

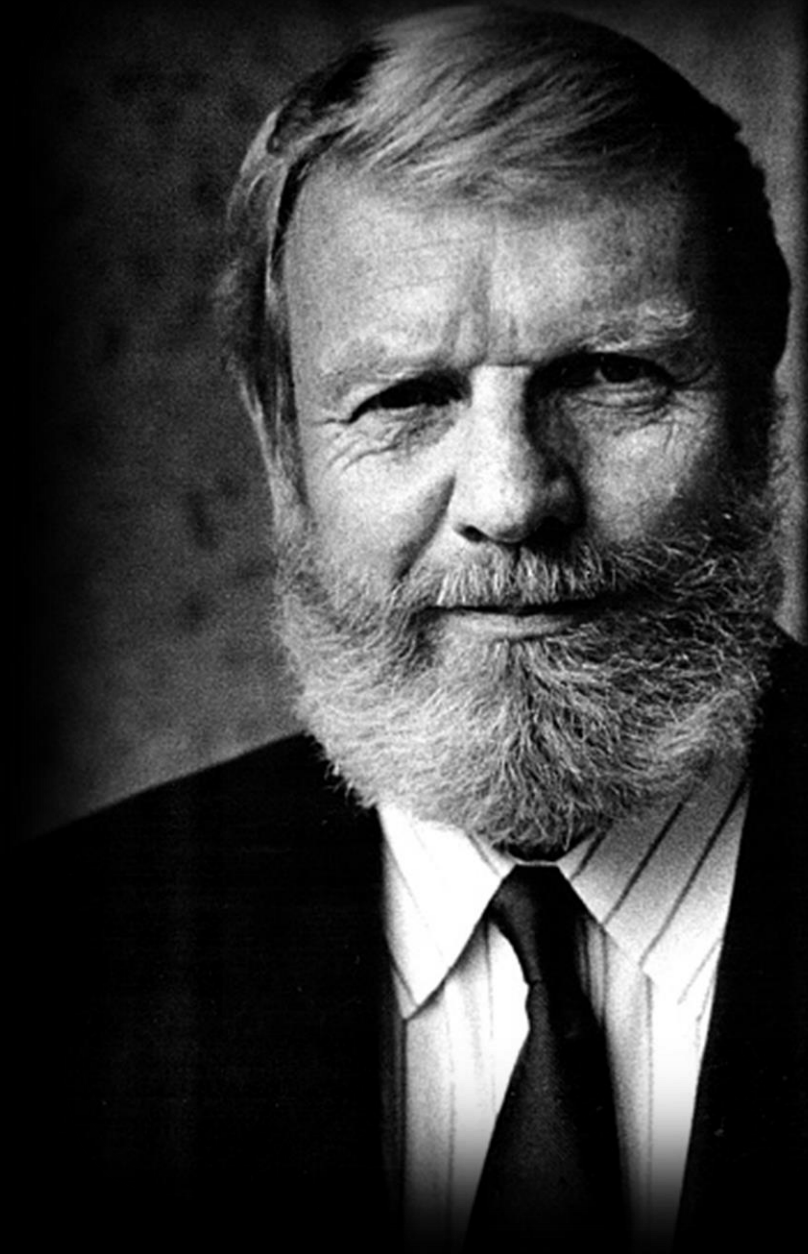
Zooming Out

Trends and drivers impacting the health sector over the coming decades

Stefan Hajkowicz



What's a Megatrend?



John Naisbitt

Why Explore the Future?

“the best way to anticipate change in your sector is to spend some time outside of it” – Michael Cameron

“... CSIRO identified the impact on office towers and shopping centres of: technology; ageing; and the need for more efficient energy sources ... and how e-commerce would boost demand for logistics property. Cameron has followed the advice with a big push into that sector”.

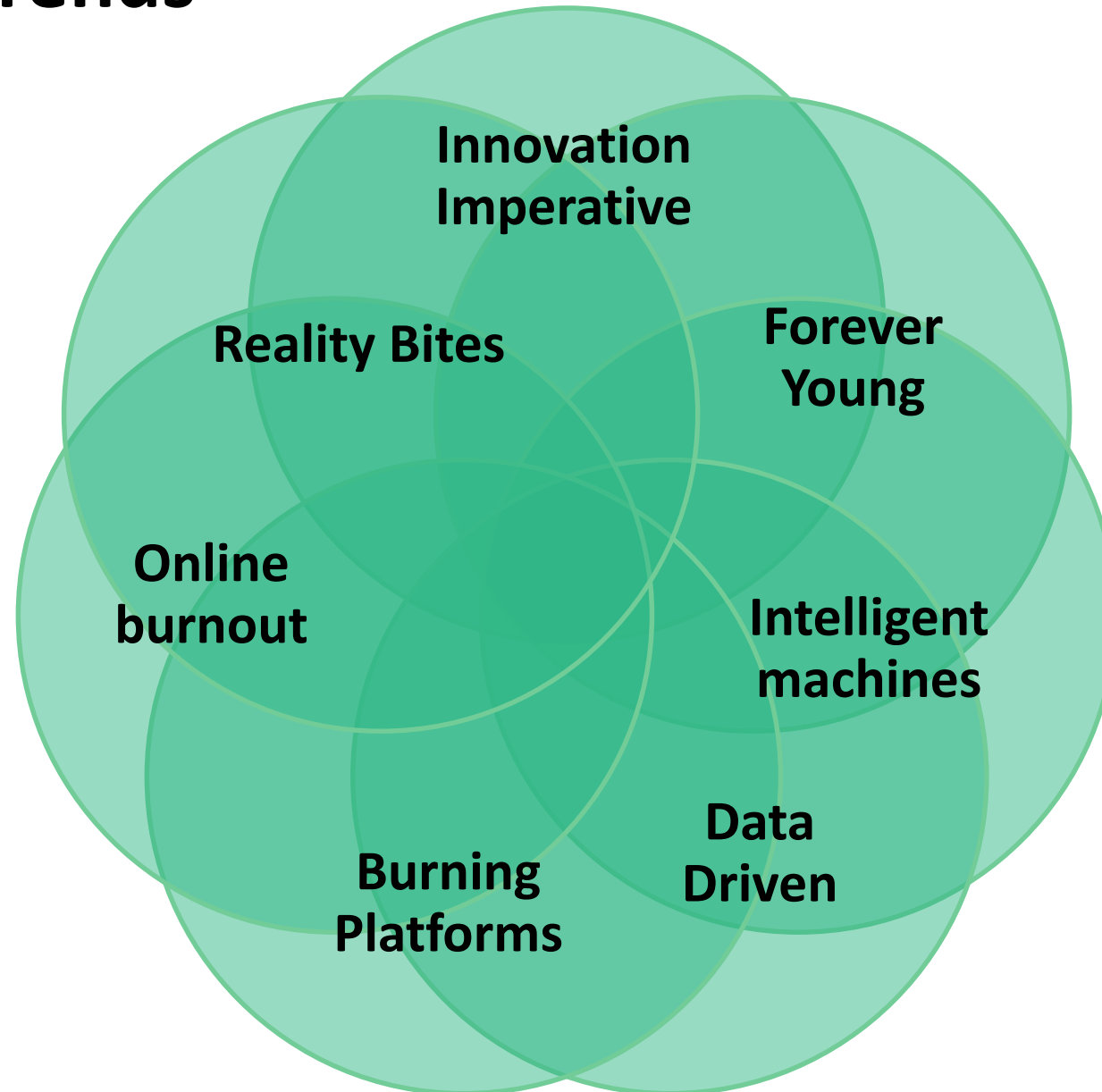
Quote and photo published in The Australian Financial Review, 9 April 2015

Photo of Michael Cameron, GPT CEO by Louie Douvis



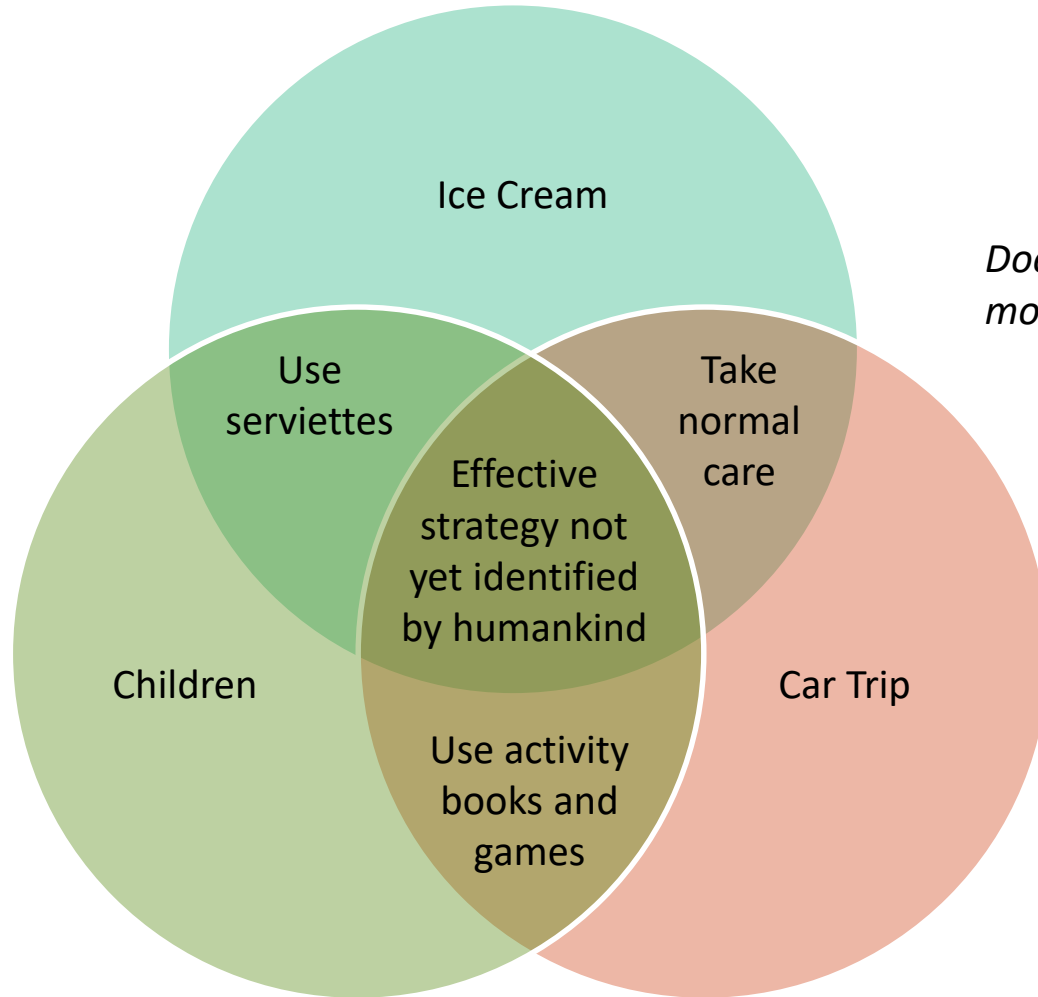
Michael Cameron (CEO of GPT)

Healthcare Megatrends



Why a Venn Diagram?

Each area of overlap tells a unique story about the future



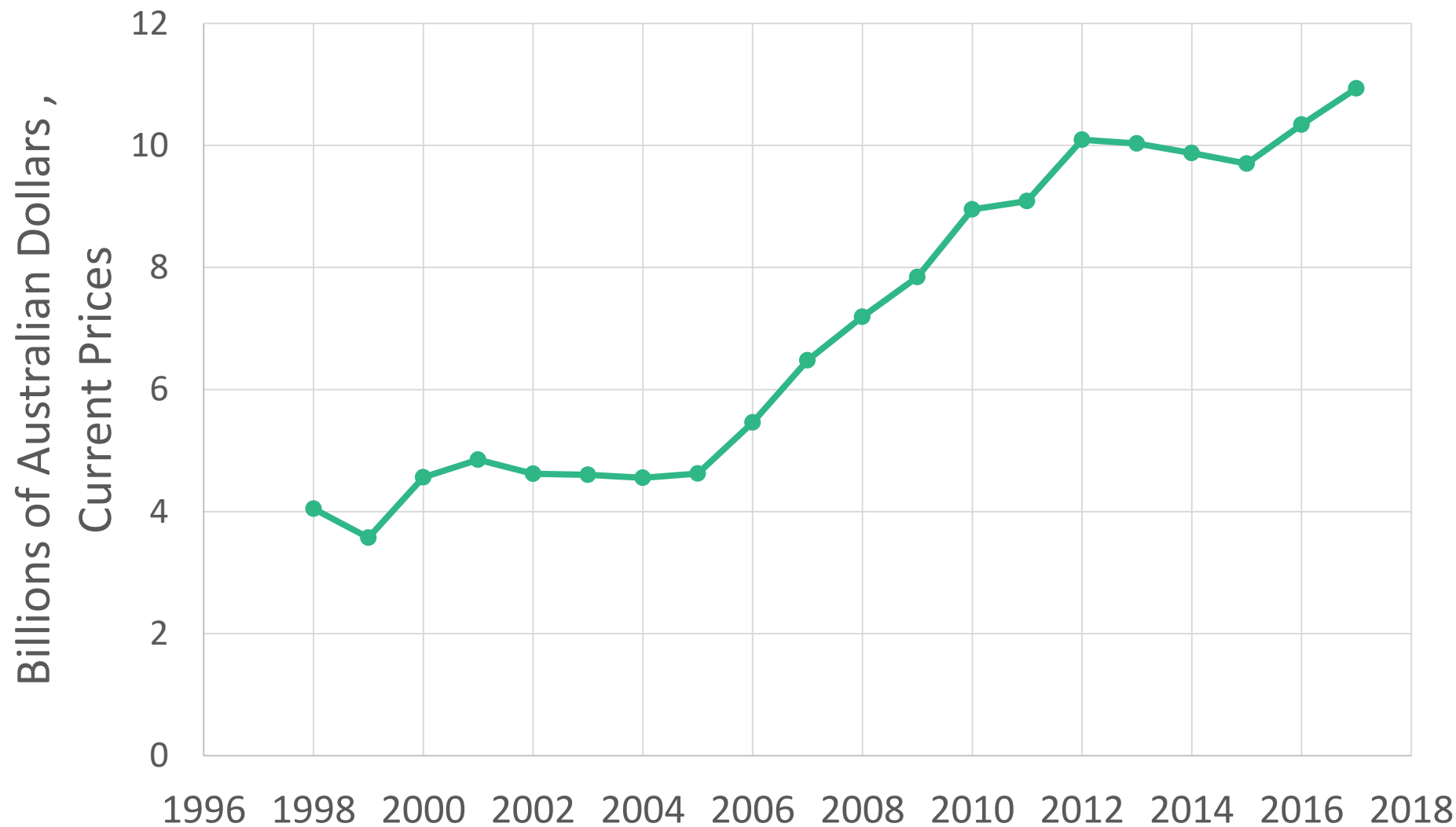
Does the strategy perform in most/all areas of overlap?



1. Demand Growth

The growth and continued growth in demand for healthcare services and innovations to improve the efficiency and effectiveness of services.

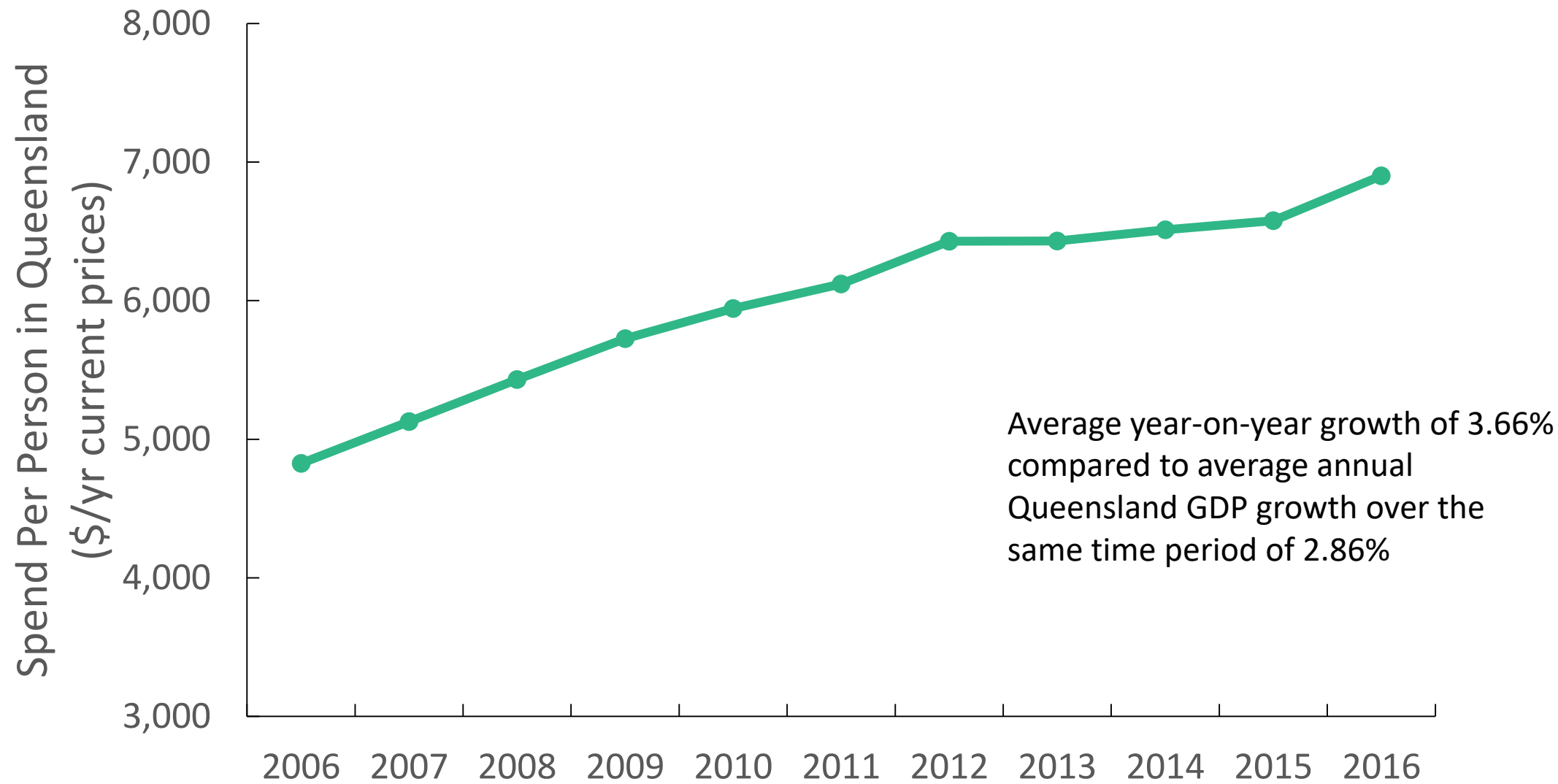
Queensland State Government Healthcare Spending



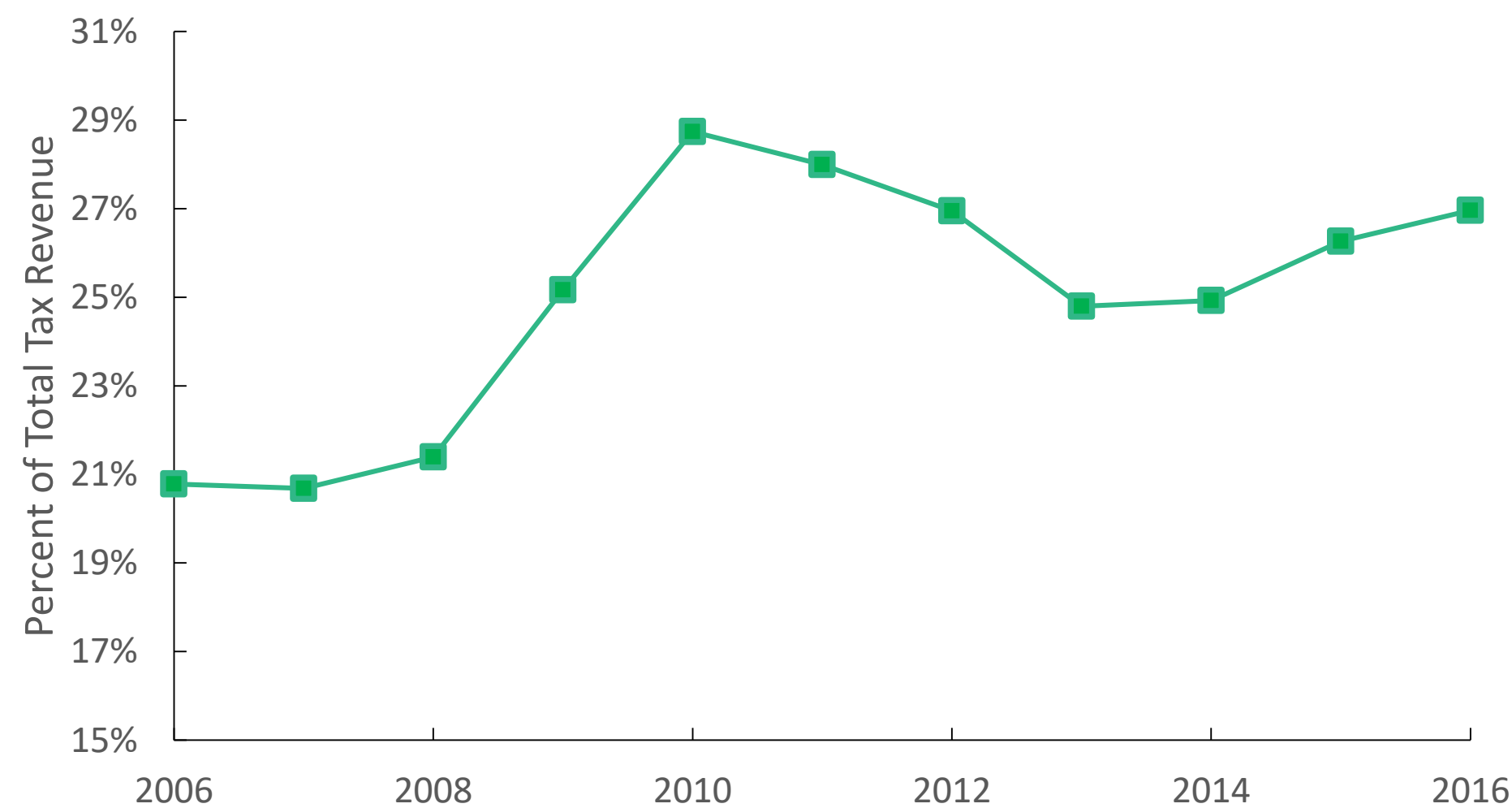
One scenario we generated (with sustained growth in health spend and low growth in revenue) sees the entire government budget spent on healthcare by 2080.

Obviously this can't happen. But we need to innovate.

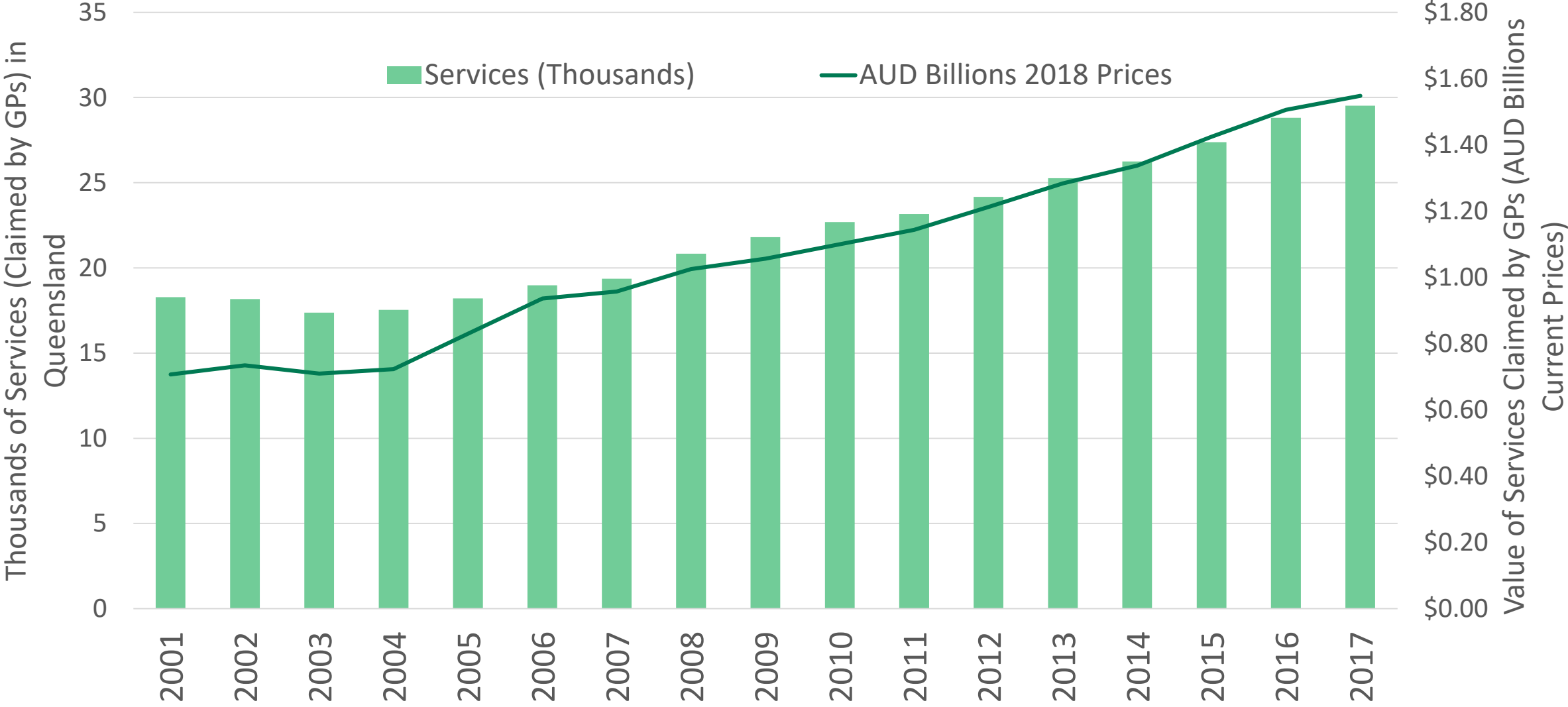
Individual Healthcare Spending, Queensland



Australian Government Health Spend, Percent of Tax Revenue



Increasing Demand for Primary Care, Queensland



Source: Australian Government Department of Health, General Practice Workforce Statistics

Innovation to Keep People Out of Hospital - Telehealth

The CSIRO National NBN Telehealth Trial

A selected test group of 150 patients suffering chronic conditions with frequent hospital admissions used stay-at-home tele-monitoring for 276 days. The test patients were found to have a:

46.3% reduction in medical expenditure

25.5% reduction in pharmaceutical expenditure

53.2% reduction in unscheduled admission to hospital

67.9% reduction in length of stay when admitted to hospital

41.3% and 44.5% reduction in mortality relative to control patients



The control group (300 patients) showed no significant change in these variables.

Branko Celler et al. 2018. Studies in Health Technology and Informatics

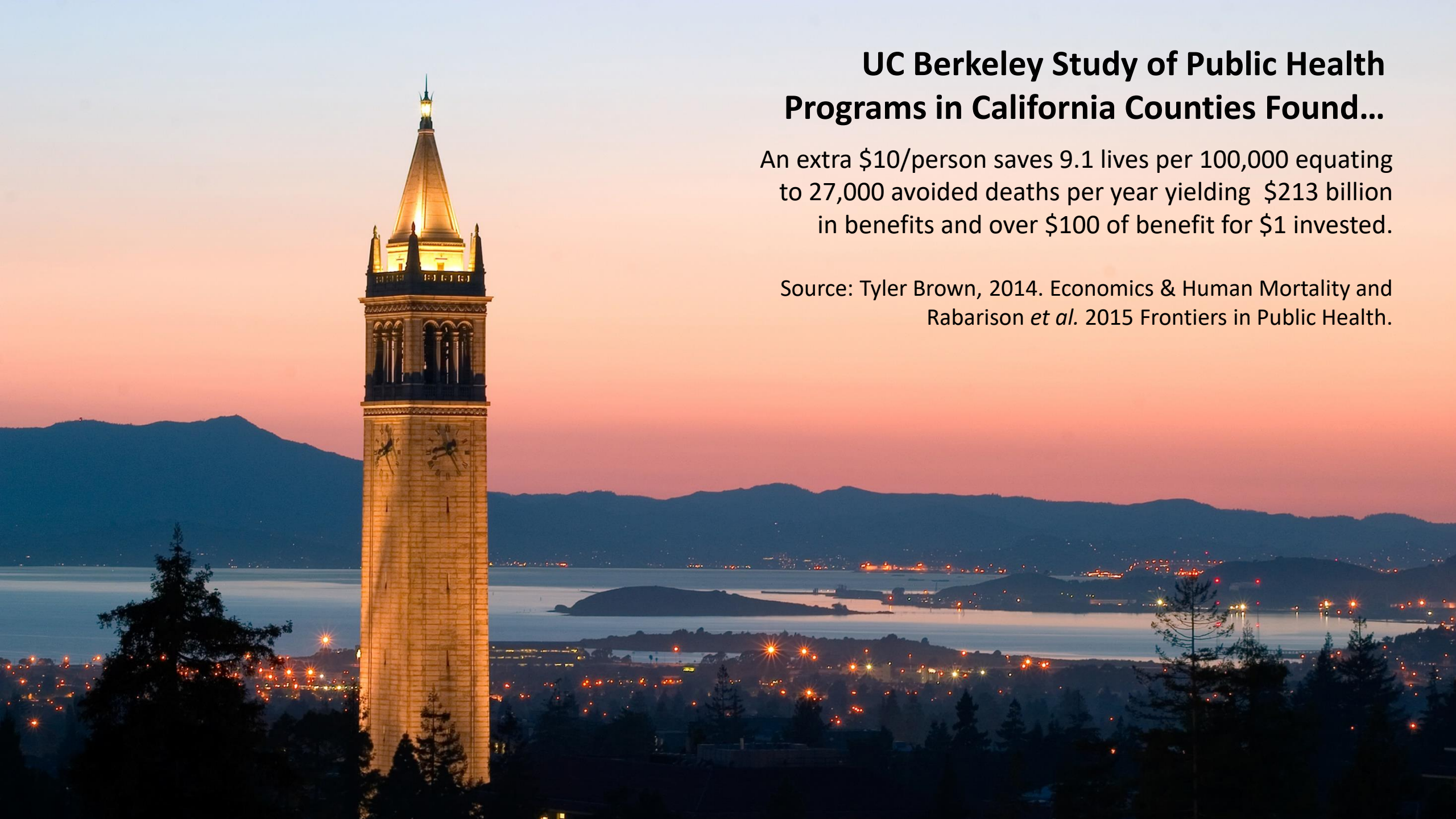


Microsoft Hololens



The haptic workbench

Image by North Sullivan Photography / CSIRO



UC Berkeley Study of Public Health Programs in California Counties Found...

An extra \$10/person saves 9.1 lives per 100,000 equating to 27,000 avoided deaths per year yielding \$213 billion in benefits and over \$100 of benefit for \$1 invested.

Source: Tyler Brown, 2014. Economics & Human Mortality and Rabarison *et al.* 2015 Frontiers in Public Health.

The pandemic of physical inactivity

“Physical inactivity is the fourth leading cause of death worldwide”

- Prof Dr Harold Kohl et al., 2012 The Lancet

In Australia Physical inactivity is main cause for 21–25% of breast & colon cancers, 27% of diabetes and 30% of heart disease.

Only one-third of children undertook the recommended 60 minutes of daily physical activity.

60% of Australian adults did less than the recommended 30 minutes of moderate intensity physical activity per day.

- Australian Government, Department of Health

Source: Australian Bureau of Statistics (ABS) 2013 - Australian Health Survey: Physical Activity, 2011-12. ABS Catalogue number 4364.0.55.004





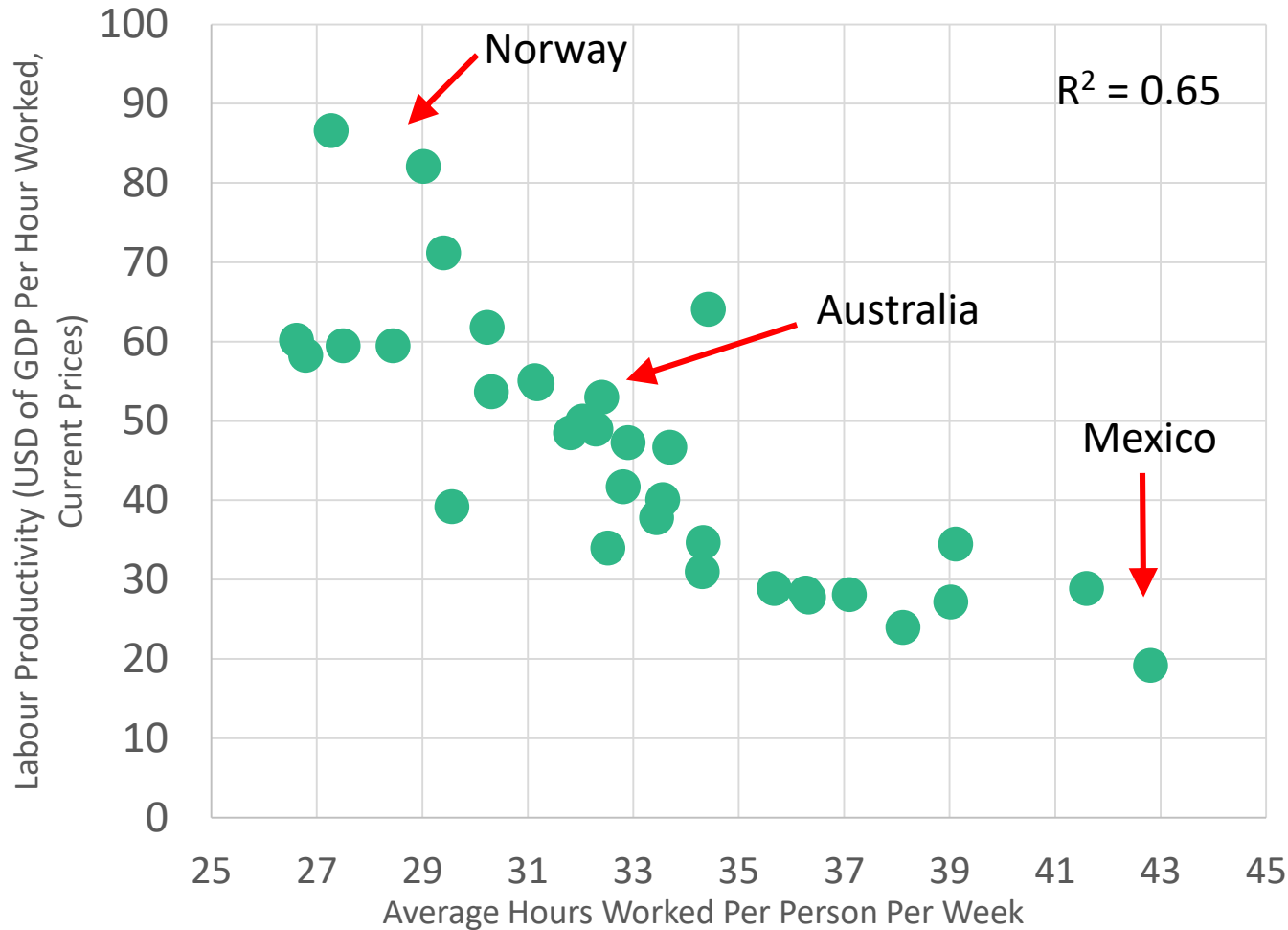
Healthcare Infrastructure? If we build it people will use it.

Females are 1.43 times more likely to ride to work if there's a bicycle path (Garrard et al, 2008, Preventative Medicine)

Comprehensive study of 90 large US cities found commuters more likely to ride (than drive) with bicycle infrastructure (Dill and Carr, 2014. Transportation)

Working Smarter (Not Just Harder)

A high tech digitally enabled economy rewards intelligence more than brute force



Source: OECD Statistics



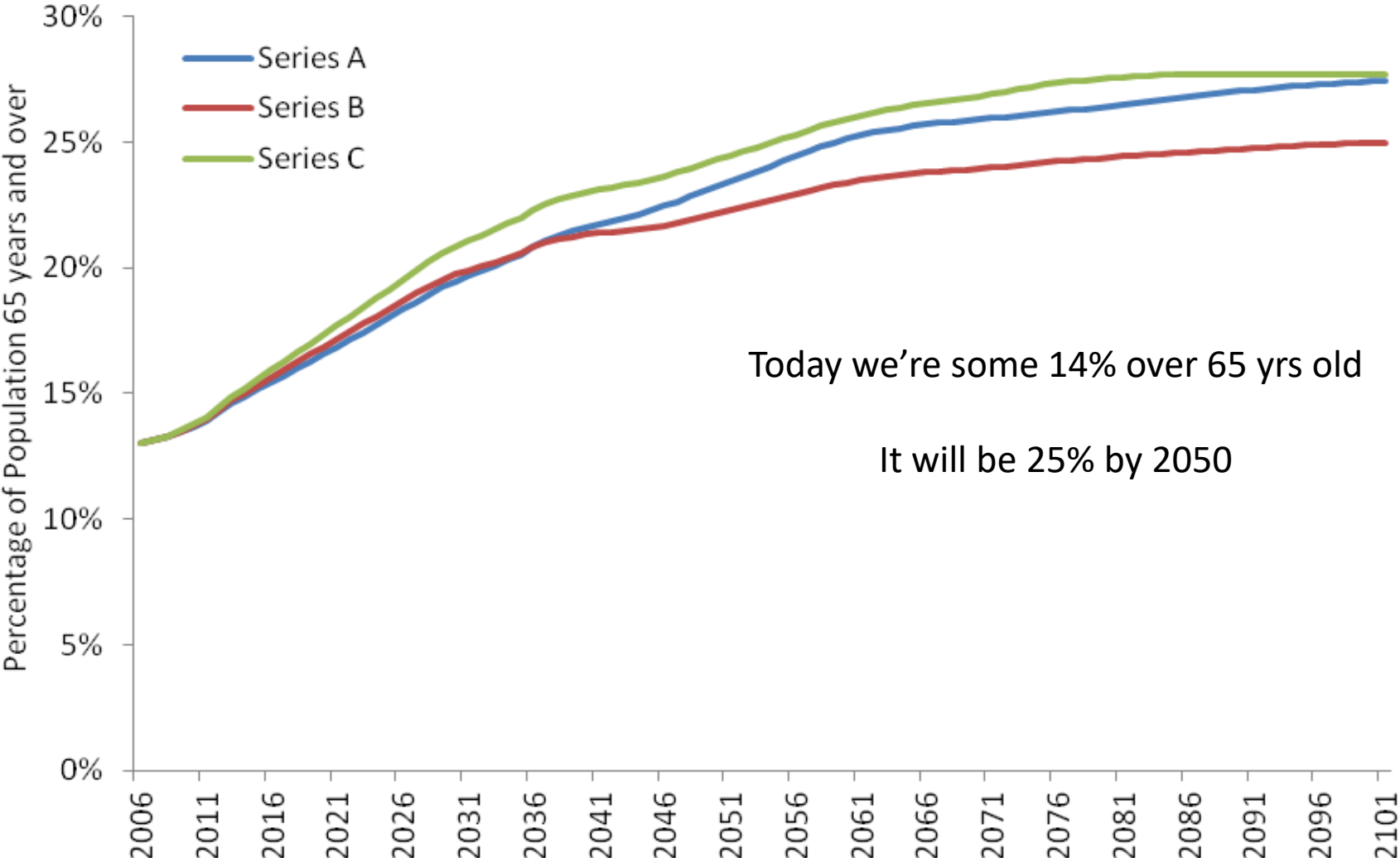
Experiments in Sweden, reducing the work week from 8 to 6 hours tested by:

- Svartedalens elderly care home
- Internet startup, Brath
- Filimundus App Developer
- Stockholm city council
- Toyota service centre in Gothenburg

2. Forever Young



The Ageing Population – Australia



36% of Japan's Population
Over 65yrs by 2050

Source: Japan National Institute of Population and Social
Security Research, Population Forecasts



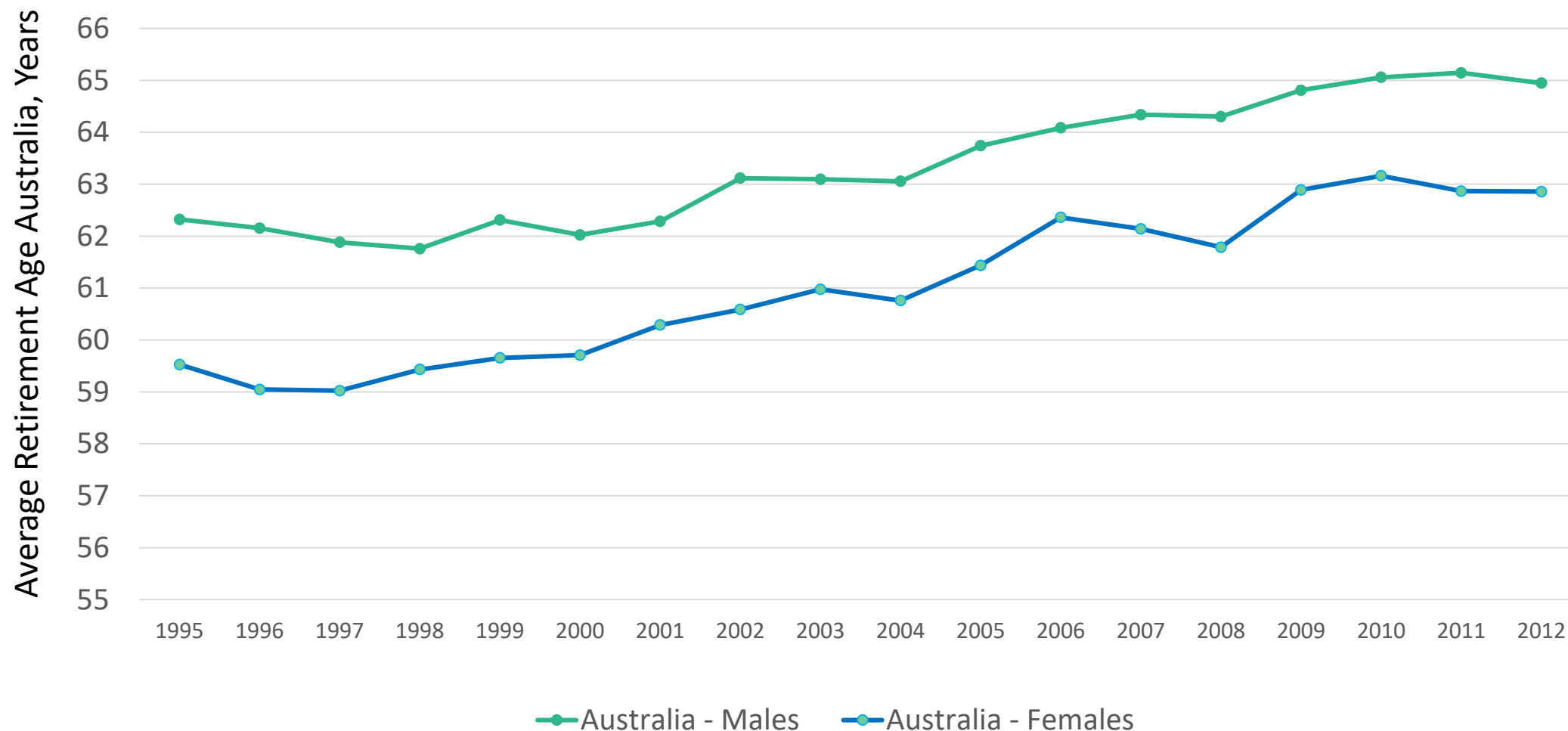
Average Retirement Age

Is on the Rise



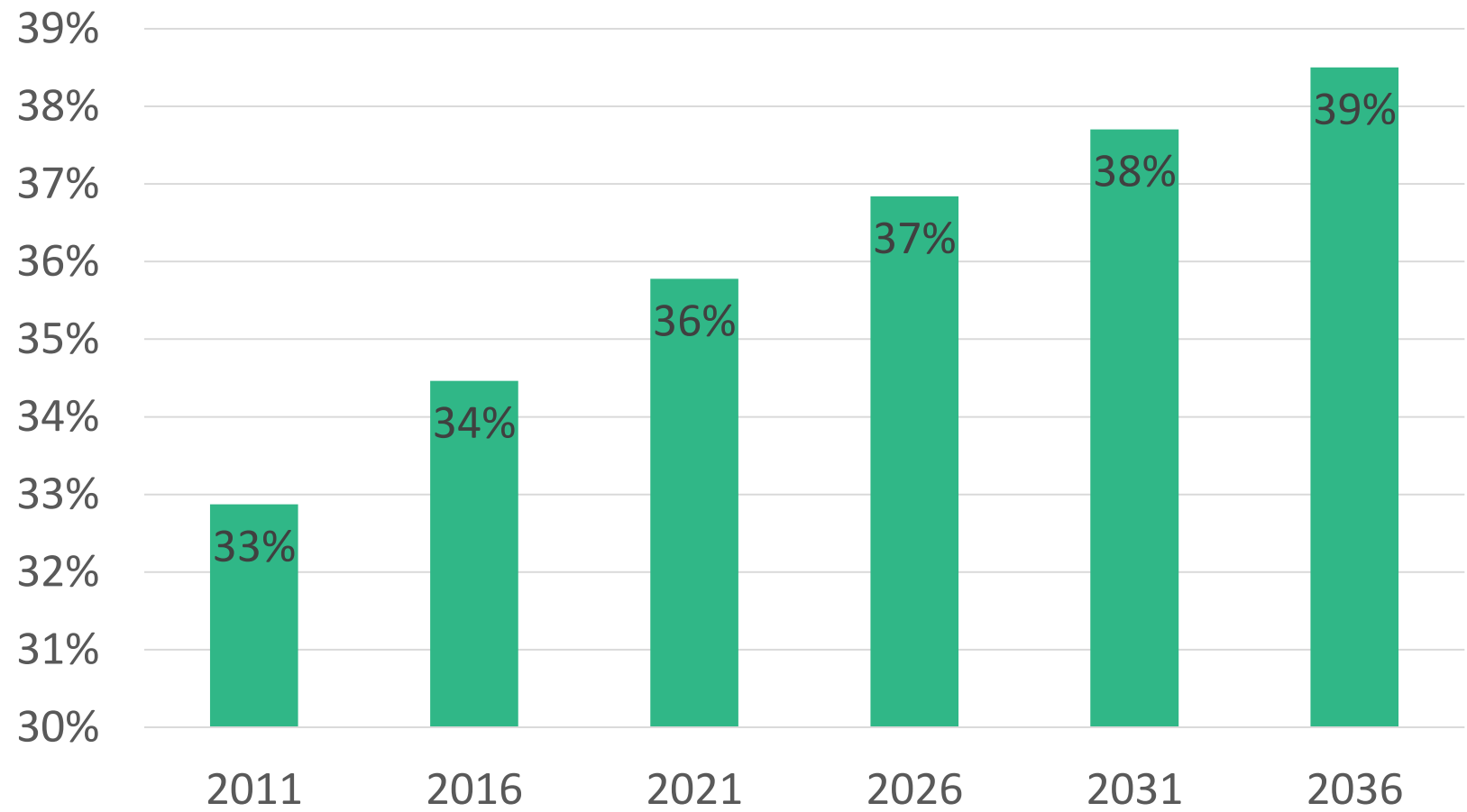
As of June 2013
Australia's
entire
workforce had
a \$727 billion
shortfall for a
comfortable
retirement.

- Rice Warner
Actuaries



Forecasts of the Dependency Ratio in Queensland

Portion of population aged 0-15 and >65 years old grows from 35% to 39%

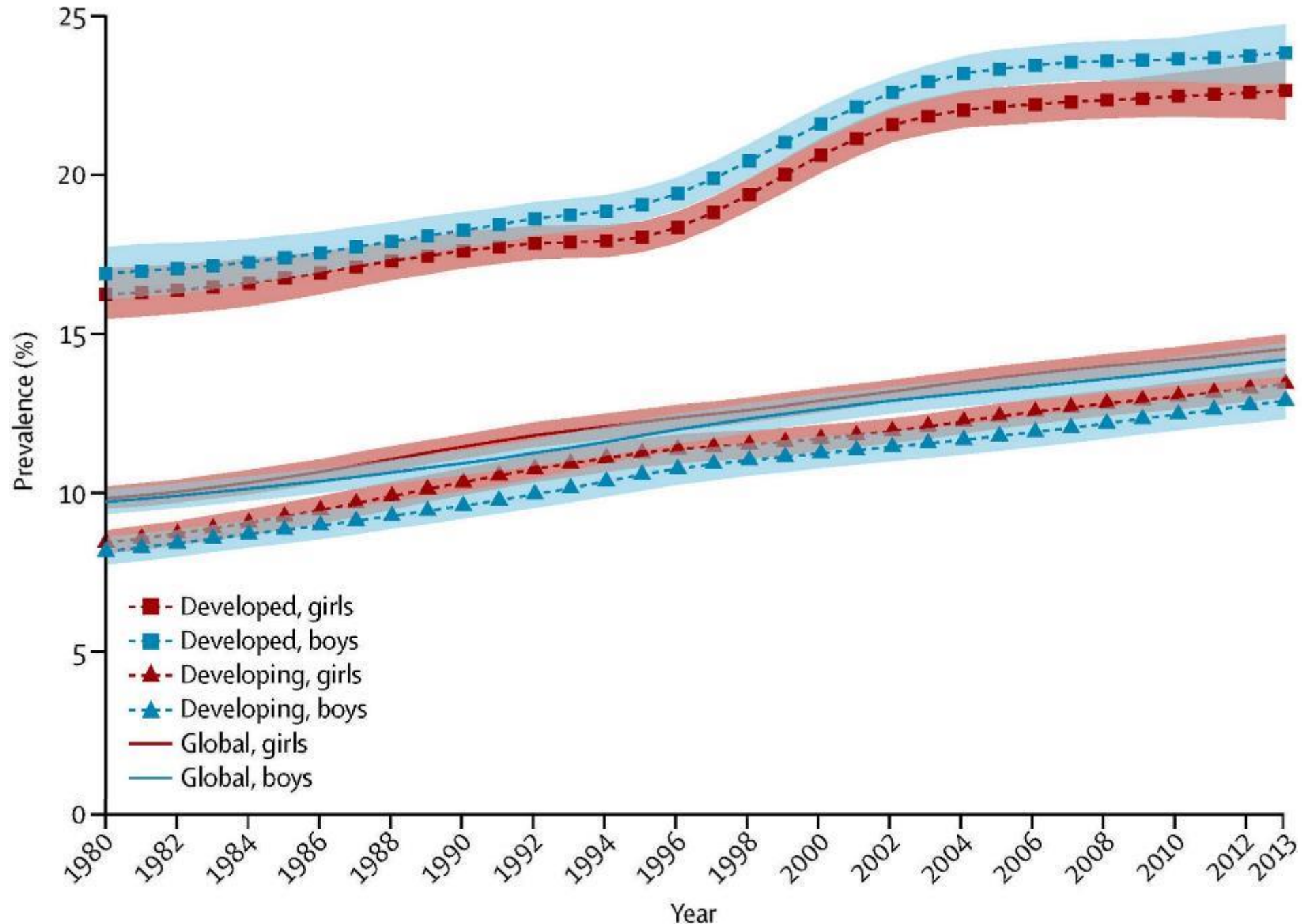


Data source: Australian Bureau of Statistics and Queensland Government Statisticians Office Population Forecasts

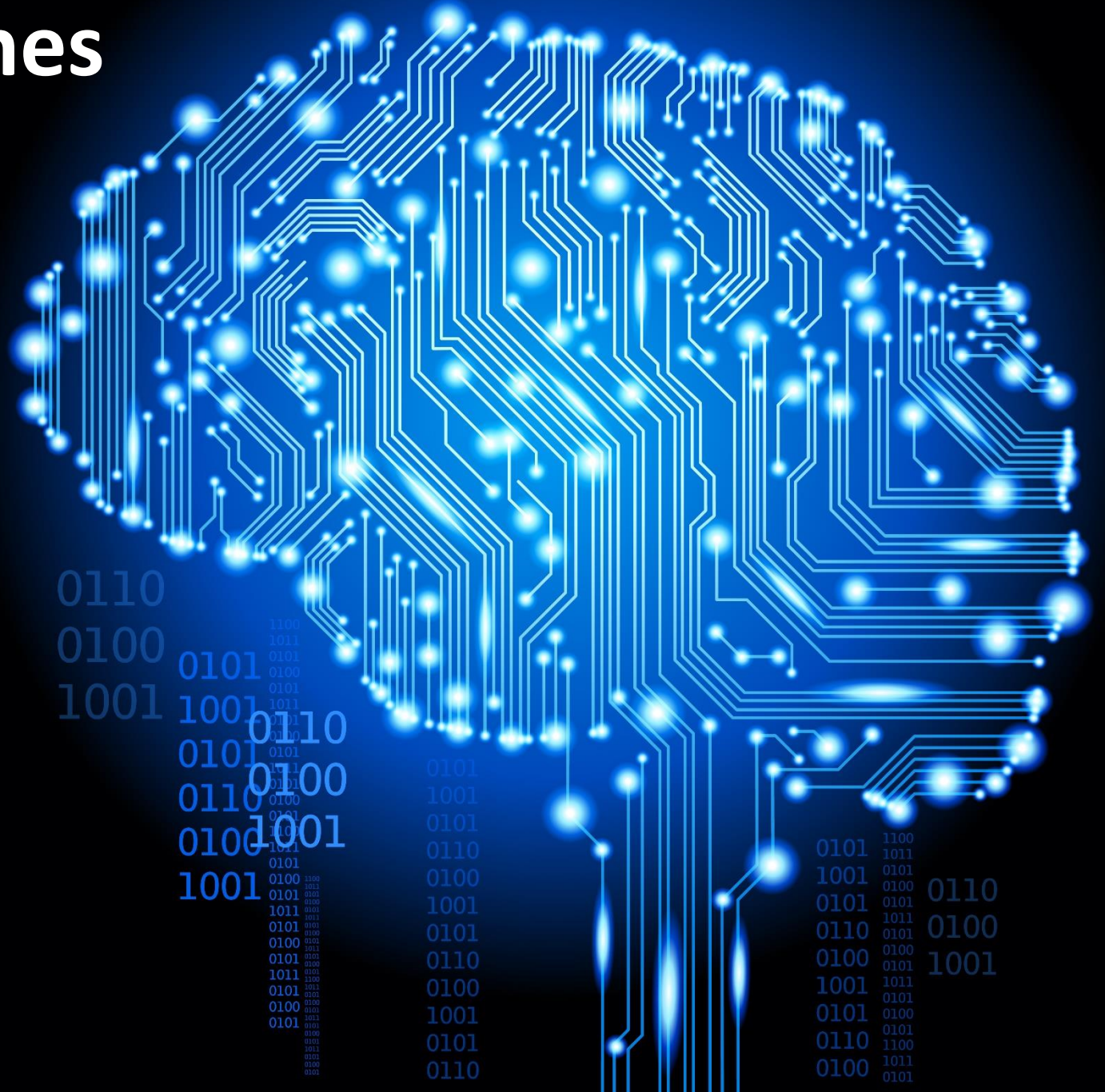
Worldwide Obesity Prevalence Rates

“In 2010, overweight and obesity were estimated to cause 3·4 million deaths, 3·9% of years of life lost, and 3·8% of disability-adjusted life-years (DALYs) worldwide”

The Lancet 2014 384, 766-781. Ng et al.



3. Intelligent Machines



Artificial Intelligence



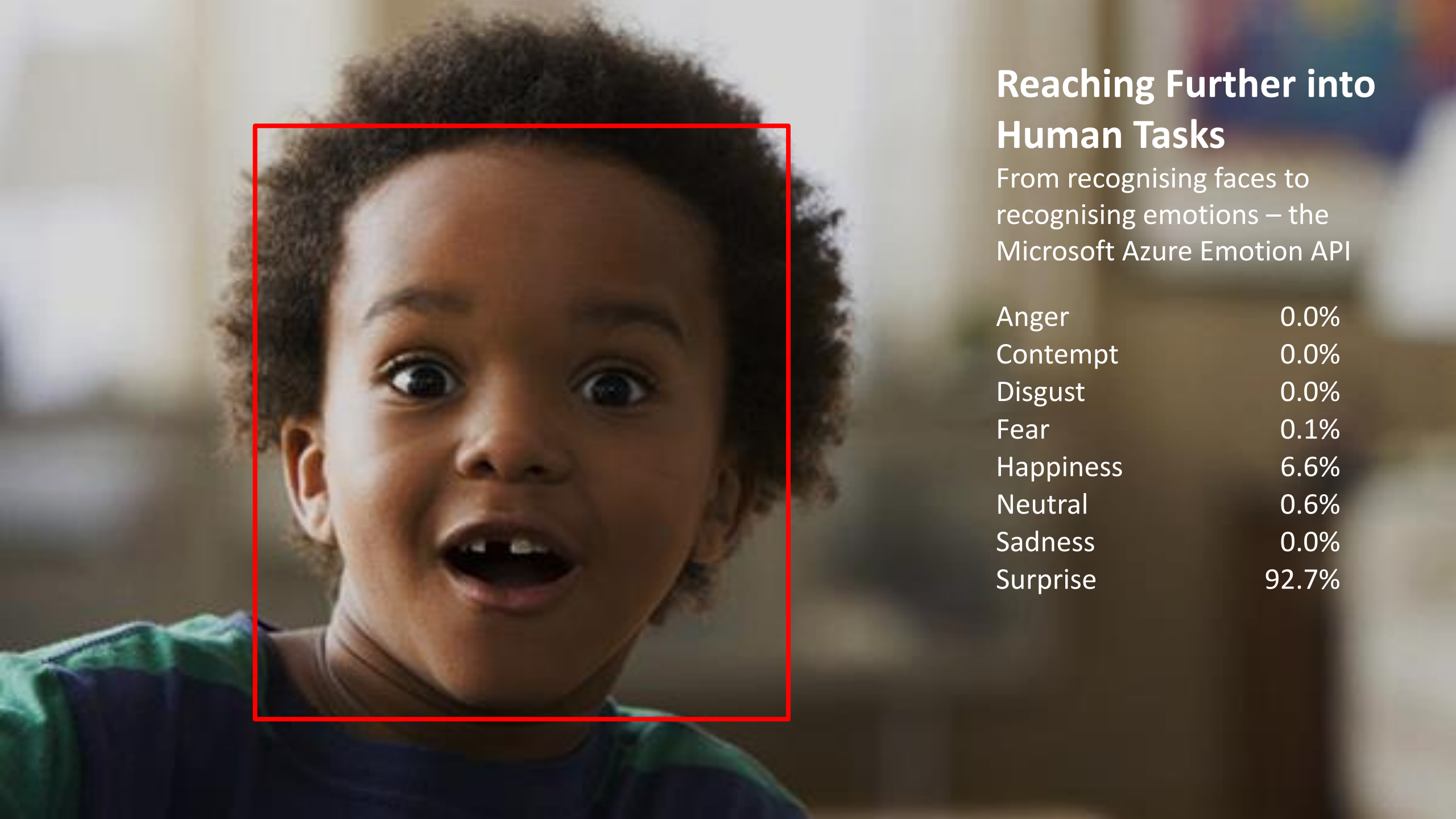
Mojave Desert, California
DARPA Grand Challenge, Race Day 2004
Image source: Wikimedia commons, DEXTER



Kunming Park, China



*Previously
Unidentified
Type of Dog*

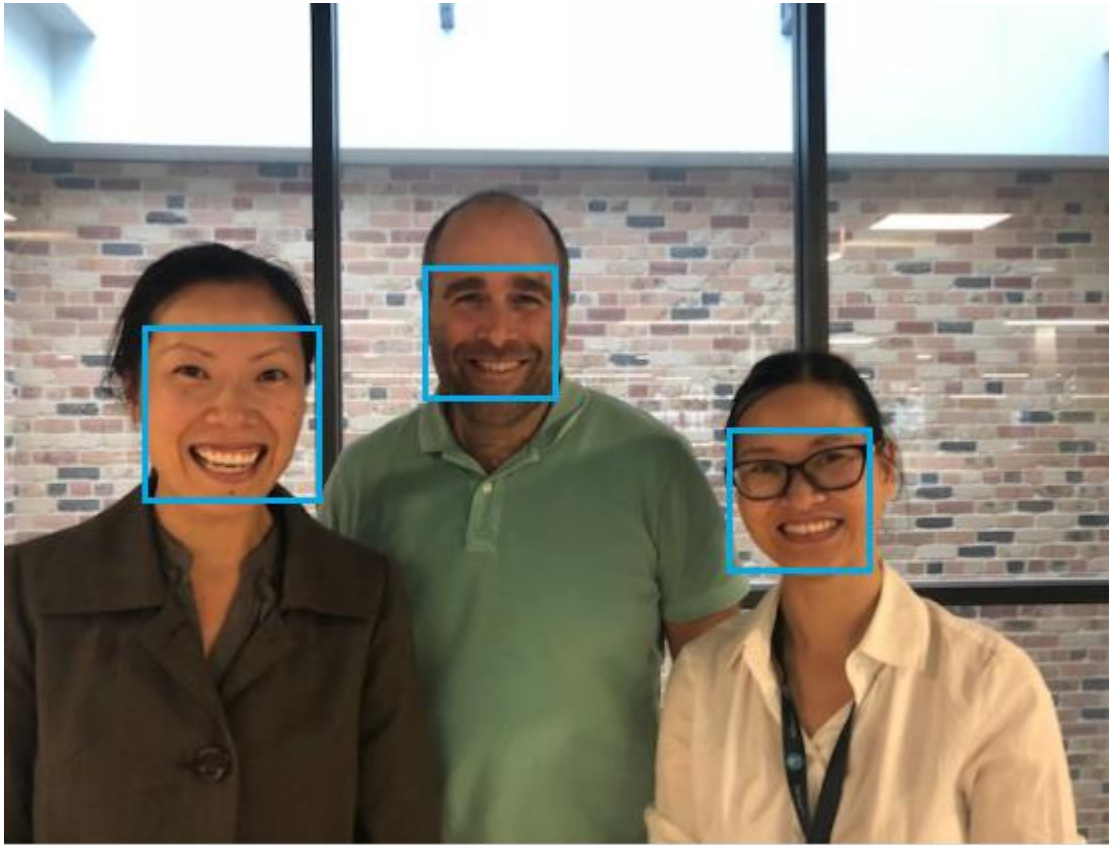


Reaching Further into Human Tasks

From recognising faces to recognising emotions – the Microsoft Azure Emotion API

Anger	0.0%
Contempt	0.0%
Disgust	0.0%
Fear	0.1%
Happiness	6.6%
Neutral	0.6%
Sadness	0.0%
Surprise	92.7%

We tried being happy
– and nailed it

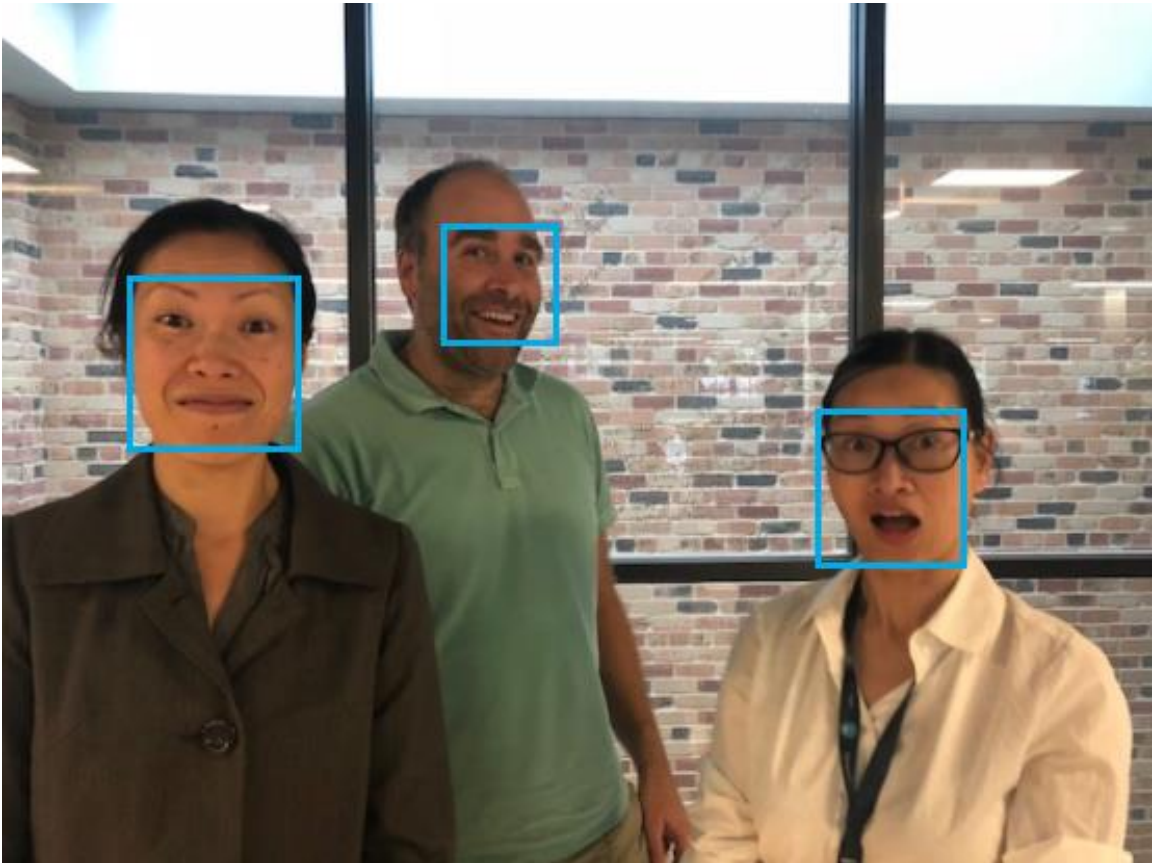


anger	0.0%
contempt	0.0%
disgust	0.0%
fear	0.0%
happiness	100.0%
neutral	0.0%
sadness	0.0%
surprise	0.0%

anger	0.0%
contempt	0.0%
disgust	0.0%
fear	0.0%
happiness	100.0%
neutral	0.0%
sadness	0.0%
surprise	0.0%

anger	0.0%
contempt	0.0%
disgust	0.0%
fear	0.0%
happiness	100.0%
neutral	0.0%
sadness	0.0%
surprise	0.0%

We tried being surprised – only Hien could do it. Me & Wen looked happy



anger	0.04%
contempt	0.64%
disgust	0.15%
fear	0.11%
happiness	94.37%
neutral	2.83%
sadness	0.19%
surprise	1.68%

anger	0.00%
contempt	0.00%
disgust	0.00%
fear	0.00%
happiness	99.99%
neutral	0.00%
sadness	0.00%
surprise	0.01%

anger	0.00%
contempt	0.00%
disgust	0.07%
fear	0.00%
happiness	0.03%
neutral	0.04%
sadness	0.00%
surprise	99.85%



Image and Data Source: Cas cruncher, BBC News
Jozef Maruscak, Rebecca Agliolo and Ludwig Bull (Law Students involved in the study)

Impacts of Automation on the Workforce

Could it be 47% of all jobs are done by a robot?



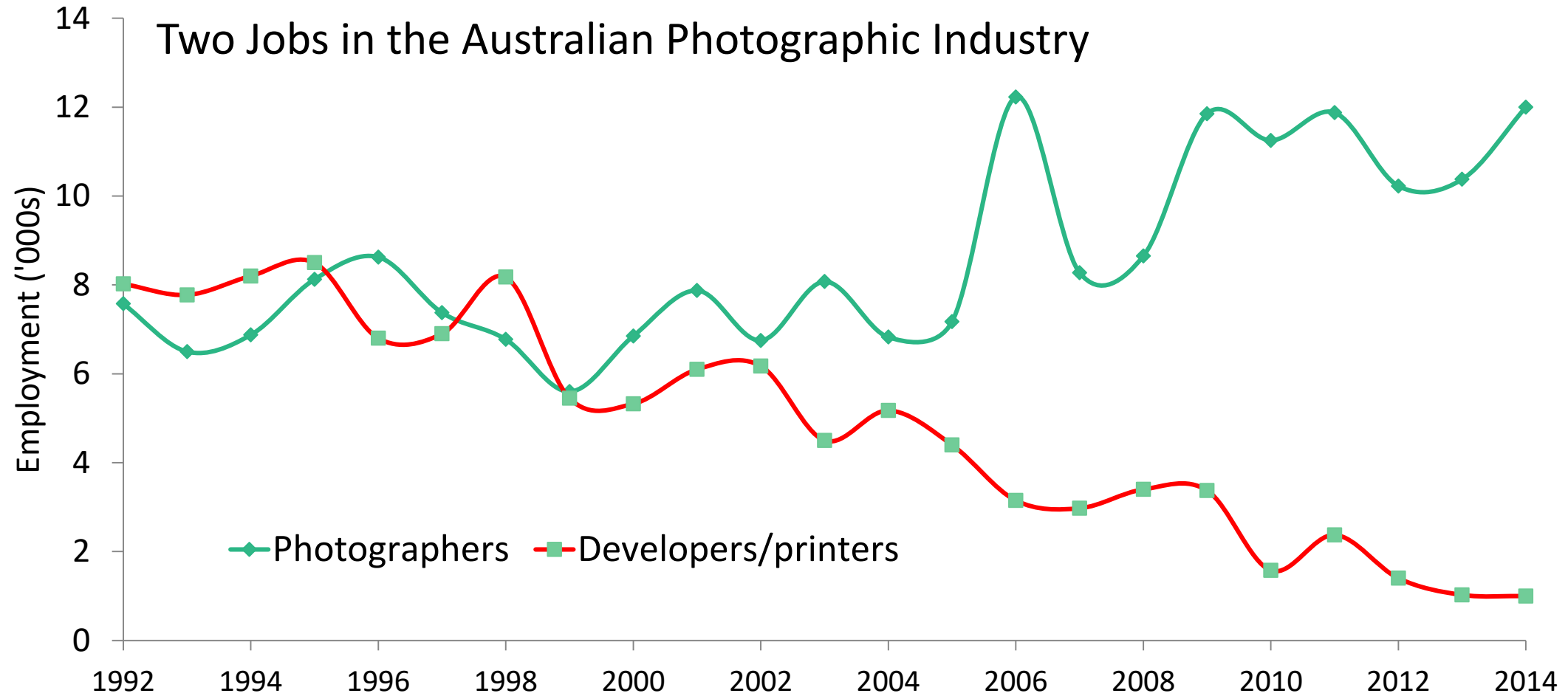
Associate Professor
Michael Osborne
University of Oxford
(Image Source)

But don't Worry - Marovec's Paradox is Here to Help

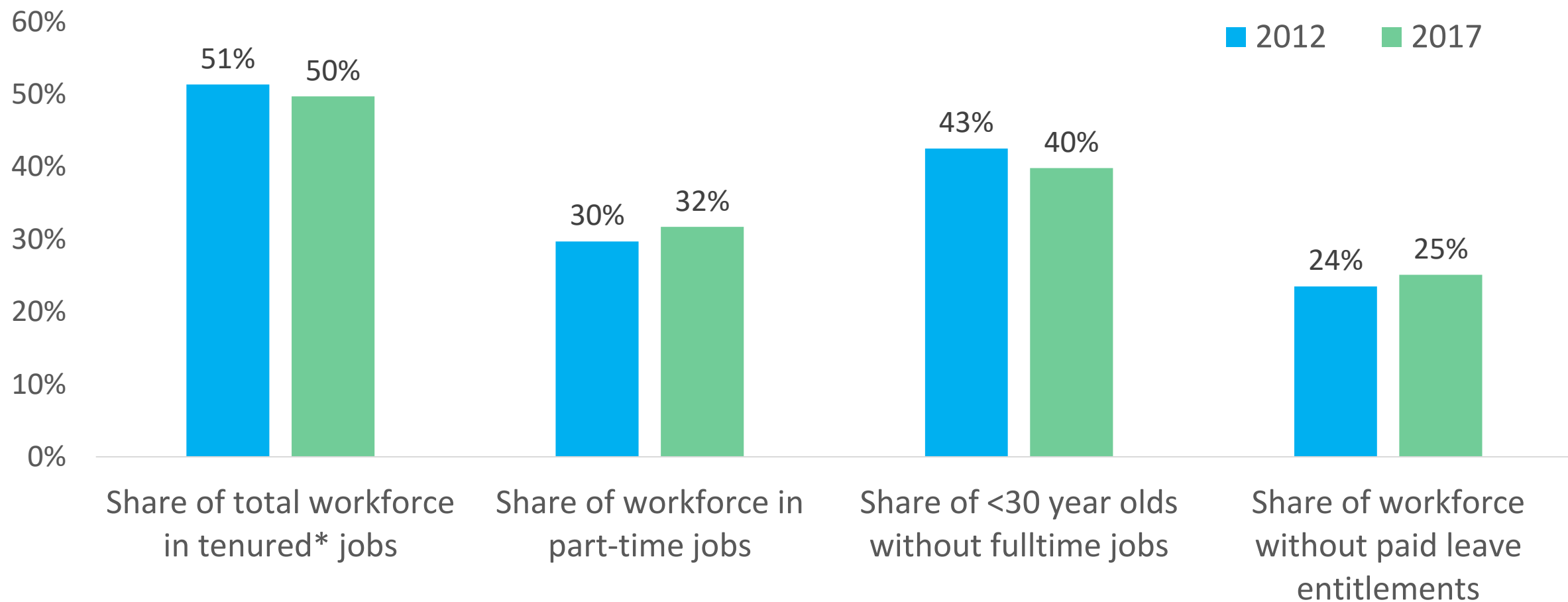
The Berkeley Robot for the Elimination of Tedious Task (Brett) by Prof Abbeel at UC Berkley. Image source: Youtube



Bifurcation of Labour Markets



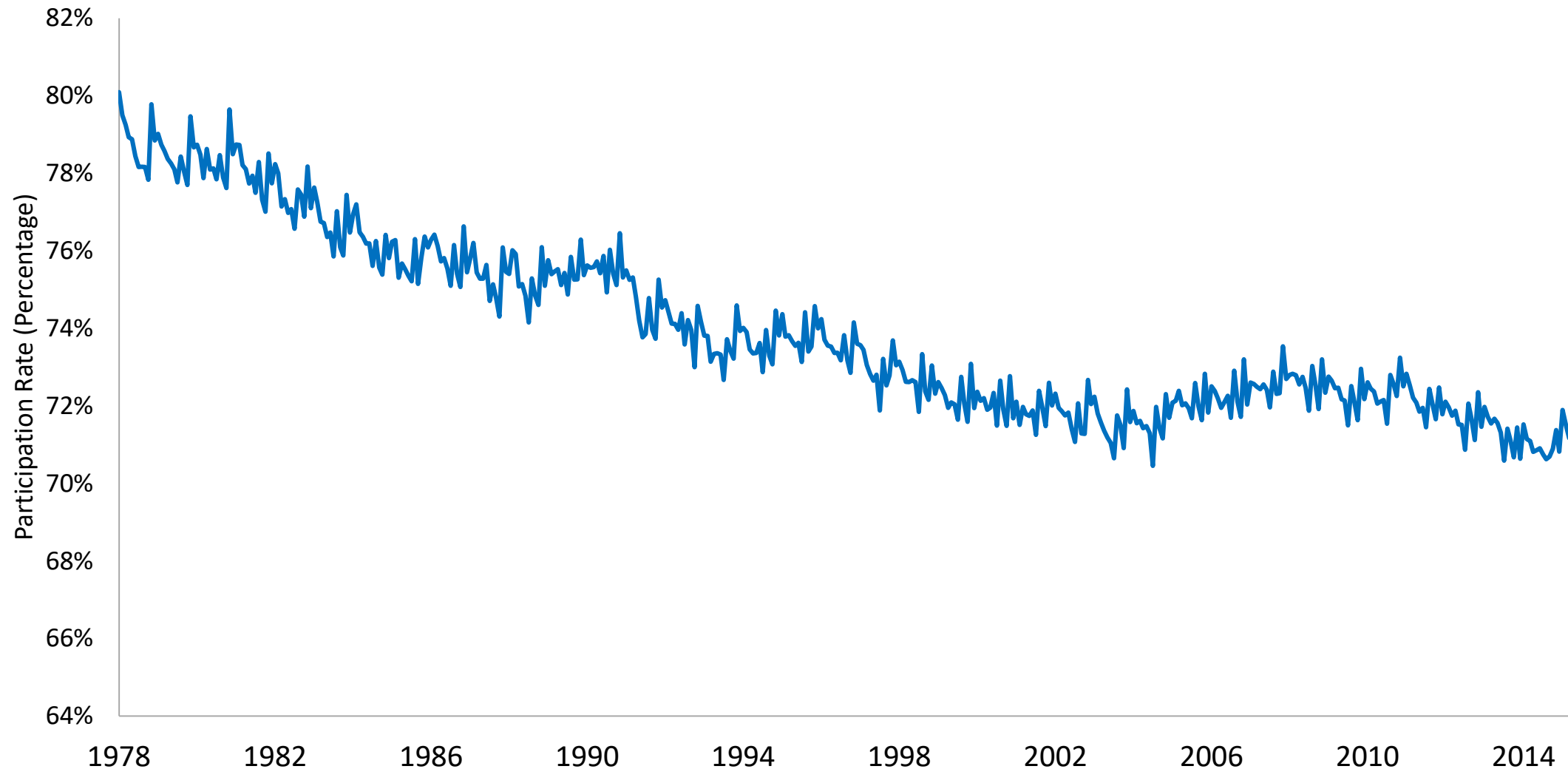
Casualization of the Workforce



Source: Centre for Future Work, ABS

Not Everyone is Making the Transition

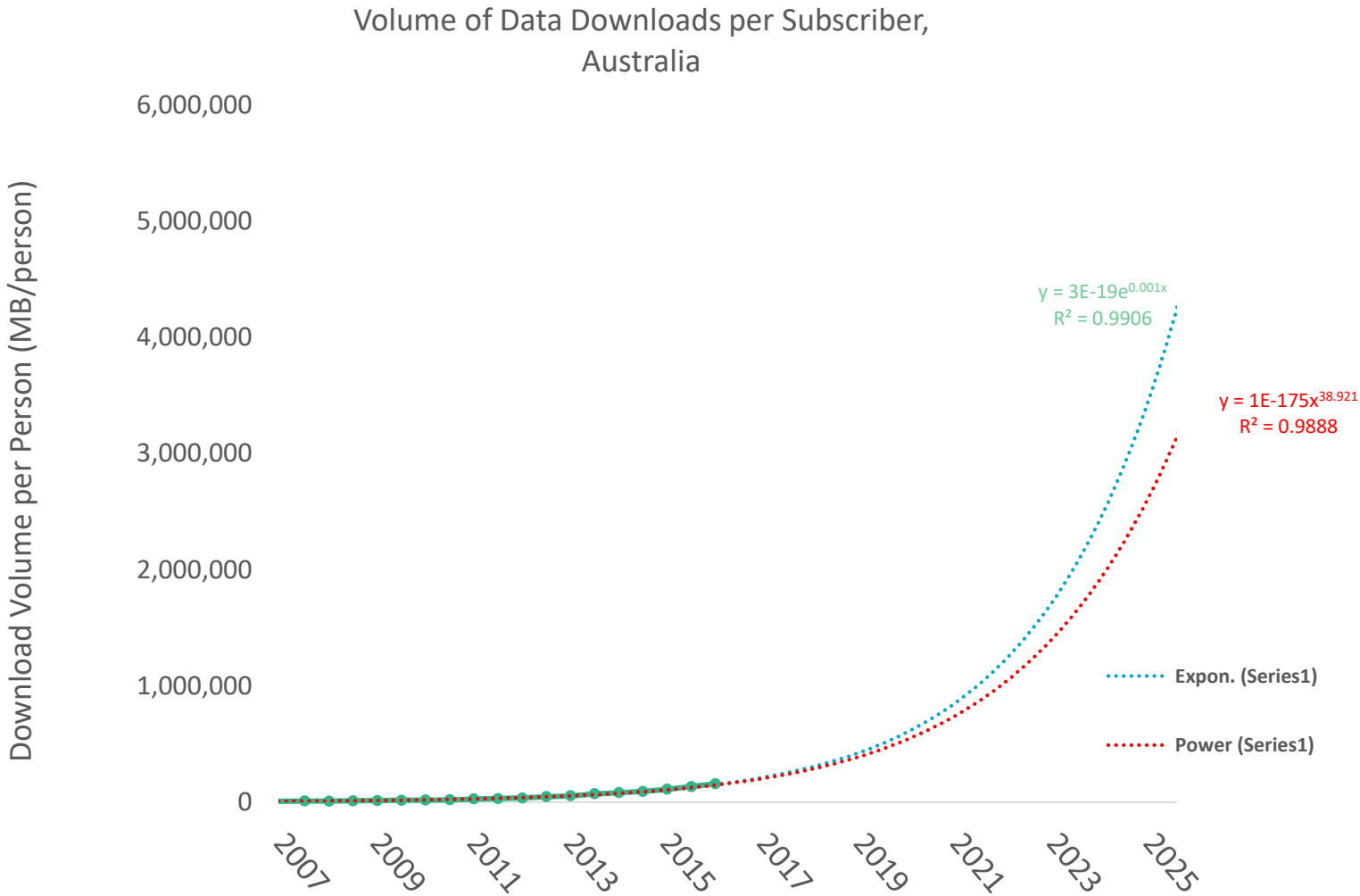
Working Age Males in Australia, Labour Force Participation Rate



Source: ABS (2015) 6202.0 Labour Force, Australia, Australian Bureau of Statistics

4. Data Driven

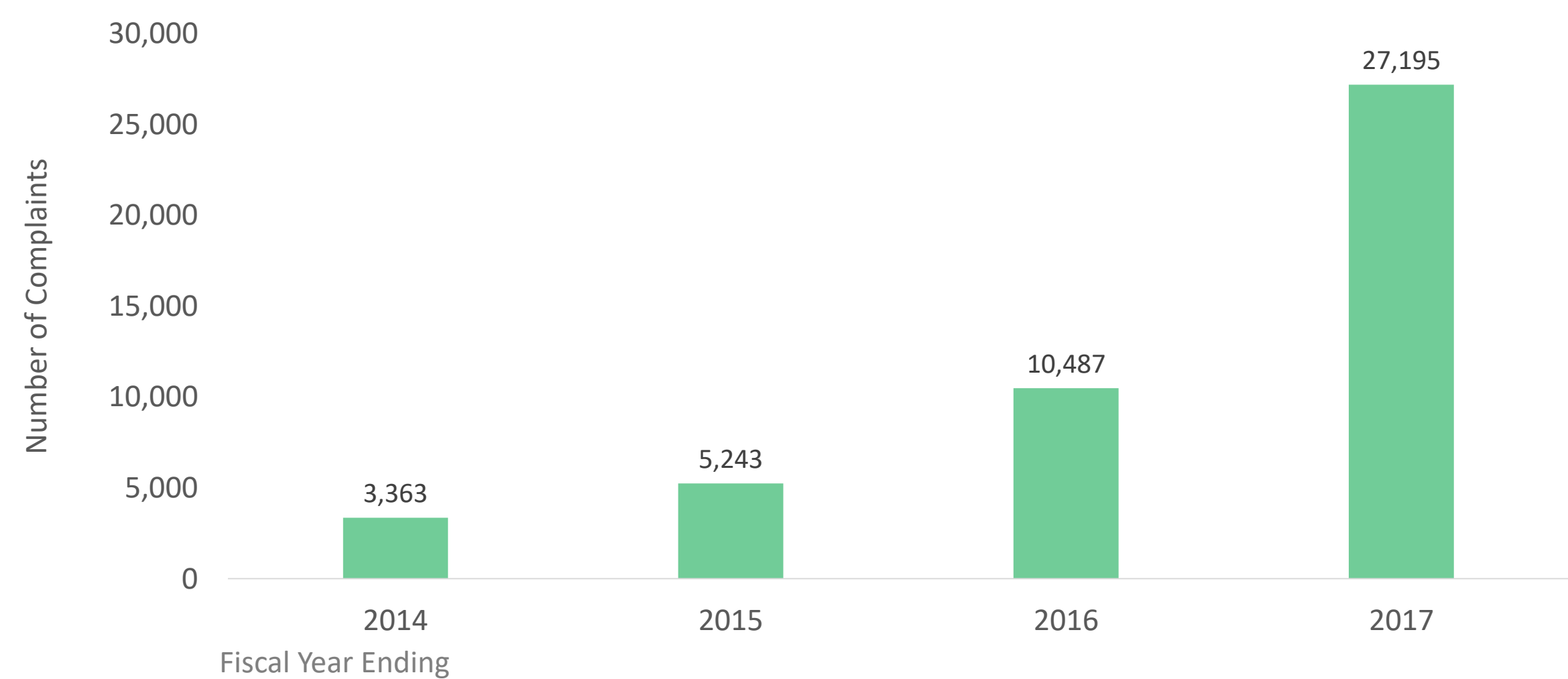
Meeting the Future Data Demand (Storage, Analysis, Distribution)



Everything suggests this trends upwards. For example, by 2025 genomics is forecast to produce between 2-40 exabytes per year – dwarfing twitter, youtube and astronomy

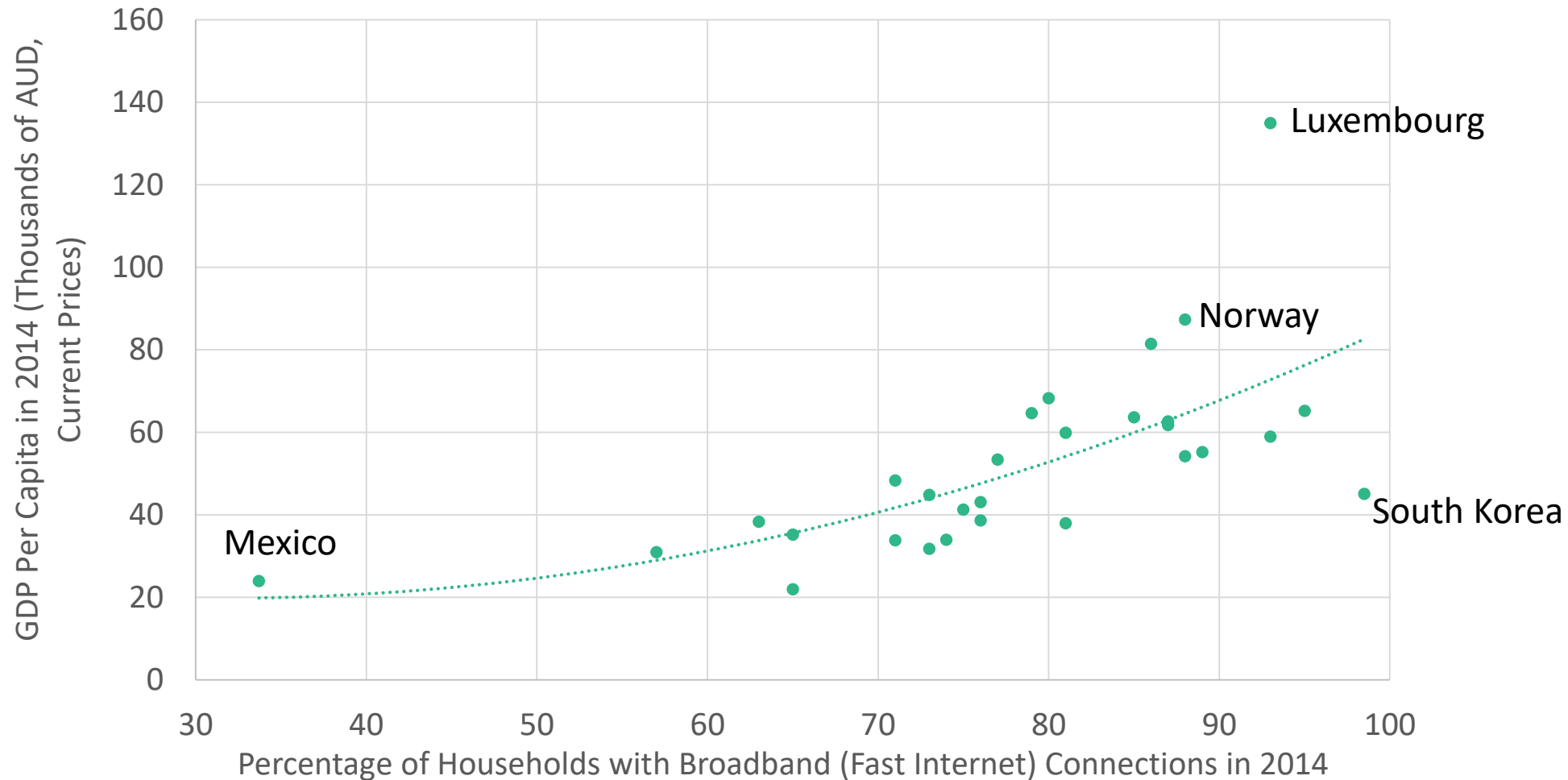
Demand for Improved Services

Complaints by Australians about broadband connections to the telecommunications ombudsman



Connectivity Versus Growth – OECD Countries

Unravelling the Relationship Between Digital Connectivity and Economic Growth



According to a recent IDC Report worldwide revenues for big data and business analytics (BDA) reached \$150.8 billion in 2017, an increase of 12.4% since 2016





Data Scientists are in Demand

Who ever thought of being a data scientist at school? By 2020 the number of jobs for all data professionals in the United States will increase by 364,000 openings to 2,720,000 (IBM Forecast)

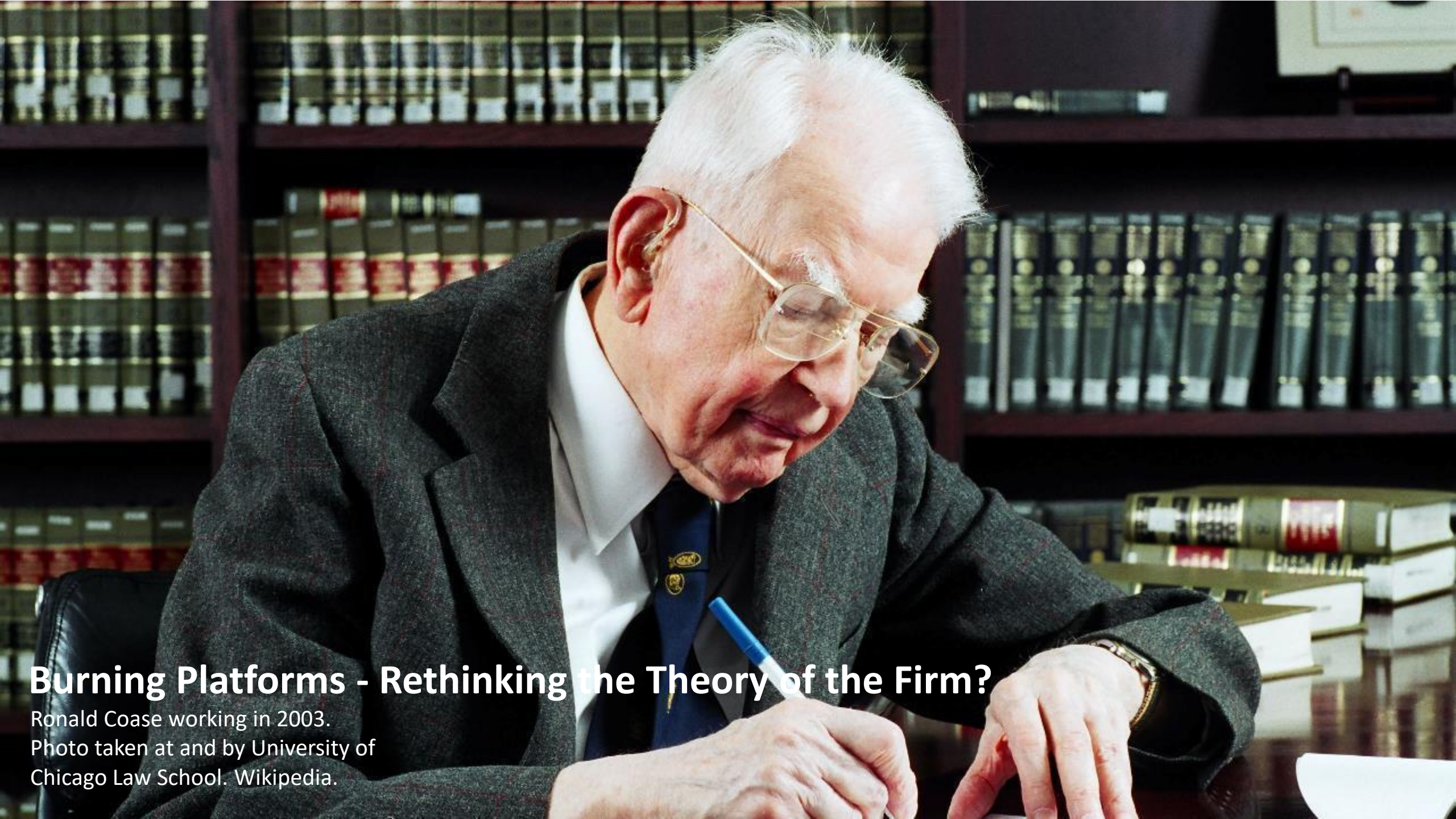
Sources of Cognitive Bias that Robots Don't Have

1. Bandwagon effect
 2. Implicit favourite bias
 3. Recency bias
 4. Asymmetric risk preferences
 5. Confirmation bias
 6. FOMO, fear of missing out
- ... And the list goes on >100



5. Burning Platforms





Burning Platforms - Rethinking the Theory of the Firm?

Ronald Coase working in 2003.
Photo taken at and by University of
Chicago Law School. Wikipedia.

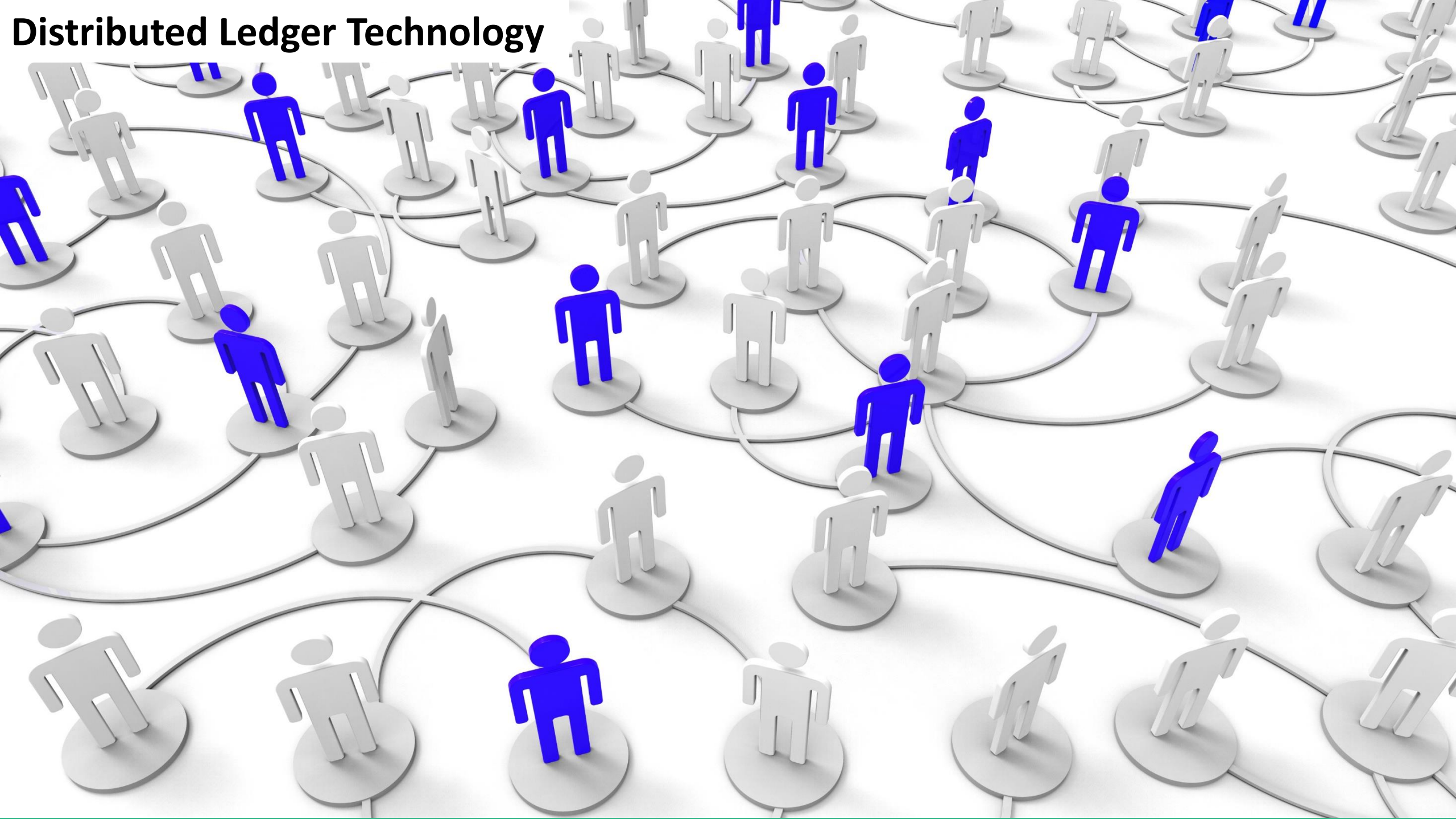


New Business Models

Amazon Spent
AUD\$30.1 Billion on
R&D Last Year
Australia spends
AUD\$34 billion/year

amazon

Distributed Ledger Technology

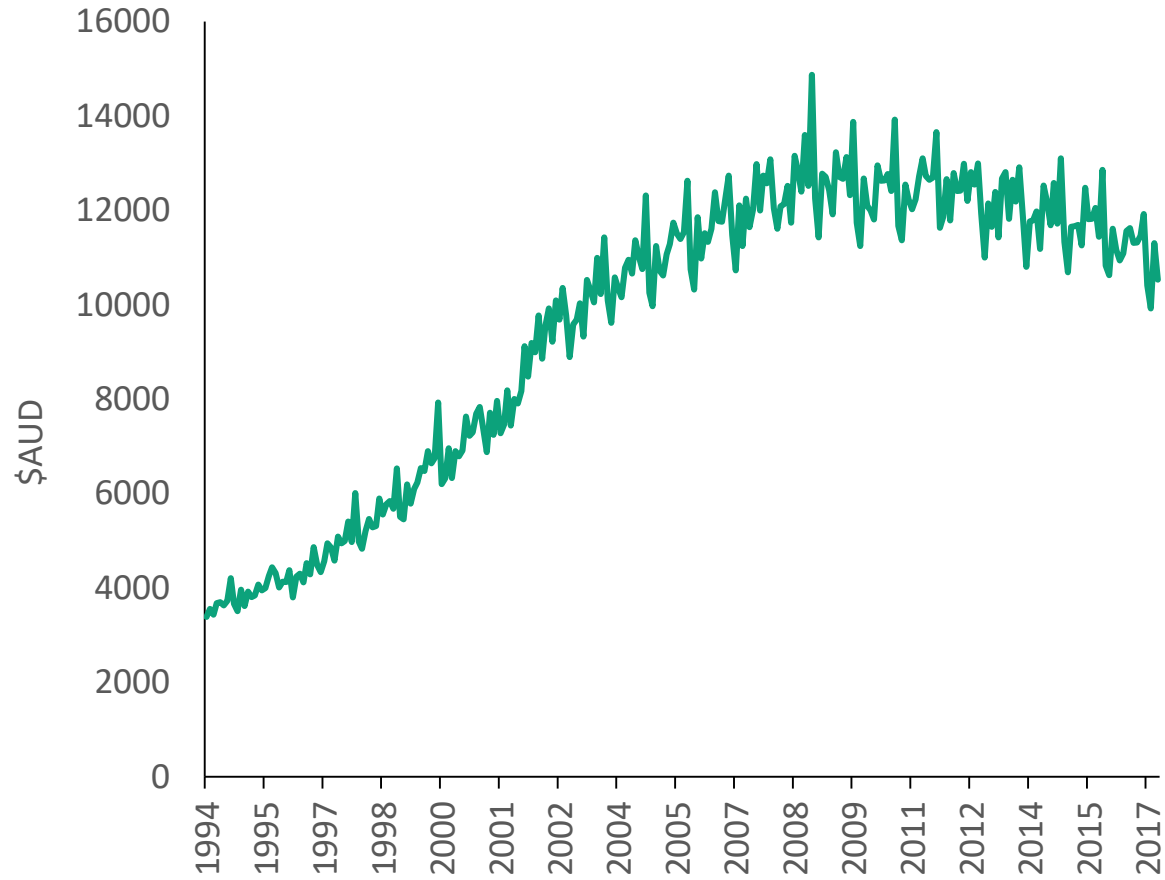


New Models for Finance

DLT and Money – Is there a change happening?

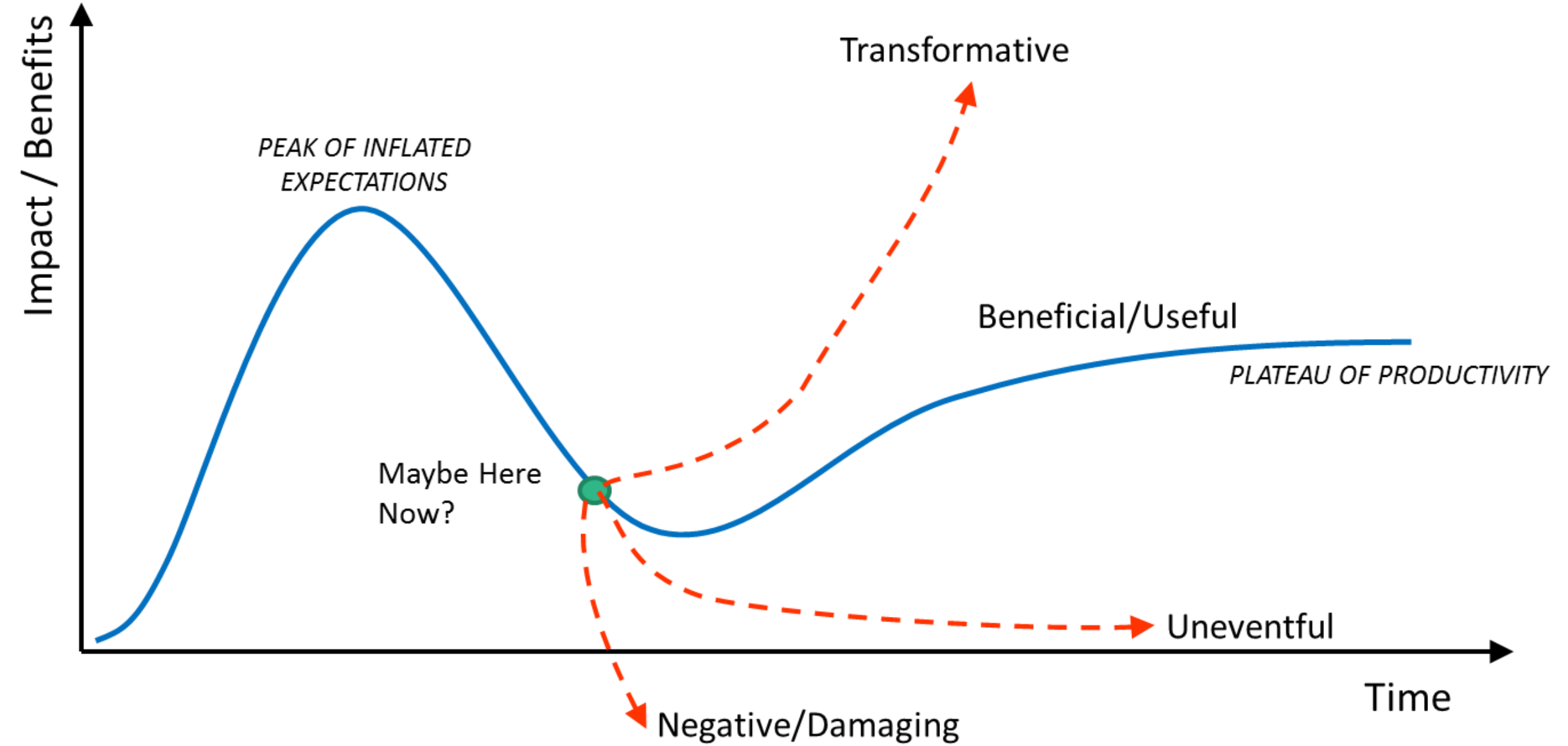


Withdrawals at Australian ATMs



Price of a Bitcoin (Australian Dollars)





Blockchain and Pharmaceutical Product Provenance

The trade in counterfeit pharmaceuticals is worth US\$163 to US\$217 billion/year. This trade harms and kills millions of people per year (PWC Strategy&)



6. Online Burnout

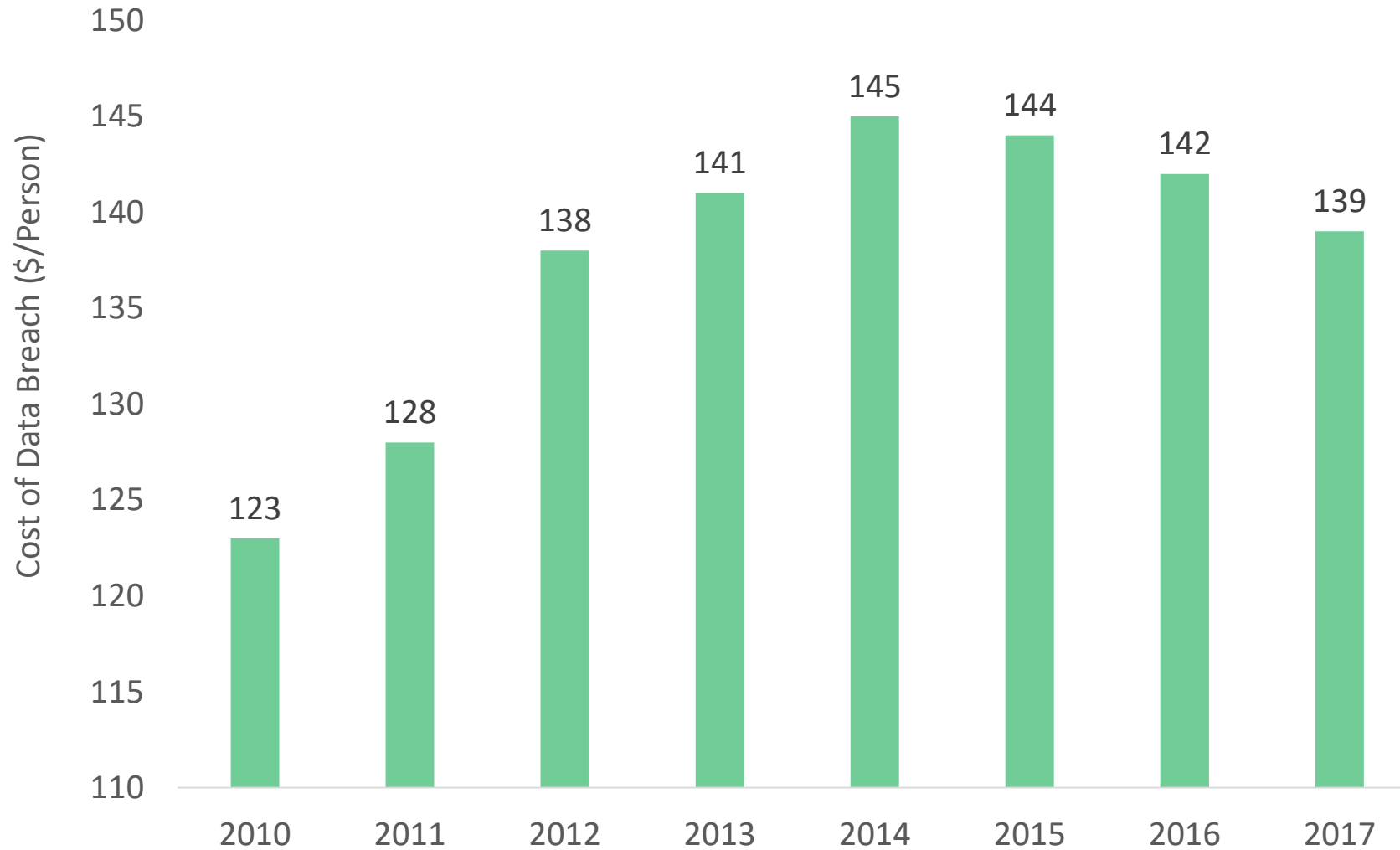




Approximately one in five young people in Australia under 18 (20%) reported experiencing online bullying.

Source: Australian Government, [bullyingnoway.gov.au](https://www.bullyingnoway.gov.au)

Data breaches – Per capita costs, Australia



New Vulnerabilities in Cyber Physical Systems

In a demonstration cyber attack on a popular commercial car researchers were:

"In a target vehicle, at low speeds (5-10 mph) [able to]:

- *Engine shutdown*
- *Disable brakes*
- *Steering*

In a target vehicle, at any speed [able to]:

- *Door locks*
- *Turn signal*
- *Tachometer (motor rotation speed)*
- *Radio, heating ventilation air conditioning, GPS"*



Quote taken from Federal Bureau of Investigation (FBI)
Alert Number I-031716-PSA issued 17 March 2016

TechLash

European Competition Commissioner
Margrethe Vestager on 27 June 2017
in Belgium.

Source: Reuters Business News

EU antitrust regulators fined Alphabet
(Google) 2.42 billion euros for favoring its
own shopping service in searches





Heightened
Privacy Awareness

The New World of Online Manipulation

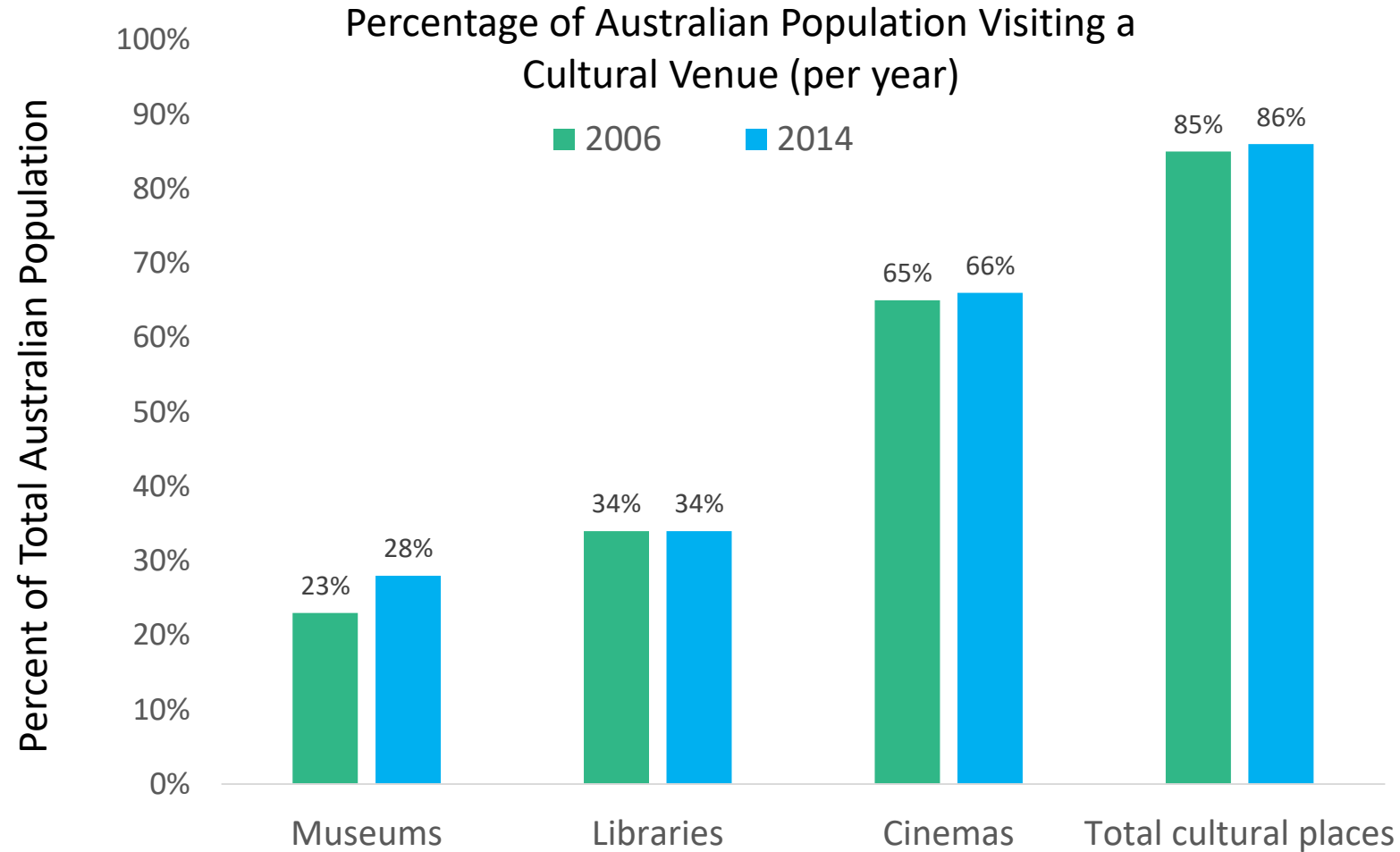
James Comey testifies in front of the Senate Intelligence Committee during hearing in the Hart Senate Office building
June 8 2017 in Washington DC



7. Reality Bites



And people still like the physical world...



Despite ever growing virtual options

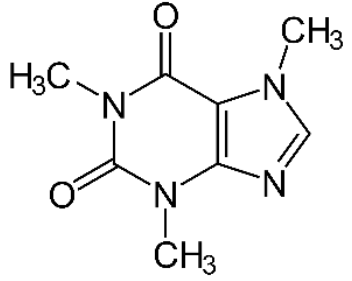
NETFLIX



Australian Bureau of Statistics: 4114.0 - Attendance at Selected Cultural Venues and Events, Australia

The Experience Economy 2.0

Is it really just $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$?



THE GREEK SPOT

GREEKGATEWAY.COM

We don't
have WIFI!
Eat, drink and
talk to
each other.

The Data61 Insight Team

Research excellence combined with
business relevance

Please connect with us
[@stefanhajkowicz](#)



Thank you

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