THE FOURTH INDUSTRIAL REVOLUTION:
Implications and opportunities
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MILE Presentation
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Then and now
The new global economy: the world since 2006

A virtually new world
World, largest listed companies by market capitalisation, $bn

**End 2006**
- Exxon Mobil
- General Electric
- Gazprom
- Microsoft
- Citigroup
- Bank of America
- Royal Dutch Shell
- BP
- PetroChina
- HSBC

**2016***
- Apple
- Alphabet
- Microsoft
- Berkshire Hathaway
- Exxon Mobil
- Amazon
- Facebook
- Johnson & Johnson
- General Electric
- China Mobile

Source: Bloomberg

*At August 24th 2016*
250,000 years for civilization to reach 1 billion people.

Now 250,000 each day.

It took a century to add the second billion.

1 billion every 12 years.

Economic output doubled to $5,2 trillion by 1950.

First 50 yrs of 20th C Faster rate of economic growth than entire previous century.

Today world output x10 than 1950.
Currently, growing at a pace that doubles every 25 years
Our world changing at a faster pace than in all of human history.
Resource depletion

- Water 4.5 billion years old
- The earth recycles its water
- The amount of water cannot be increased or decreased
- There is no more water on our planet today than there was millions of years ago

1820-fossil fuel use becomes widespread
Since 1860-2 trillion barrels of oil used
- Burning the first trillion took about 130 years
- the next was consumed in 22 years.

- Single glass of beer = 75 litres
- Cup of coffee (140 litres)
- Cell phone (912 litres)
- $20 billion-Cost to India’s economy from water borne diseases per year
- 300 tons of water used to manufacture 1 ton of steel

50% planet’s surface = Food production
The world uses an area the size of South America to grow our crops and an area the size of Africa for livestock production
Disruptive Innovation

World’s largest taxi company owns no taxis
The most popular media owner creates no content
Largest accommodation provider owns no real estate
Largest phone company owns no telecom infrastructure
World’s most valued retailer has no inventory
Fastest growing bank has no actual money
The world’s largest movie house owns no cinemas
Largest software vendor doesn’t write the apps

✔ Uber grew to $68bn in 7 years
## Disruption

<table>
<thead>
<tr>
<th>Disruptee</th>
<th>Disruptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainframe computers</td>
<td>Personal computers</td>
</tr>
<tr>
<td>fixed line telephones</td>
<td>Cellular phones</td>
</tr>
<tr>
<td>hotels</td>
<td>Air bnb</td>
</tr>
<tr>
<td>traditional taxis</td>
<td>Uber</td>
</tr>
<tr>
<td>encyclopaedia</td>
<td>Wikipedia/google</td>
</tr>
<tr>
<td>CD player</td>
<td>iPod/iTunes</td>
</tr>
<tr>
<td>local stores</td>
<td>eBay/Amazon</td>
</tr>
<tr>
<td>long distance calls</td>
<td>Skype</td>
</tr>
<tr>
<td>cinemas/video rental</td>
<td>Netflix</td>
</tr>
</tbody>
</table>

### 2007:

- Garmin and Tom Tom worth $38bn
- iPhone changed telecom, smartphone and computer market
The rapidly changing world: the pace of change

100 million users

Telephone: 75 Years
Instagram: 2 Years
Pokemon Go: 1 Month

Apple, Uber, Kodak

Source: socialnomics via https://twitter.com/keithweed/status/495149053114867712
These innovations created large industries e.g. **Internal combustion engine** led to cars = oil, steel, aluminium and rubber industries = construction of highways.
The relationship between the revolutions

Mechanisation (1760-1840)

mass production (1870-1940)

mass production and electricity (2IR)

manufacturing of computers and telecommunications devices (1960-2010)

information collection, transmission and processing capabilities of the third revolution
Emerging catalytic technologies
The Internet of Things

By 2020

✓ Up to 30 billion devices with unique IP addresses are connected to the Internet.
Economic impact of more than $14 trillion.

• Describes a system where the Internet is connected to the physical world via sensors and apps
• Ashton 1999
Global distribution of AI start ups

*AI*: software that allows computers to mimic human intelligence.

**Singularity**: tipping point where machines start improving themselves without human involvement.

**Machine learning**: the process of discovering patterns in data which are used to make predictions.
# Global view of AI

<table>
<thead>
<tr>
<th>Market share AI companies</th>
<th>Top AI cities</th>
<th>Leading AI research</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA (40%)</td>
<td>Silicon Valley</td>
<td>China (41 000 papers)</td>
</tr>
<tr>
<td>China (11%)</td>
<td>London</td>
<td>USA (25 500)</td>
</tr>
<tr>
<td>UK (7%)</td>
<td>Tel Aviv</td>
<td>Japan (11 700)</td>
</tr>
<tr>
<td>Canada (3.8%)</td>
<td>New York</td>
<td>UK (10 100)</td>
</tr>
<tr>
<td>Japan (3.1%)</td>
<td>Beijing</td>
<td>Germany (8000)</td>
</tr>
</tbody>
</table>

**China:**
- Start-ups received 48% global funding
- Has 641 AI patents (2017) x5 than USA
AI expenditure

- AI could contribute up to $15.7 trillion to the global economy by 2030.
- U.S. employers will spend more than $650m on annual salaries for 10,000 jobs in AI.
Where AI’s gains will be realised

AI’s impact on GDP by 2030

- 26.1% China
- 14.5% North America
- 11.5% Southern Europe
- 10.4% Developed Asia
- 9.9% Northern Europe
- 5.6% Africa, Oceania, & other Asian markets
- 5.4% Latin America

$15.7 trillion potential GDP gain
Where industries will put practical AI to work

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Industry</th>
<th>High-potential use cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Healthcare</td>
<td>• Supporting diagnosis by detecting variations in patient data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Early identification of potential pandemics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Imaging diagnostics</td>
</tr>
<tr>
<td>1</td>
<td>Automotive</td>
<td>• Autonomous fleets for ride sharing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Semi-autonomous features such as driver assist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Engine monitoring and predictive, autonomous maintenance</td>
</tr>
<tr>
<td>3</td>
<td>Financial services</td>
<td>• Personalized financial planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fraud detection and anti-money laundering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Automation of customer operations</td>
</tr>
<tr>
<td>4</td>
<td>Transportation and logistics</td>
<td>• Autonomous trucking and delivery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Traffic control and reduced congestion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Enhanced security</td>
</tr>
<tr>
<td>5</td>
<td>Technology, media, and</td>
<td>• Media archiving, search, and recommendations</td>
</tr>
<tr>
<td></td>
<td>telecommunications</td>
<td>• Customized content creation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Personalized marketing and advertising</td>
</tr>
<tr>
<td>6</td>
<td>Retail and consumer</td>
<td>• Personalized design and production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Anticipating customer demand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inventory and delivery management</td>
</tr>
<tr>
<td>7</td>
<td>Energy</td>
<td>• Smart metering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• More efficient grid operation and storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Predictive infrastructure maintenance</td>
</tr>
<tr>
<td>8</td>
<td>Manufacturing</td>
<td>• Enhanced monitoring and auto-correction of processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Supply chain and production optimization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• On-demand production</td>
</tr>
</tbody>
</table>

Source: PwC Global AI Impact Index, 2017
AI: Governments get on board

- In 17 months close onto 23 countries have developed AI plans.
- Kenya and Tunisia = an AI plan
IP and Patents: the war for the future

1. ZTE
2. Huawei Technologies,
3. Qualcomm Inc.
4. Mitsubishi Electric
5. LG Electronics

Who buys robots and who makes them?

The world of robots

- Automotive industry: 103 thousand units
- Electrical/electronics industry: 91 thousand units
- Metal: 29 thousand units
- Chemical, rubber and plastics: 20 thousand units
- Food: 8 thousand units
- Others: 19 thousand units
- Unspecified: 24 thousand units

Countries with the highest number of robot sales:

- China: 87 thousand units
- Republic of Korea: 41 thousand units
- Japan: 39 thousand units
- U.S.: 31 thousand units
- Germany: 20 thousand units
Changing face of the Auto industry
4IR and the Auto industry

- Apple (iOS) - Mercedes, Nissan, BMW
- Android - Audi, Honda, GM
- Microsoft been in autos since 1990s'
- Software = 25% of cost of building a car
EV global sales

China’s EV market is already nearly three times that of the U.S
EVs accounted for 2.2% of China’s auto market (2017)
China: 40% of EVs sold globally
Driverless vehicles - new frontier

EV Sales by Country in 2017

- China: 579,000
- United States: 198,350
- France: 118,770
- Norway: 62,260
- Germany: 54,560
- Japan: 54,100
- United Kingdom: 47,250
- Australia: 2,280
- India: 2,000
- Brazil: 360
Agriculture—the global picture

- **2IR** 41% of US labour force-agriculture
- **3IR** this declined to 4%
- By 2000 it stood at 2%
**Agriculture** - Drones collect data based on heat emissions. Translated into optimal patterns of irrigation which command fully automated systems on the ground.

**Food processing** - Near infrared spectroscopic analysis which provides data at different points of the food processing value chain.
4IR: farms
## Building industry: 4IR innovations

<table>
<thead>
<tr>
<th>Construction</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drones</strong> survey and inspect construction site.</td>
<td><strong>Embedded sensors</strong> monitor assets, check for deterioration and facilitate predictive maintenance</td>
</tr>
<tr>
<td><strong>3D printers</strong> prefabricate building components.</td>
<td><strong>Big data</strong> on energy usage is collected digitally</td>
</tr>
<tr>
<td>Building work = <strong>Robots and autonomous vehicles</strong></td>
<td></td>
</tr>
<tr>
<td><strong>3D laser scanning</strong> or aerial mapping to compare work in progress against a virtual model</td>
<td></td>
</tr>
<tr>
<td><strong>Radio Frequency ID</strong> = tracks materials, equipment and workers</td>
<td>$10 trillion and 6% of global GDP</td>
</tr>
</tbody>
</table>

Largest consumer of resources and raw materials
50% of global steel production
3 billion tonnes of raw materials used to manufacture building products
SA Building industry and 4IR

SOUTH AFRICA

- R947.2 billion infrastructure budget
- 1.6 million housing units by 2019
- R135 billion on transport infrastructure
- Major construction companies lost 50-70% of market share in 2017

Construction

demolition

3D printing + robotic machines used to standardise production

Bricklaying (feed bricks into a machine and use CAD software)
The number of cities powered by more than 70% RE doubled between 2015 and 2017.
Solar power rose to record prominence in 2017, as the world installed more new solar power projects, than the net additions of coal, gas and nuclear plants combined.
RE: Largest Corporate Buyers

Currently the world’s largest corporate buyer of renewable power, 2.6 gigawatts (2,600 MW)
4IR: jobs and skills

- Mckinsey: 50% of global economy/1.2 billion people/ $14.6 trillion wages
- 65% of children that started primary school in 2017 will be employed in positions that do not currently exist.
- 50% of subject knowledge acquired during the first year of a four year technical degree is outdated by the time students graduate
- By 2020 more than a third of desired core skill sets will be comprised of skills that are not considered crucial to the job today.
Can smart technology make government smarter?

The Lower Colorado River Authority (LCRA) use **275 connected river sensors** to report *stream flows, temperature, rainfall and humidity*, on a public website in real time.

The Los Angeles City Authority uses IoT on **145 000 street lights and 4500 intersections**.

Artificial Intelligence*: inventory of **700 000** trees to identify disease

In Mississippi, Alexa AI service to plug into government information about things like taxes and vehicle registration

WinSun (2014) built **10 houses per day using 3D printed building components**+

6 storey building.

Komatsu developed **automated bulldozers** whose drones & 3D scanners relay terrain data to bulldozer =speeds up pre-foundation work.
**4IR in Africa: smartphones and mobile money**

SSA: 50% of world’s mobile money platforms/500m users by 2020.

100 million people using Zoona in 2016

Kenya: $38 billion moved along mm platforms in 2016 (Bloomberg)

Zimbabwe: 50 000 machines imported in 2016

National ID, mobile number and security pin sent to beneficiary.
## 4IR in Africa

<table>
<thead>
<tr>
<th><strong>Ethiopian Commodity Exchange</strong></th>
<th>IBM uses IoT to trace entire coffee value chain; 5 million bags of coffee. Next is sesame seeds and haricot beans</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aeroview</strong></td>
<td>Developed by Cape Town based Aerobotics. AI and drones identify problem areas in crops. Harnesses infra-red imagery to map regions and individual crop rows.</td>
</tr>
<tr>
<td><strong>SOPHiA</strong></td>
<td>(Morocco, Cameroon, SA) AI used to identify disease-causing mutations and decide on effective care</td>
</tr>
<tr>
<td><strong>Zipline</strong> (Rwanda)</td>
<td>Makes 150 daily blood deliveries to remote patients. 30 minute access. Drone airport scheduled for 2020</td>
</tr>
<tr>
<td><strong>Android app in 6 African countries</strong></td>
<td>Examines for early signs of cervical cancer.</td>
</tr>
<tr>
<td><strong>Nigeria</strong></td>
<td>App provides instant diagnosis and location of medication</td>
</tr>
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South Africa and 4IR

Most prolific research producers

<table>
<thead>
<tr>
<th>AUTONOMOUS VEHICLES</th>
<th>ROBOTICS</th>
<th>QUANTUM COMPUTING</th>
<th>ARTIFICIAL INTELLIGENCE</th>
<th>INTERNET OF THINGS</th>
<th>3D PRINTING</th>
<th>NANO-TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>UKZN 25</td>
<td>UKZN 55</td>
<td>UKZN 63</td>
<td>UKZN 23</td>
<td>UP 18</td>
<td>SU. 19</td>
<td>CSIR 479</td>
</tr>
<tr>
<td>UCT 20</td>
<td>CSIR 54</td>
<td>SU 30</td>
<td>UP 21</td>
<td>CSIR 14</td>
<td>Wits 4</td>
<td>Wits 416</td>
</tr>
<tr>
<td>UP 19</td>
<td>UCT 46</td>
<td>Wits 22</td>
<td>UJ 19</td>
<td>UWC 11</td>
<td>CUT 3</td>
<td>NRF 397</td>
</tr>
<tr>
<td>CSIR 15</td>
<td>UP 44</td>
<td>UCT 20</td>
<td>UCT 15</td>
<td>Unisa 10</td>
<td>&lt;3</td>
<td>UJ 381</td>
</tr>
</tbody>
</table>

Share in world publications

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>SOUTH AFRICA</th>
<th>WORLD</th>
<th>SHARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robotics</td>
<td>322</td>
<td>190,965</td>
<td>0.16</td>
</tr>
<tr>
<td>Artificial intelligence</td>
<td>140</td>
<td>30,685</td>
<td>0.45</td>
</tr>
<tr>
<td>Internet of Things</td>
<td>79</td>
<td>14,039</td>
<td>0.56</td>
</tr>
<tr>
<td>3D printing</td>
<td>38</td>
<td>8,689</td>
<td>0.43</td>
</tr>
<tr>
<td>Autonomous vehicles</td>
<td>164</td>
<td>41,703</td>
<td>0.39</td>
</tr>
<tr>
<td>Quantum computing</td>
<td>203</td>
<td>58,097</td>
<td>0.34</td>
</tr>
<tr>
<td>Nanotechnology</td>
<td>2928</td>
<td>996,083</td>
<td>0.29</td>
</tr>
<tr>
<td>All disciplines</td>
<td>204,515</td>
<td>39,176,830</td>
<td>0.52</td>
</tr>
</tbody>
</table>
South Africa and 4IR

According to Africa Analysis:

- IoT installed base in South Africa will reach **35 million by 2020**.
- IoT services will be responsible for up to **50% of business revenue by 2020**.

Stellenbosch-based **HealthQ** develops technologies and uses biomathematical models to power fitness trackers and other wearable devices that help users monitor their overall health and fitness.

Gauteng govt using drones in large infrastructure projects.

**SqwidNet’s** open access IoT network is deployed across 8 metros and covers 49% of population.

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</tr>
<tr>
<td>Placing a SIM Card into a vehicle to track its performance (SA invention).</td>
<td></td>
</tr>
<tr>
<td>Huge market for connected car technology (infotainment, track location of fleet vehicles)</td>
<td></td>
</tr>
</tbody>
</table>
Thank You

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