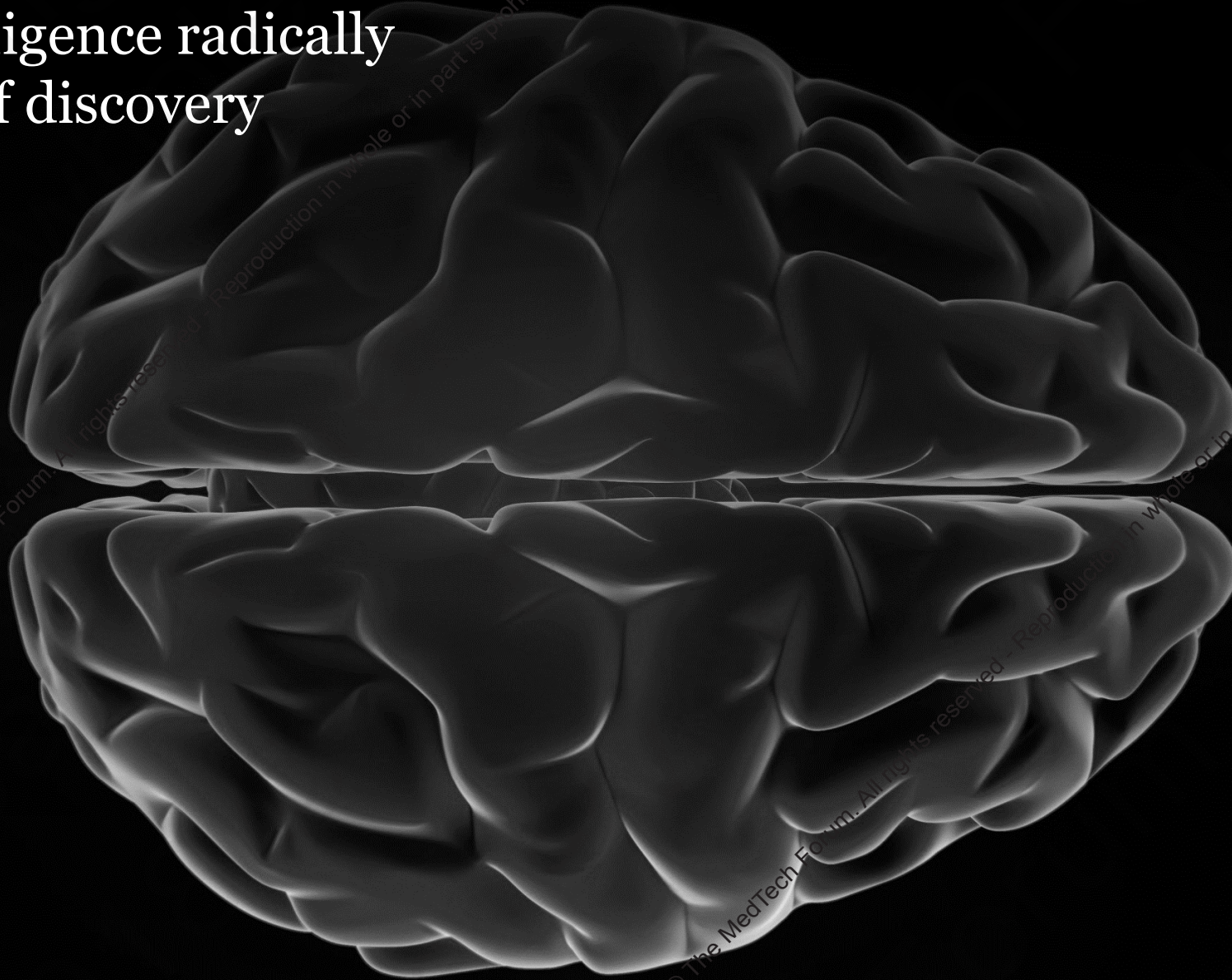
We expect *Augmented Intelligence* to be applied in waves …

Wave 1

Apply to things we've always done

- Weather
- Sales
- Maintenance

Wave 2

Apply to things we couldn't do before

- Autonomous vehicles
- Hospital operations
- Real-world evidence

Wave 3

Reimagine the core operating process

- Product development
- Organization design
- Business model

Early adopters become serial adopters

AI Index

Relatively low ▢▢▢▢▢ Relatively high

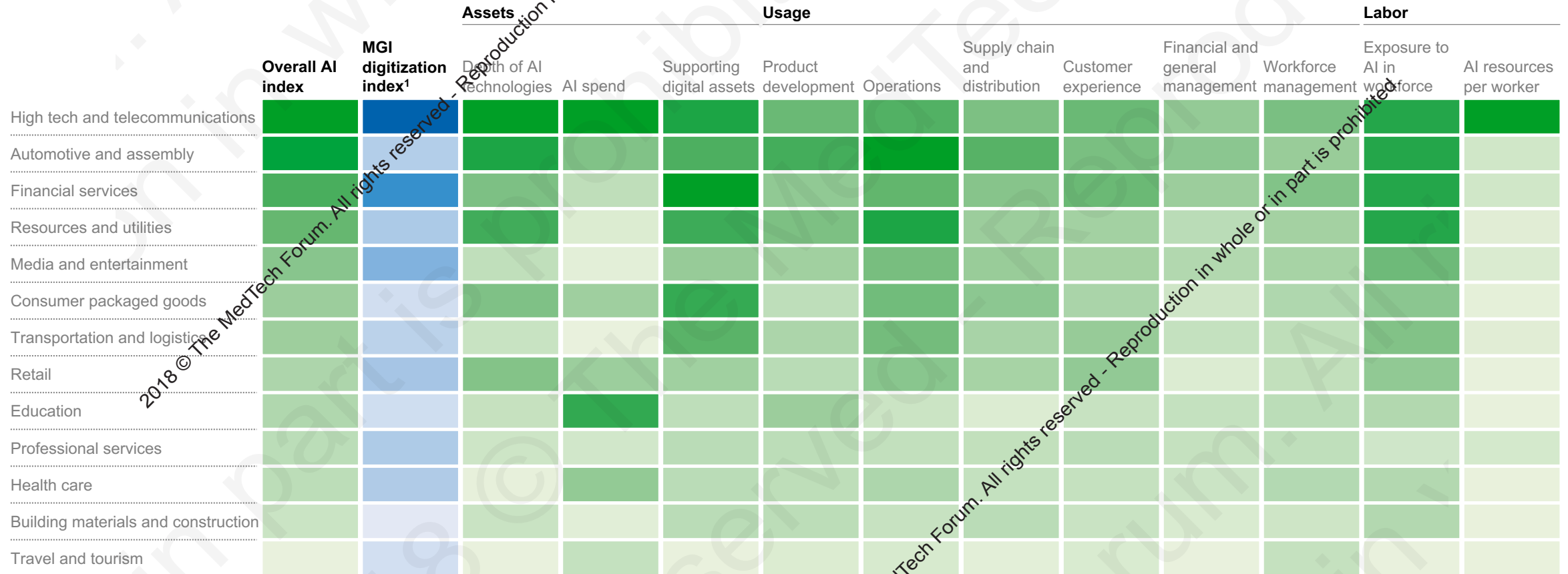|	Overall AI index	MGI digitization index[1]	Assets			Usage						Labor		
			Depth of AI technologies	AI spend	Supporting digital assets	Product development	Operations	Supply chain and distribution	Customer experience	Financial and general management	Workforce management	Exposure to AI in workforce	AI resources per worker
High tech and telecommunications														
Automotive and assembly														
Financial services														
Resources and utilities														
Media and entertainment														
Consumer packaged goods														
Transportation and logistics														
Retail														
Education														
Professional services														
Health care														
Building materials and construction														
Travel and tourism														

Applying this in the real world.

Re-engineering the product development process

Linked and cleaned the previously unlinked datasets
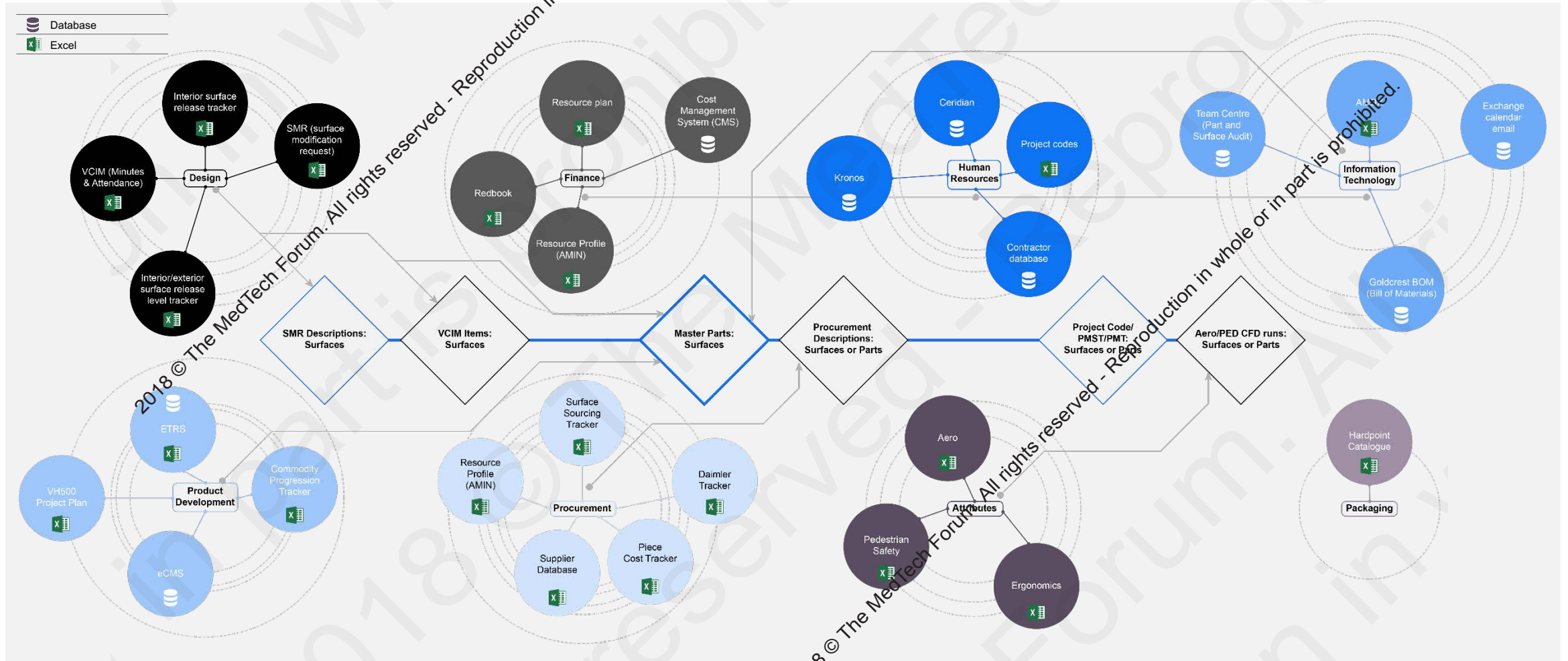
Data offers different perspectives

Part
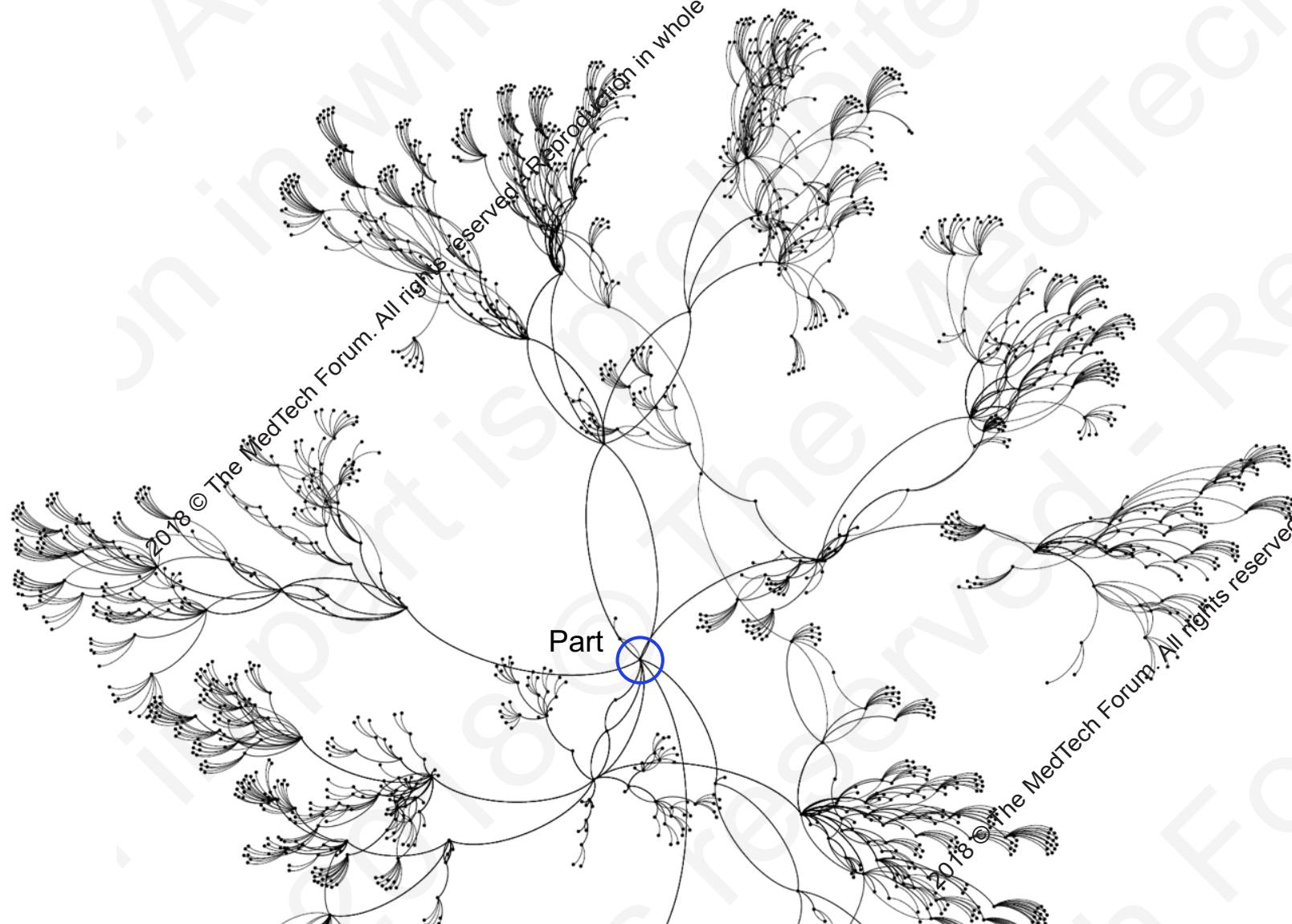
The car as a network

Explanatory model to understand drivers of performance...

TOTAL OPPORTUNITY

OPPORTUNITY | DRIVER

100 Days

58.7 Days — TEAM DYNAMICS

23.1 Days — PROCESS DESIGN/ ADHERENCE

8.9 Days — SOURCING & SUPPLYING

7 Days — ITERATIONS/ REVISIONS

Explanatory

Modelling technique using **Linear Regression** to arrive at insight

...which, in turn, allow precise interventions

- One such factor we uncovered was the significance of aligning the way designers and engineers communicate, and work together

- Because engineers were not waiting for final design sign off before iterating components, time and money was being lost

DRIVER

OPPORTUNITY

LEVER

100 Days

23.1 PROCESS DESIGN/ ADHERENCE

9.3 Days

Time Spent | CDL3
Extended time at AA1a delays CDL4

9.2 Days

Time Spent | CDL6 Delay
Extended time at AA1b

4.6 Days

Idle Time | CDL6 Delay
Gap between last CDL4 and first CDL6 gap

Reimagining the core operating system of the firm

Product Development		Production	Launch	After-Sales
10%	**11%**	**25>80**		**5/6**
Reduction in time-to-market	Reduction in programme costs	Uplift in 'right-first-time' quality	Not touched	Understanding root cause of warranty claims
25 data systems		**+ 14 data systems**		**+ 4 data systems**

The opportunity in MedTech.

Advanced analytics can significantly improve efficiency and drive impact across the value chain in MedTech

R&D > **Manufacturing** > **Supply Chain** > **Market access & commercial** > **Service** > **Enabling functions**

Example Of Applications (not exhaustive)

A R&D and clinical trials efficiency

Collect medical data directly from trial participants in their homes and conduct analysis to speed up device performance evaluation, use machine learning to optimize R&D team effectiveness

Yield optimization

Analyze historic data to identify most critical manufacturing parameters and utilize machine learning to reach optimum process conditions

Procurement excellence

Forecast future scenarios of customer demand to set the right level of inventory stock and product mix

B Field force effectiveness

Optimize sales deployment by predicting propensity to buy of potential leads based on real world data

Pricing

Use machine learning for deal target pricing

C RWE

Identify clinically and commercially relevant patient segments leveraging real world data

D Predictive maintenance

Accurately estimate potential device break-down and analyze most effective preventive action based on historical performance data

E Beyond product services

Develop data services beyond the product, by use of machine learning and augmented reality (e.g., to improve utilization/throughput, accuracy of procedure forecasting, personalized medicine)

Overdue payment reduction

Automate customer order and invoicing process to shorten processing time and proactively prevent payment overdue

People analytics

Use big data and machine learning for core HR processes

Illustrative impact we have seen

10% shorter time to market

15+% faster enrollment

10-15% reduction in trial costs

50% yield improvement

15-20% reduced inventory holding cost

5-10% procurement savings

10+% net revenue increase

4-7% higher price

18-27% lower maintenance costs

12% improvements of customers' utilization

10% reduction in overdue payments

50% reduction in high performing employee churn

A Predict what is driving speed of enrollment, costs and quality of clinical trials

300m	10-20%	10-15%	5x
Integrated 300 million data entries of so far disconnected internal trial data (Trial Management, Quality, Finance, HR, etc.) with external data (Rx/claims, publications, etc.) into a rich data lake and used predictive algorithms to forecast site-level patient recruitment and quality events	Faster enrollment	Lower trial costs	Better targeting of site level audits

B   Understanding what is driving sales performance

20
Integrated data sets that the firm had never previously linked, including many it had never used at all, such as CRM, e-mails, and patient diagnostic data

25%
Faster initiation of first sale

10%
Increase in sales from avoiding dormant accounts

II
Pause

State

WI (3D)

Edges represent:

All Patients

Options
- ☑ Show Nodes
- ☑ Show Edges
- ☑ Auto-rotate

Jul 2015
0 / 4515 Physicians Converted

Nodes: Converted?

Edges: All Patients (Shared)

0   500

STRAFE   ZOOM   ROTATE

▶
Play

State

KY ⌄

Edges represent:

All Patients ⌄

Options

☑ Show Nodes
☑ Show Edges

Apr 2017

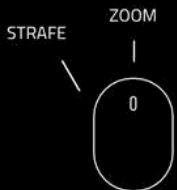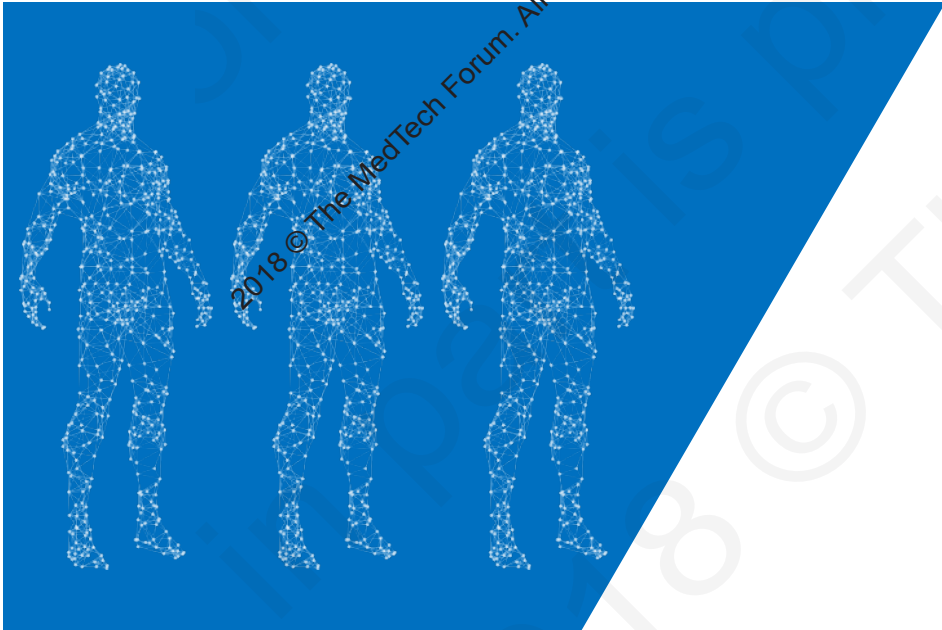**506** / 4441 Physicians Converted

Nodes: Converted?

✕   ✓

Edges: All Patients (Shared)

0   500

STRAFE   ZOOM

0

C Identify clinically and commercially relevant patient segments in which drug has better efficacy and cost profile than competitors

65m

Detailed 10years of EMR & claims data with 65mn patients Available now, & everyone can access

Replicated findings from previous research to show robustness of the approach and data

58%

Identified 4 clinically relevant patient segments where drug meaningfully outperforms competitors – segments together cover 58% of patient population

Live interactive tool deployed for cross-functional team to explore patient segments and build actionable clusters

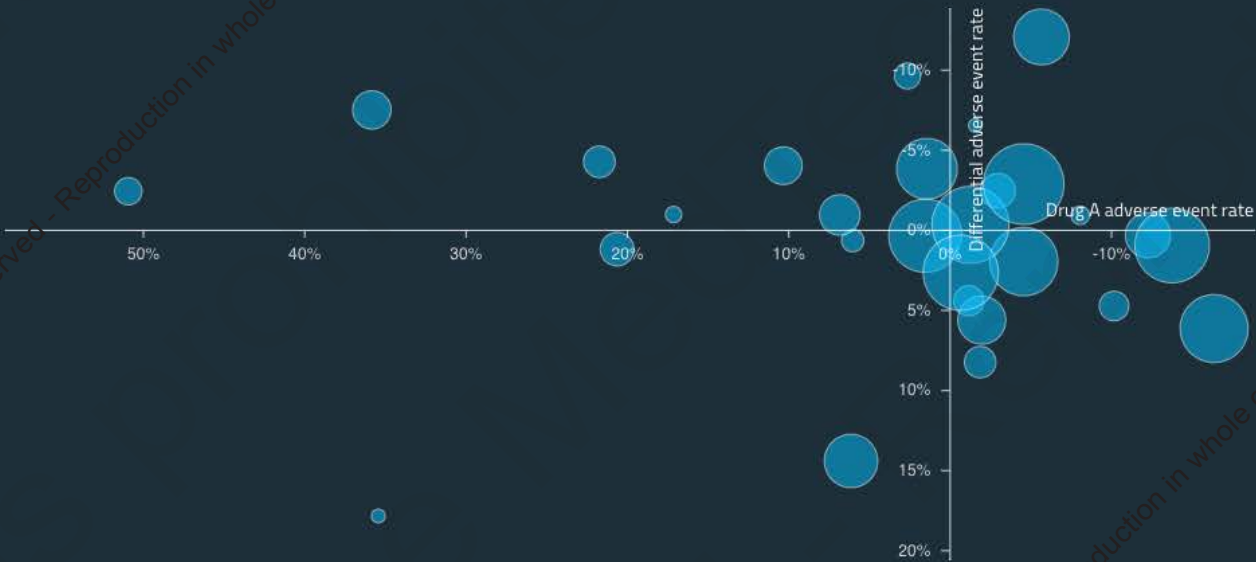**Efficacy:** ● All adverse events   ○ Effective adverse events

Bubble size

● No. of Drug B patients

○ Total cost per adverse event

○ Incremental adverse-event-related cost per patient

Patient segments: Drug A vs. Drug B

Differential adverse event rate

Drug A adverse event rate

10%
5%
0%
5%
10%
15%
20%

50% 40% 30% 20% 10% 0% -10%

Legend

- - - Max: **88.6%**
- - - Mean: **40.7%**
- - - Min: **11.3%**

Segments

Drug A outperforms Drug B, and performs better than average

Male patients

Obese patients

Patients aged >=53 and <61 years at treatment start

Patients aged >=61 and <70 years at treatment start

Patients aged <53 years at treatment start

Patients in regions with >=23% and <26% college education rates

All Patients

No. of patients - Drug B

Total in analysis
10,268

No. in segment
10,268

Perc. in segment
100.0%

Incurred incremental cost (pppy)

Total: -$1.50

Additional cost:
-$1.30

Disorder marked cost:
$0.20

Adverse event marked cost:
-$0.20

Incurred cost (per adverse event)

Total cost
$1,358

Disorder marked cost
$40

Adverse event marked cost
$178

Adverse event rate differential (pppy)

Difference: **-0.1%**

0.866   0.865

0.0011

Drug B   Δ   Drug A

Adverse event rate by efficacy (pppy)

Effective

0.866 0.865

Drug B: **10%**
Drug A: **9%**

Ineffective

Drug B: **90%**
Drug A: **91%**

Drug B Drug A

D Reducing service cost of MRI scanners with analytic troubleshooting & condition based maintenance

50,000
Unique instrument with 1GB per instrument plus 10 years service data

25%
Predicts common service events 90 days ahead of time

$300m
Saving opportunity of $35m/yr in North America and $300m/yr globally

E Developing service to increase theatre utilisation without compromising quality

800k
Procedures across 16 hospitals over 8 years

35%
Improvement in procedure forecasting

12%
Increase in theatre suite utilisation

Lessons and scars.

Patterns we've spotted along the way

1

Start with what you have

- Leveraging latent internal and external data as an asset; think of 'edge data'

- Embrace the taboo of 'garbage' data, instead invest in data provenance

- Variety more important than volume, so invest in 'machine readable' connectivity

2

Build feedback loops

- Focus on using your data to help you continuously improve

- Instrument everything; your process, your product, your people

- Capturing, interpreting and exploiting data at scale and at pace to outlearn your rivals

3

Build capabilities not models

- It's not about the analytics; it's how you embed them into the operating model

- Cascade performance driven use case to benefit from 'network effects'

- Leaders invest in 5 building blocks: data & analytics, IT, process (incl. action and judgment),governance, and people / culture

Making it happen.

'Winners' have taken a few critical decisions to lay the foundation

Reporting lines, policies, standards

- How to structure the analytics function?
- Will we enforce global standards?

External data partnerships, data lakes

- How do we design win-win partnerships with distinctive data providers?
- What are do we need to consider regarding legal and privacy requirements?
- How do we tackle data security?

Business/IT interactions, internal processes in analytics "function"

- Do we create new analytics business partner roles?
- How do we design processes to be as agile as possible?
- What business processes need to be adapted which ones automated?

Talent, skills

- What skills gaps do we fill in first?
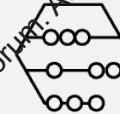- How do we attract & retain talent?
- How do we manage change?

Analytics, data mgmt., visualization platforms/tools

- What global platforms do we build as enterprise capabilities?
- What does this imply for the existing system landscape?
- What is the role of cloud-sourcing?
- How shall data be visualized?

Governance

People

Analytics

Data

IT

Process

Data: new paradigm needed

From

Data as by-product of the corporation to be managed internally

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Traditional warehouse structured process to implement new data elements

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"Boring data" (e.g., structured, internal, and centralized data)

Receive dos and don'ts from legal

Local data access restricted by physical location (e.g., home office desktop)

New data sources	
Orchestration of data	
Unstructured data	
Privacy and legal considerations	
Data security	

To

Data that can be acquired of created (e.g., sensors, public application, interfaces, crowd-surfing)

Test-and-learn "data lakes" environment to make data available quickly

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Diverse data (e.g., unstructured external and distributed data)

Really understand and actively shape corporate policies

"Democratization" of data while keeping data security in any location, time, or device (e.g., iPad)

People: new capabilities needed

Analyze Big Data through advanced analytics to get strategic/business insights

Drive the design and execution of the overall Big Data and analytic strategy Provide link across IT, analytics, and business

Support the design, development and maintenance of the data architecture

Analytics developers

Data Scientists

Translator

Head of analytics

IT data specialists

Solution Architects

Business Owners

Responsible to develop the software to program with Big Data

"Translate" business needs into advanced analytics language (e.g., define data requirements)

Define the content of the data they own and are responsible for data quality

Ensure future data requirements and delivery roadmap is robust and complete
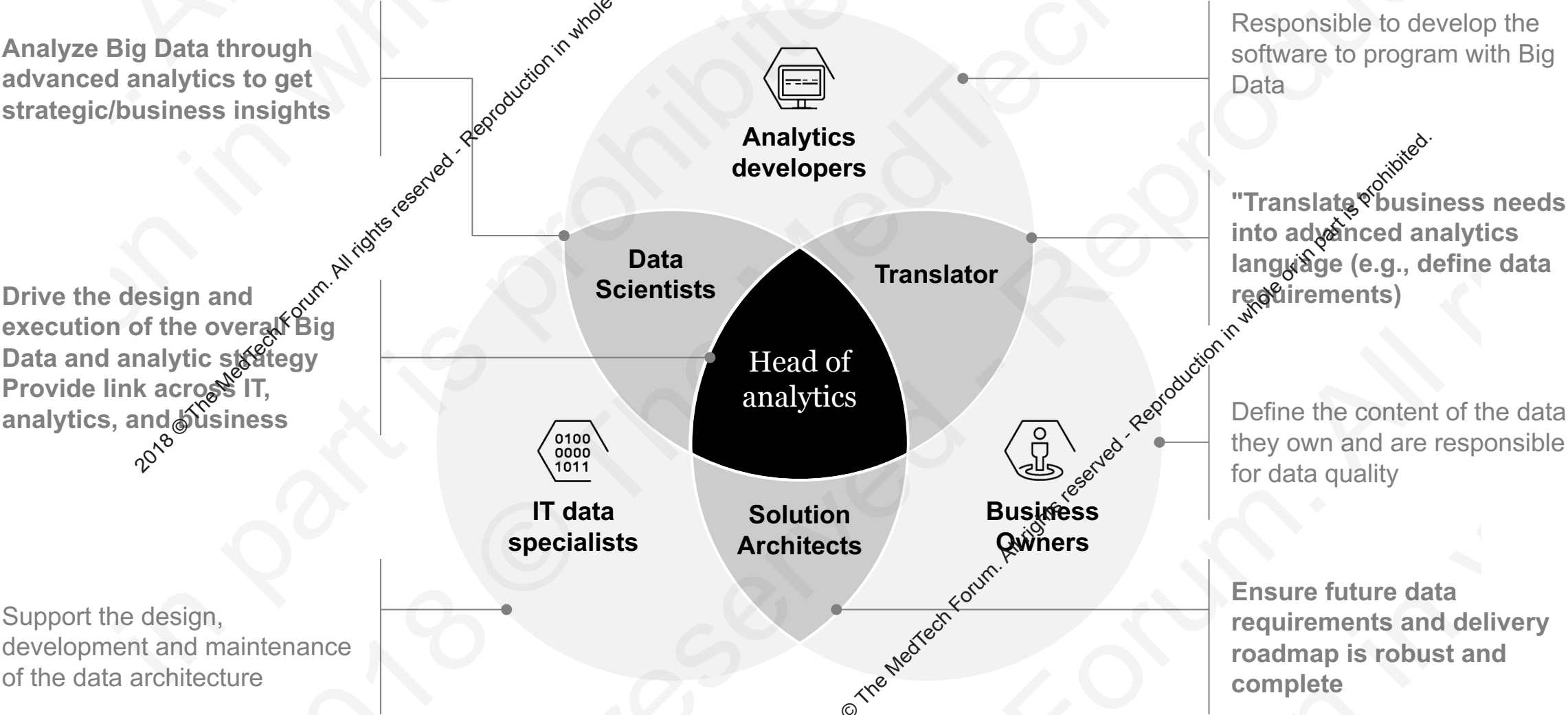
Forget about perfection, focus on progression and compound the improvement

Sir David Brailsford, CBE

1%

Thank you.
Q&A.