Intelligence.
Beautifully engineered.
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.
Why now?

Better algorithms
Better GPUs
More data
Cloud

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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...

<table>
<thead>
<tr>
<th>Wave 1</th>
<th>Wave 2</th>
<th>Wave 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply to things we’ve always done</td>
<td>Apply to things we couldn’t do before</td>
<td>Reimagine the core operating process</td>
</tr>
<tr>
<td>• Weather</td>
<td>• Autonomous vehicles</td>
<td></td>
</tr>
<tr>
<td>• Sales</td>
<td>• Hospital operations</td>
<td></td>
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<tr>
<td>• Maintenance</td>
<td>• Real-world evidence</td>
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<tr>
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<td>• Product development</td>
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<td>• Organization design</td>
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<td>• Business model</td>
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</table>
# Early adopters become serial adopters

## AI Index

<table>
<thead>
<tr>
<th>Overall AI index</th>
<th>MGI digitization index</th>
<th>Assets</th>
<th>Usage</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Depth of AI technologies</td>
<td>AI spend</td>
<td>Supporting digital assets</td>
</tr>
<tr>
<td>High tech and telecommunications</td>
<td></td>
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<tr>
<td>Automotive and assembly</td>
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<tr>
<td>Financial services</td>
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<tr>
<td>Resources and utilities</td>
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<tr>
<td>Media and entertainment</td>
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<tr>
<td>Consumer packaged goods</td>
<td></td>
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<tr>
<td>Transportation and logistics</td>
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<td>Retail</td>
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<td>Education</td>
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<tr>
<td>Professional services</td>
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<tr>
<td>Health care</td>
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<tr>
<td>Building materials and construction</td>
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<tr>
<td>Travel and tourism</td>
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</table>

*Relatively low | Relatively high*
Applying this in the real world.
Re-engineering the product development process
Data offers different perspectives
The car as a network
Explanatory model to understand drivers of performance...

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.
Reimagining the core operating system of the firm

<table>
<thead>
<tr>
<th>Product Development</th>
<th>Production</th>
<th>Launch</th>
<th>After-Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>11%</td>
<td>25&gt;80</td>
<td>5/6</td>
</tr>
<tr>
<td>Reduction in time-to-market</td>
<td>Reduction in programme costs</td>
<td>Uplift in 'right-first-time' quality</td>
<td>Not touched</td>
</tr>
<tr>
<td>25 data systems</td>
<td>+ 14 data systems</td>
<td>+ 4 data systems</td>
<td>Understanding root cause of warranty claims</td>
</tr>
</tbody>
</table>
The opportunity in MedTech.
Advanced analytics can significantly improve efficiency and drive impact across the value chain in MedTech

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.

**B** Field force effectiveness
Forecast future scenarios of customer demand to set the right level of inventory stock and product mix.

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

**F** Pricing
Use machine learning for deal target pricing.

**G** Field force effectiveness
Optimize sales deployment by predicting propensity to buy of potential leads based on real world data.

**H** Overdue payment reduction
Automate customer order and invoicing process to shorten processing time and proactively prevent payment overdue.

**I** People analytics
Use big data and machine learning for core HR processes.

**J** Procurement excellence
Forecast future scenarios of customer demand to set the right level of inventory stock and product mix.

**K** Yield optimization
Analyze historical data to identify most critical manufacturing parameters and utilize machine learning to reach optimum process conditions.

**L** Pricing
Use machine learning for deal target pricing.

**M** Procurement excellence
Forecast future scenarios of customer demand to set the right level of inventory stock and product mix.

**N** Yield optimization
Analyze historical data to identify most critical manufacturing parameters and utilize machine learning to reach optimum process conditions.

**O** Procurement excellence
Forecast future scenarios of customer demand to set the right level of inventory stock and product mix.

**P** Yield optimization
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**Q** Procurement excellence
Forecast future scenarios of customer demand to set the right level of inventory stock and product mix.

**R** Yield optimization
Analyze historical data to identify most critical manufacturing parameters and utilize machine learning to reach optimum process conditions.

**S** Procurement excellence
Forecast future scenarios of customer demand to set the right level of inventory stock and product mix.

**T** Yield optimization
Analyze historical data to identify most critical manufacturing parameters and utilize machine learning to reach optimum process conditions.

Illustrative impact we have seen

- **10%** shorter time to market
- **50%** yield improvement
- **15-20%** reduced inventory holding cost
- **10%** increase in revenue
- **10%** reduction in overdue payments
- **15-20%** lower maintenance costs
- **12%** improvements of customers’ utilization
- **10-15%** reduction in trial costs
- **5-10%** procurement savings
- **4-7%** higher price
- **50%** reduction in high performing employee churn
- **18-27%** lower maintenance costs
- **10%** reduction in overdue payments
- **10-15%** reduction in trial costs
- **5-10%** procurement savings
- **4-7%** higher price
- **50%** reduction in high performing employee churn
A Predict what is driving speed of enrollment, costs and quality of clinical trials

**300m**
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.

**10-20%**
Faster enrollment

**10-15%**
Lower trial costs

**5x**
Better targeting of site level audits
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.
Identify clinically and commercially relevant patient segments in which drug has better efficacy and cost profile than competitors

- **65m**
  - Detailed 10 years 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

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

All Patients

<table>
<thead>
<tr>
<th>No. of patients - Drug B</th>
<th>Incurred incremental cost (pppy)</th>
<th>Incurred cost (per adverse event)</th>
<th>Adverse event rate differential (pppy)</th>
<th>Adverse event rate by efficacy (pppy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total in analysis</td>
<td>Total: -$1.30</td>
<td>Total cost: $1,358</td>
<td>Difference: -0.11</td>
<td>Effective Drug B: 10%</td>
</tr>
<tr>
<td></td>
<td>Additional cost: -$1.30</td>
<td>Disorder marked cost: $40</td>
<td>Drug A: 9%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disorder marked cost: $0.20</td>
<td>Adverse event marked cost: $178</td>
<td>Drug B: 90%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perc. in segment: 100.0%</td>
<td></td>
<td>Ineffective Drug B: 90%</td>
<td></td>
</tr>
</tbody>
</table>

Segment
- 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 >=2.3% and <2.65 college education rates
Reducing service cost of MRI scanners with analytic troubleshooting & condition based maintenance

- Predicts common service events 90 days ahead of time
- Saving opportunity of $35m/yr in North America and $300m/yr globally
- Unique instrument with 1GB per instrument plus 10 years service data
- 50,000 unique instruments worldwide
- 25% reduction in service cost
- $300m potential savings 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 management, 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?
## Data: new paradigm needed

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data as by-product</strong> of the corporation to be managed internally</td>
<td><strong>Data that can be acquired of created</strong> (e.g., sensors, public application, interfaces, crowd-surfing)</td>
</tr>
<tr>
<td>Traditional warehouse structured process to implement new data elements</td>
<td>Test-and-learn “data lakes” environment to make data available quickly</td>
</tr>
<tr>
<td>“Boring data” (e.g., structured, internal, and centralized data)</td>
<td>Diverse data (e.g., unstructured external and distributed data)</td>
</tr>
<tr>
<td>Receive dos and don’ts from legal</td>
<td>Really understand and actively shape corporate policies</td>
</tr>
<tr>
<td>Local data access restricted by physical location (e.g., home office desktop)</td>
<td>“Democratization” of data while keeping data security in any location, time, or device (e.g., iPad)</td>
</tr>
</tbody>
</table>
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**
- **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
Thank you.
Q&A.