



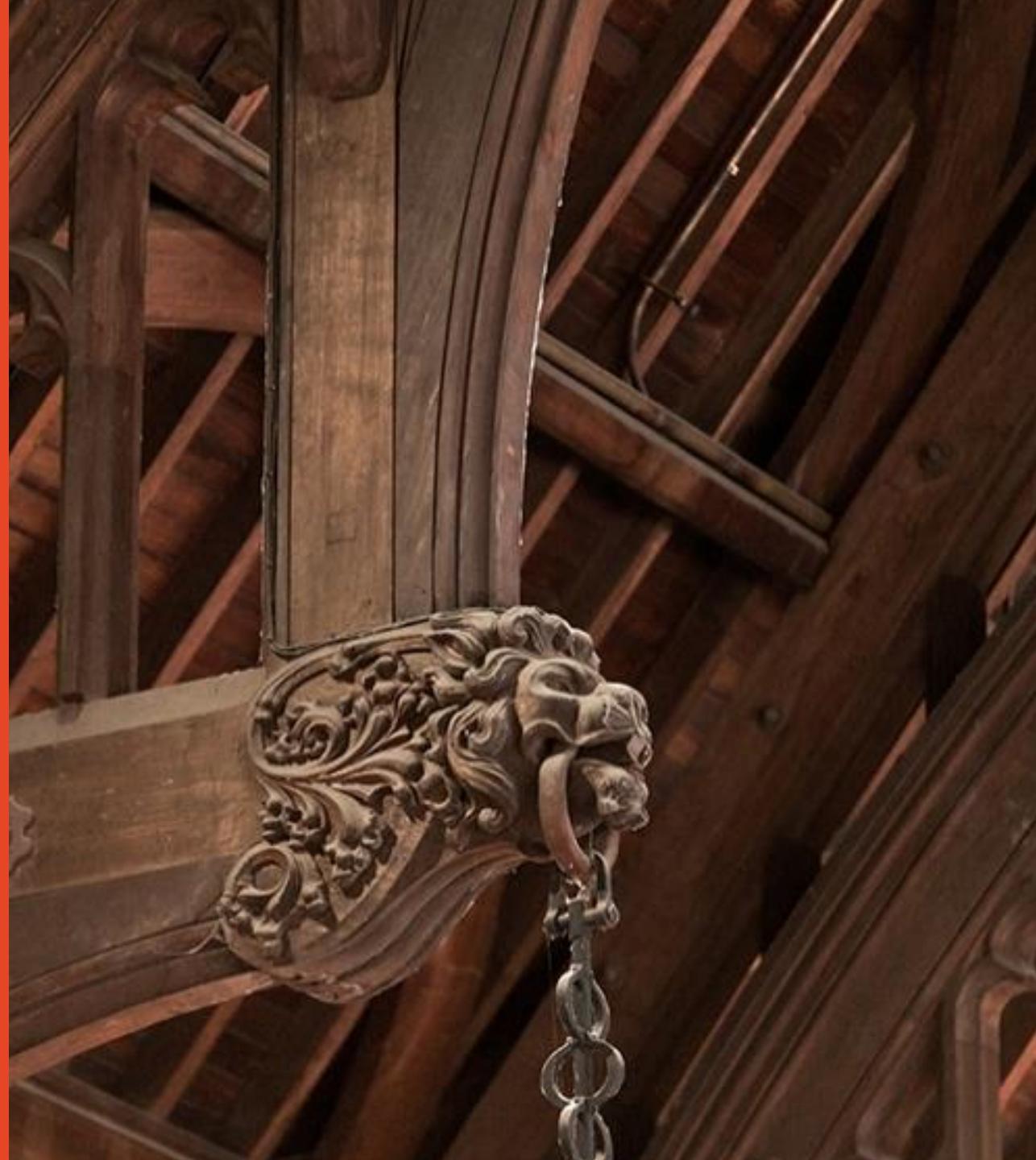
<https://boingboing.net/2018/02/06/car-in-space-elon-musk.html>

# **INFO5992 Understanding IT Innovations**

## **Week 2: Introduction to Technological Innovation**

A/Prof Jinman Kim

Semester 1, 2018



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# Agenda

- Brief Introduction to the Teaching team
- Recap of What is Innovation / Why is IT innovation important?
- Impact of IT innovations in Industry sectors
- What types of Innovation are there?
- Case Study: MOOCS
  - Technological innovation
  - Peer Assessment
- Tutorial on MOOCS

# INFO5992: Teaching Team

- Tutors: depends on your timetable
  - **M20A Kritika Joon – Link 222**
  - M20B Shilpa Shetty
  - M20C Anuj Chopra
  - **M20D Hoijoon Jung – SIT114**
  - **M20E Tian Steven Xia  
(Teaching Assistant) – SIT115**
  - M20F Ivan Chua
  - M20G Euijoon (Osmond) Ahn

Part LEC Lecture					
# Each student enrolled goes to the following class. Class allocations are preserved on Stud. 18/03/18.					
-	<a href="#">M18A</a>	Mon 18:00- [wks: 1 to 13]	in <a href="#">Eastern Avenue Lecture Theatre 315</a>	(Capacity: 205)	Taught by Jinman Kim (Preferred: 200, Limit: 200)
Part PRAC Practical					
# Each student enrolled goes to one of the following 7 classes. Class allocations are preserved Stud. on 18/03/18.					
-	<a href="#">M20A</a>	Mon 20:00 [wks: 1 to 13]	in <a href="#">Link Building 222 (North)</a>	(Capacity: 20) (Preferred: 20, Limit: 20)	
-	<a href="#">M20B</a>	Mon 20:00 [wks: 1 to 13]	in <a href="#">Link Building 222 (South)</a>	(Capacity: 20) (Preferred: 20, Limit: 20)	
-	<a href="#">M20C</a>	Mon 20:00 [wks: 1 to 13]	in <a href="#">Link Building 122</a>	(Capacity: 20) (Preferred: 20, Limit: 20)	
-	<a href="#">M20D</a>	Mon 20:00 [wks: 1 to 13]	in <a href="#">Brennan MacCallum Learning Studio 108</a>	(Capacity: 20) (Preferred: 20, Limit: 20)	
-	<a href="#">M20E</a>	Mon 20:00 [wks: 1 to 13]	in <a href="#">Brennan MacCallum Learning Studio 112-</a>	(Capacity: 40) (Preferred: 20, Limit: 20)	
-	<a href="#">M20F</a>	Mon 20:00 [wks: 1 to 13]	in <a href="#">New Law School Learning Studio 030</a>	(Capacity: 48) (Preferred: 20, Limit: 20)	
-	<a href="#">M20G</a>	Mon 20:00 [wks: 1 to 13]	in <a href="#">School of Information Technologies Laboratory 116</a>	(Capacity: 20) (Preferred: 20, Limit: 20)	

# UoS Outline

Week	Lecture Topics	Activity	Assessments
1. 5 Mar	UoS Introduction; Definition of IT Innovation; IT Innovation System; IT Innovation in Australia	Tute 1 – Welcome to your tutorial; Importance of innovation to a Country	Form Groups
2. 12 Mar	Introduction to Technological / IT innovation; Examples of IT innovation in industry sectors; Type and Source of Innovation	Tute 2 – Massive Open Online Courses – Enabling technologies and Peer-review	
3. 19 Mar	Dynamics of Technological / IT Innovation; Adoption of Technology; Dominant Design	Tute 3 – Dominant design in the Smartphone market	Individual Report Introduction
4. 26 Mar	Disruptive Innovation; Industry Value Chain; Value Network analysis	Tute 4 – Cognitive IT services and its value chain	MCQ
<b>Easter Break</b>			
5. 9 Apr	Distributed innovation I: Open / Closed innovation; Platform innovation; Web APIs;	Tute 5 – Web API considerations	Group presentation Introduction
6. 16 Apr	Distributed innovation II: Crowd innovations; Free and Open source software;	Tute 6 – Open source Geolocation and Maps	
7. 23 Apr	Distributed innovation III: User innovation; Open Data	Tute 7 – Sharing Economy from a Distributed Innovation Context	
8. 30 Apr	Innovation by Start-up companies and Opportunities	Tute 8 – Business Model Canvas	
9. 7 May	Organisational Culture; Structure supporting innovation	Tute 9 – Group Presentation preparations and feedback	MCQ Report Submission
10. 14 May	IT Innovation Management	Group Presentation	Group Presentation submissions
11. 21 May	Innovation ecosystem; Sydney's innovation ecosystem	Peer-Review Marking	
12. 28 May	Judging IT Innovations	Tute 10 – Developing a Judging criteria for IT Innovation project	
4. 30 Jun	UoS Review; UoS comments / questions	Tute 11 – Technology innovations in IT Management	Peer-review

# **The importance of IT innovation**

# Week 01 Recap – Definition of innovation

“Innovation is not simply invention; it is invention put to use. Invention without innovation is a pastime.”



(Photo by Dan Dry)

Sir Harold Evans, journalist and writer on the history of innovation

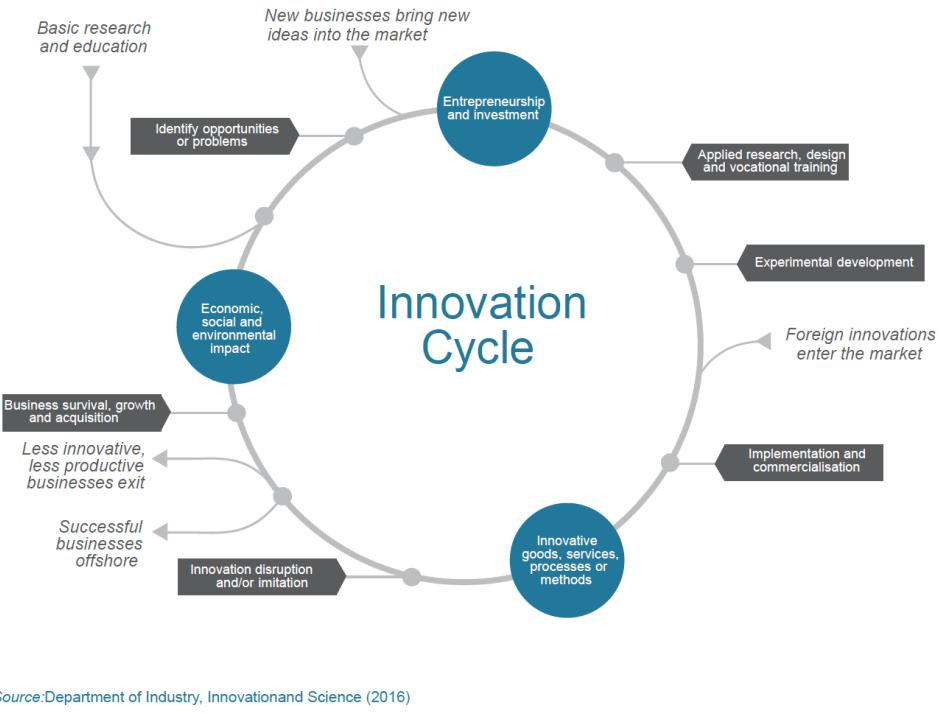
# Week 01 Recap – Definition of innovation

- *Innovation is the implementation of a new or significantly improved product (good or service), process, new marketing method or a new organisational method in business practices, workplace organisation or external relations.*
- Organisation for EconomicCo-operation and Development OECD (2005) Oslo Manual: *Guidelines for collecting and interpreting innovation data*, 3rd edition, OECD and European Commission



# Week 01 Recap – The Australian Innovation System Report

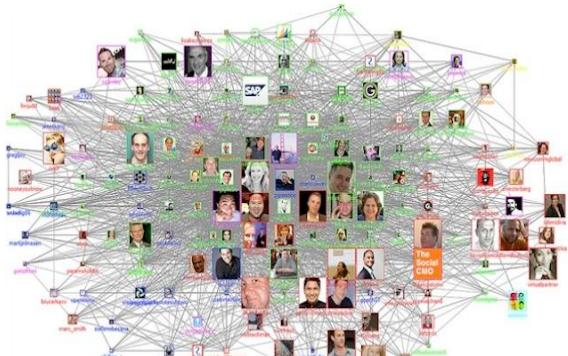
- The innovation system plays a crucial role in the long-term economic growth of a country.
- The *2016 Australian Innovation System Report* presents new indicators that measure and analyse the impact of innovation, focusing on networks and framework conditions which form the essence of the innovation system.
- This year's report provides both a historical record of the measures and comparisons across the OECD countries.



<http://www.industry.gov.au/Office-of-the-Chief-Economist/Pages/National-Innovation-Map.html>

<http://www.innovation.gov.au/Innovation/Policy/AustralianInnovationSystemReport/>

# Some newish IT innovations



Graph databases

Image: [beedesign.org](http://beedesign.org)



Mixed Reality (eg Hololens)



[https://www.robots.ox.ac.uk/~mobile/Papers/2015ISMAR\\_ondruska.pdf](https://www.robots.ox.ac.uk/~mobile/Papers/2015ISMAR_ondruska.pdf)



Tesla 3

[https://www.tesla.com/en\\_AU/model3](https://www.tesla.com/en_AU/model3)



<https://techcrunch.com/2017/05/27/googles-alphago-ai-is-retiring/> Page 11

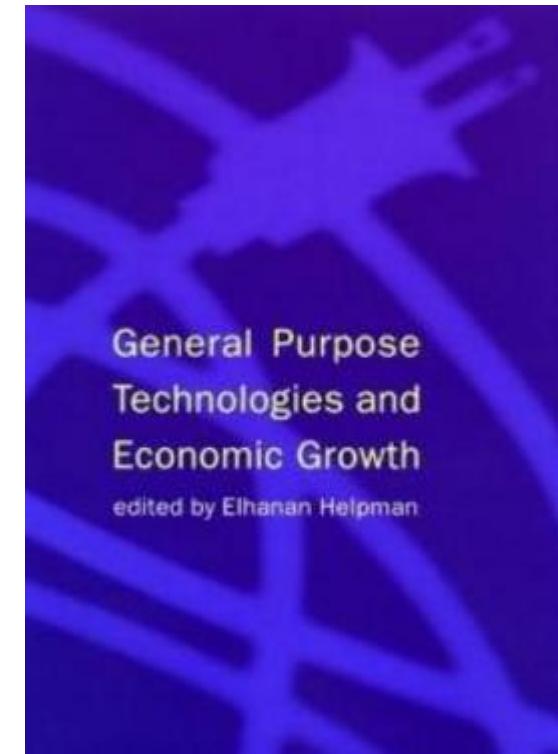
# IT as an enabling technology

- IT is a “General Purpose Technology” (GPT)
- Like electricity – it enables other technologies
- GPTs differ from other technologies and:
  - Are pervasive – spreading to most sectors
  - Continually improve in usefulness and lower in cost
  - Spawn innovation in other areas – making it easier to invent and produce new products or processes

Source: ITU, *Measuring ICT for Social and Economic Development*, 2006.  
(based on Bresnahan and Trajtenberg, “General purpose technologies”, 1995)

# General Purpose Technology

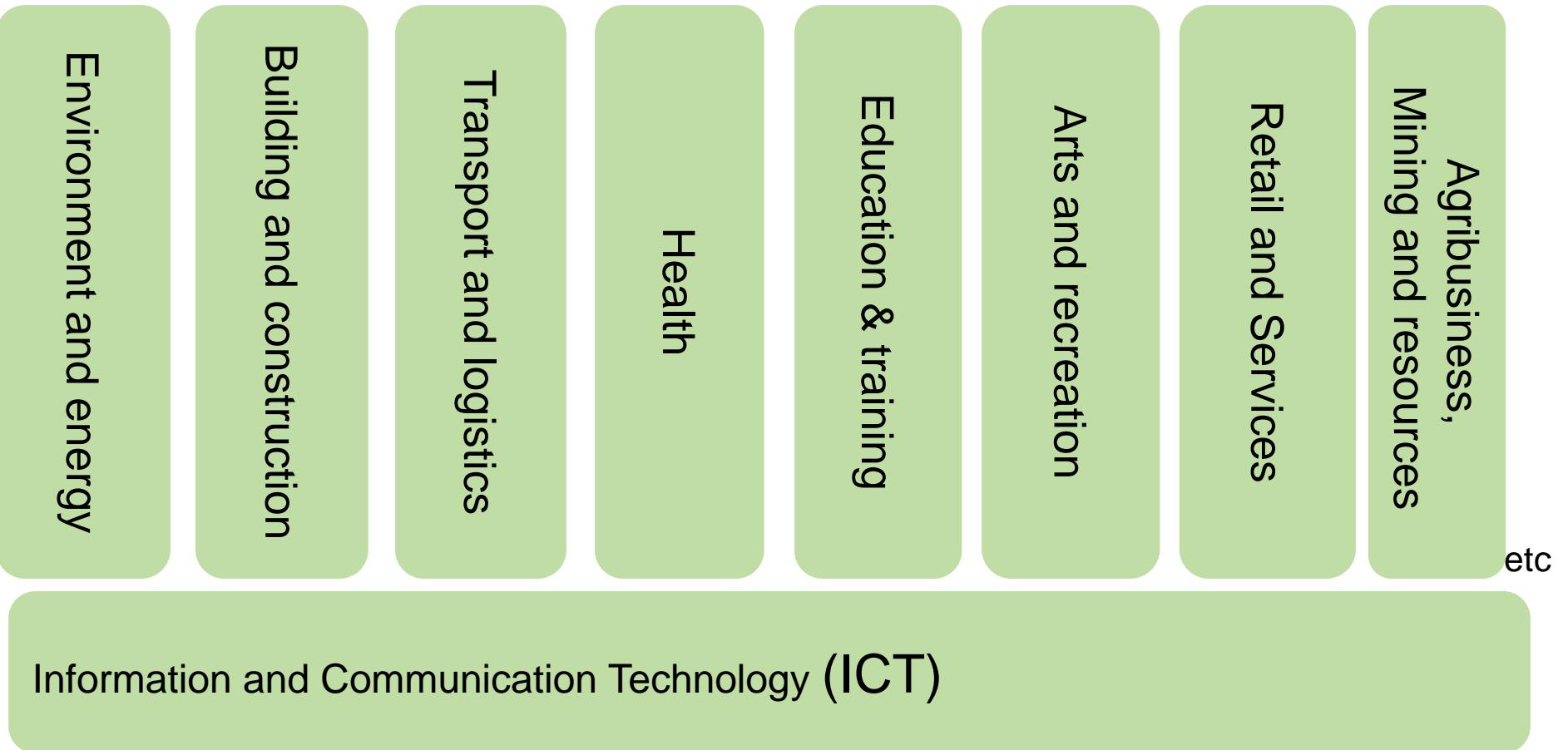
- GPT is a term coined to describe a new method of producing and inventing that is important enough to have a protracted aggregate impact. Electricity and information technology (IT) probably are the two most important GPTs so far.
- A GPT has the potential to affect the entire economic system and can lead to far-reaching changes in such social factors as working hours and constraints on family life. Examples of GPTs are the steam engine, electricity, and the computer.



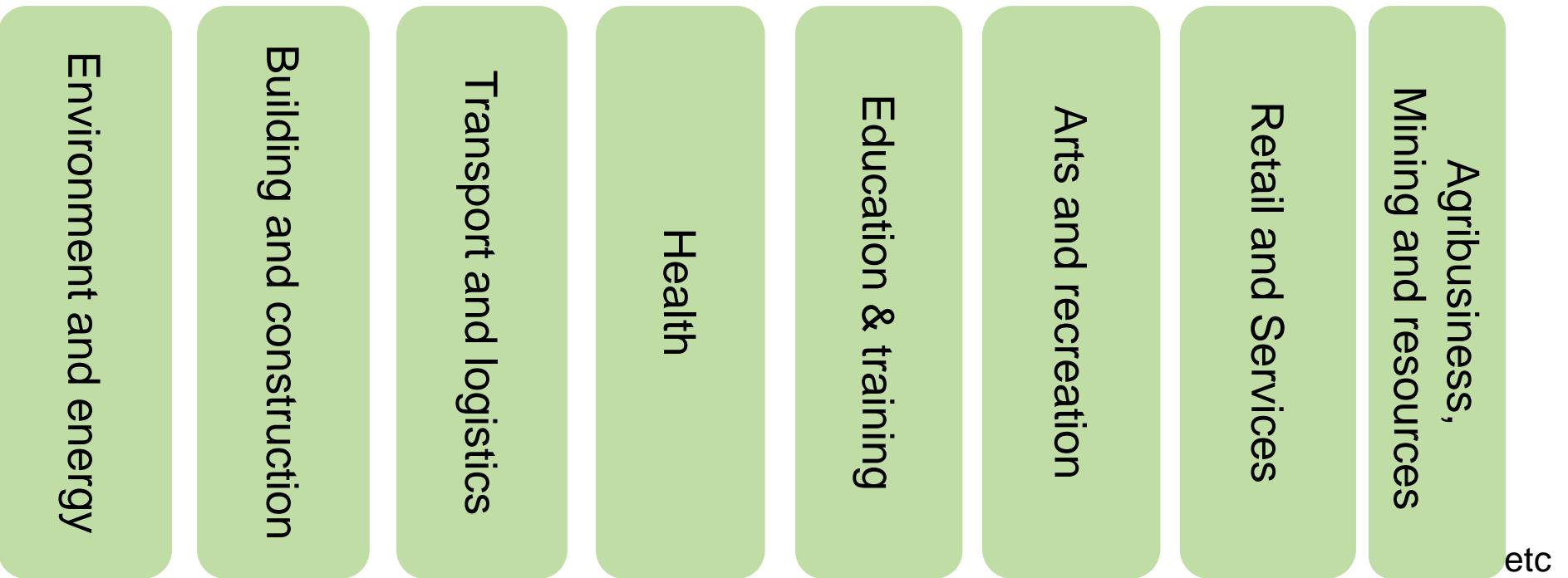
B. Jovanovic, General purpose technologies, New York University and Nber, Peter I. Rousseau, Vanderbilt University and NBER <http://www.nber.org/papers/w11093.pdf>

General Purpose Technologies and Economic Growth, edited by Elhanan Helpman Cambridge, Mass. : MIT Press, c1998.

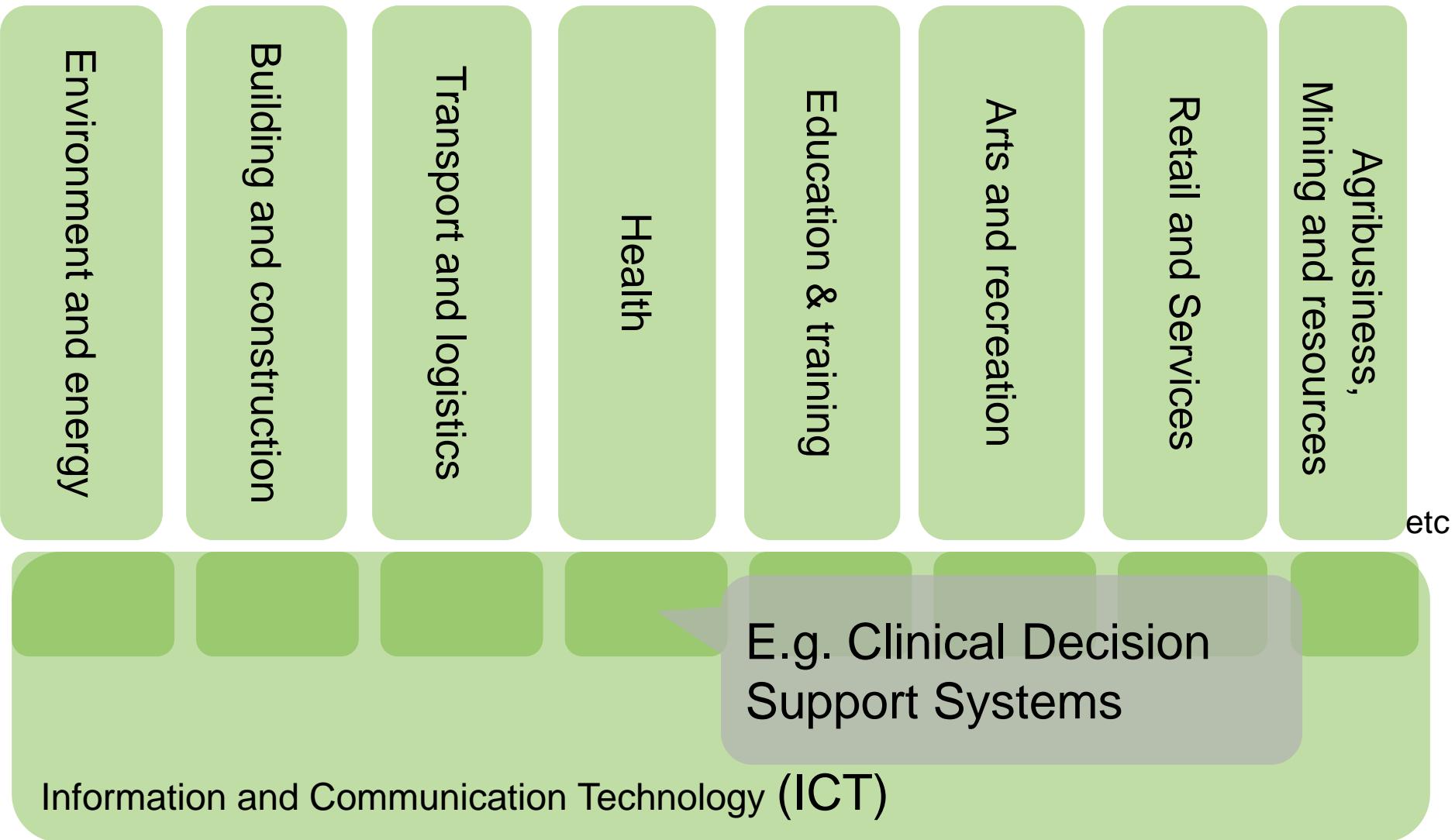
# ICT and vertical industries



# Some hot areas of current ICT Innovation

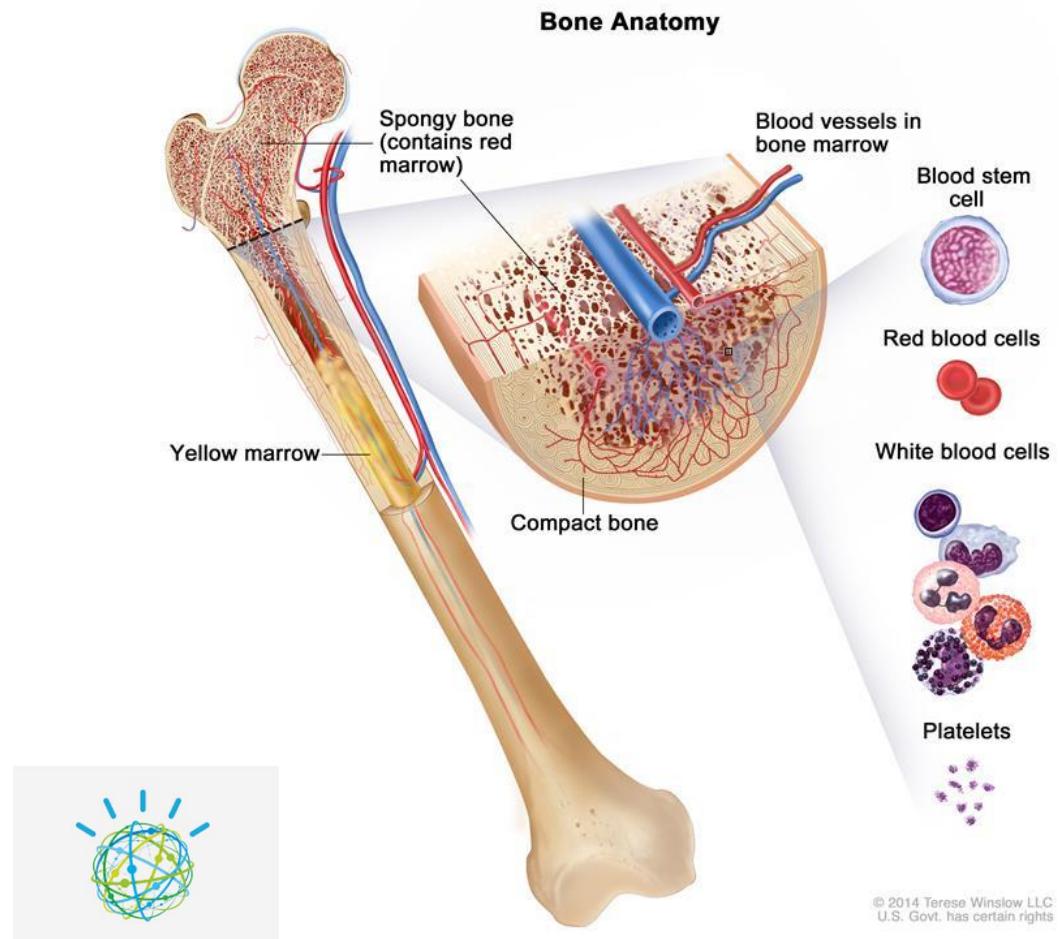


# Industry-specific ICT innovation



# Example – Leukemia (Japan)

- Diagnosis: acute myeloid leukemia
- Standard treatment not effective
- Gene testing: 1000 mutations
  - Hereditary?
  - Related to disease?
- Watson compared mutations to literature and other data
- Actual diagnosis: myelodysplastic syndrome
- 10 minutes vs. several weeks



<http://www.japantimes.co.jp/news/2016/08/11/national/science-health/ibm-big-data-used-for-rapid-diagnosis-of-rare-leukemia-case-in-japan/>

<https://www.cancer.gov/types/myeloproliferative/patient/myelodysplastic-treatment-pdq>

# Example – IBM WatsonPaths

IBM WATSON Case #710564

Logout

← Scenario Solution

### Case #710564

A 73-year-old retired nurse had finally convinced her husband, a 75-year-old retired English teacher, to see a physician for his condition. Over the past several years, the man had experienced a gradual decline in his ability to initiate and perform simple voluntary movements. He now moved much more slowly, his face was often expressionless, and most distressing of all to him, he had continual tremors, which were particularly obvious when he was drinking his afternoon tea. Upon examination, his physician further noted bradykinesia (slow movements), increased muscle rigidity (but normal muscle strength and reflexes), a decreased blinking frequency, and a slow, shuffling gait. He immediately referred the man to a neurologist.

Which of the following disorders is the **MOST** likely diagnosis?

Watson believes that the following patient details are significant

- bradykinesia
- face was often expressionless

▶ Scenario excerpts also used in Watson's solution

View Solution Graph

IBM WATSON Case #710564

Logout

← Scenario Solution

“ A 73-year-old retired nurse...  
“ He now moved much more...  
“ Upon examination, his phys...  
“ Over the past several years,...  
“ He immediately referred th...  
+ Add patient details

face was often expressionless  
hypokinesia  
athetosis  
hemiballism  
Parkinson's disease  
Huntingdon's disease  
Alzheimer's disease

<https://www.research.ibm.com/cognitive-computing/watson/watsonpaths.shtml>

# Example – Philip's electronic Intensive Care Unit (eICU)

- The eICU program is a transformational critical care telehealth program that combines A/V technology, predictive analytics, data visualization and advanced reporting capabilities



<http://www.philips.com.au/healthcare/product/HCNOCTN503/eicu-program-telehealth-for-the-intensive-care-unit>

# Critical care Datathon2018

ABOUT REGISTER

## ANZICS CORE CRITICAL CARE DATATHON

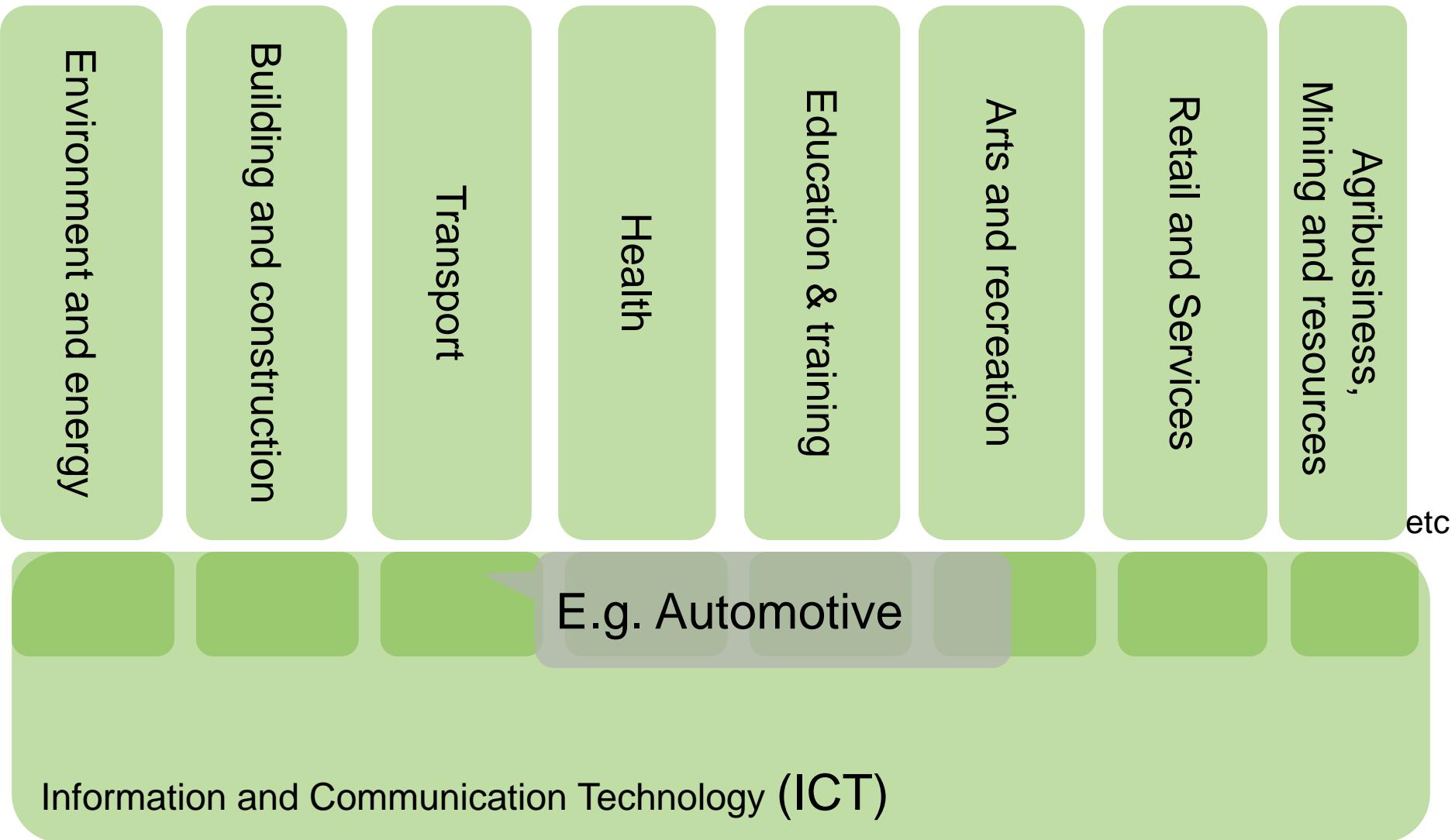
28th & 29th April 2018

Faculty of Engineering and IT, Peter Nicol Russell Learning Studio 310,

The University of Sydney

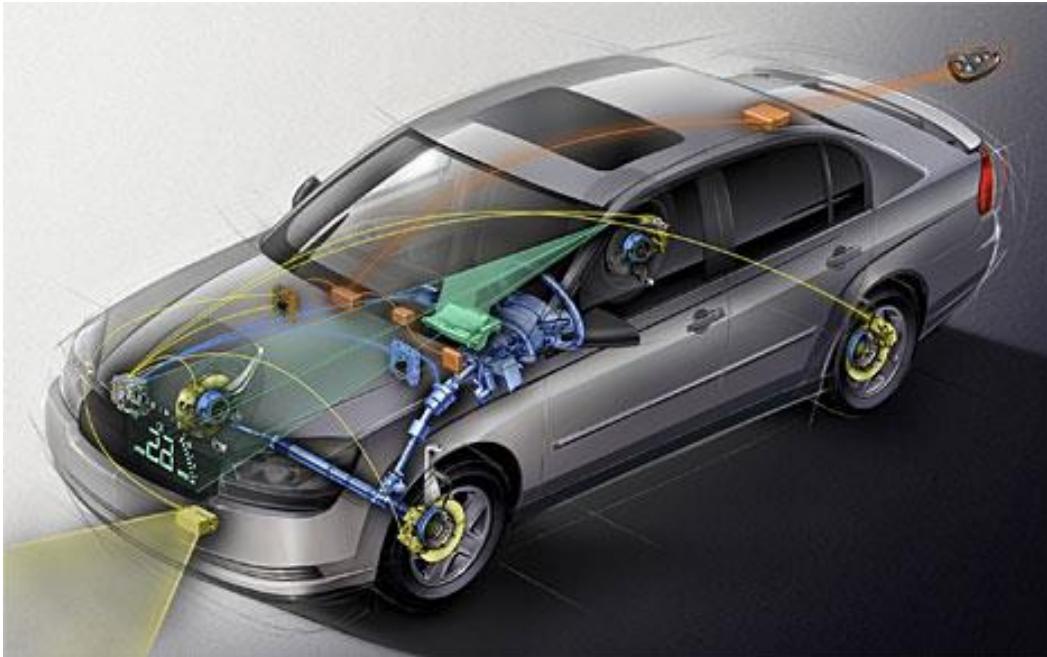
<http://datathon.anzics.com.au/>

# Industry-specific ICT innovation



## Example – Software in cars

- Today, high-end cars have:
  - Up to 100 microprocessors
  - Up to 100 million lines of software source code
  - Software development is up to 15% of the total cost



Source: IEEE Spectrum <http://spectrum.ieee.org/green-tech/advanced-cars/this-car-runs-on-code>  
Image source: General Motors

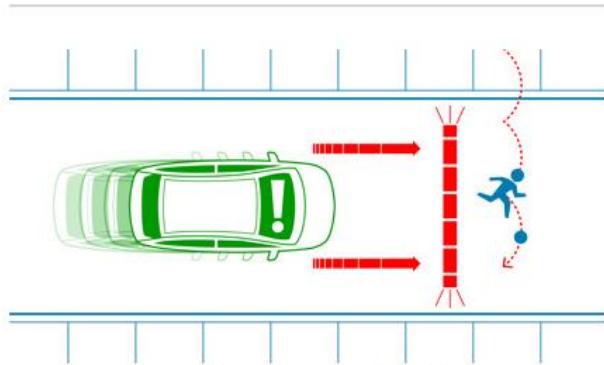
## Example – Software in cars

- What does software do in a car?

Air-bag system	Antilock brakes	Automatic transmission
Alarm system	Climate control	Collision-avoidance system
Cruise control	Communication system	Dashboard instrumentation
Electronic stability control	Engine ignition	Engine control
Electronic-seat control	Entertainment system	Navigation system
Power steering	Tire-pressure monitoring	Windshield-wiper control

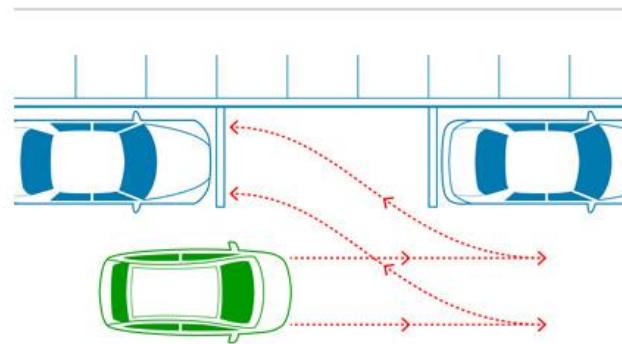
- For cars, software development is not just simple implementation
- E.g. for the hybrid transmission system in GM's Yukon, 70% of the time was spent on software development
- For modern cars, 80% of innovations come from software/computer systems
- For self-driving cars, this will be even higher due to greater number of sensors, greater need for data analytics, more AI, etc

Source: IEEE Spectrum <http://spectrum.ieee.org/green-tech/advanced-cars/this-car-runs-on-code>, 2009



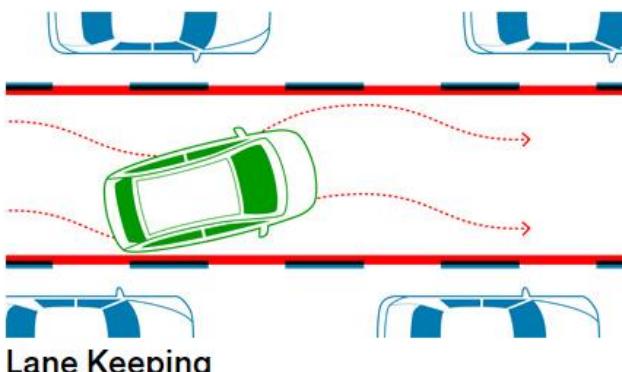
### Autonomous Emergency Braking

Humans are still a factor in the adaptation of automatic braking.



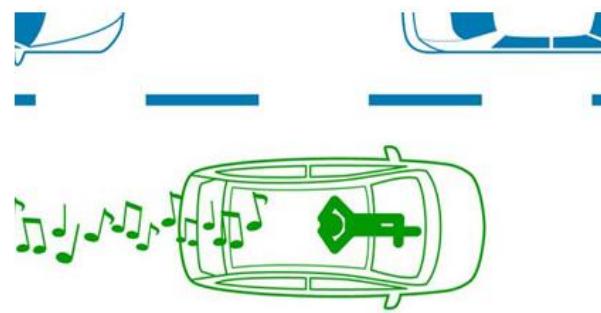
### Self-Parking

Carmakers keep trying to simplify the experience.



### Lane Keeping

Systems for keeping inside the lines are growing up, but they're still not perfect.



### Adaptive Cruise Control and Traffic-Jam Assistants

Lock on to cars with radar, but switch to other sensors in traffic.

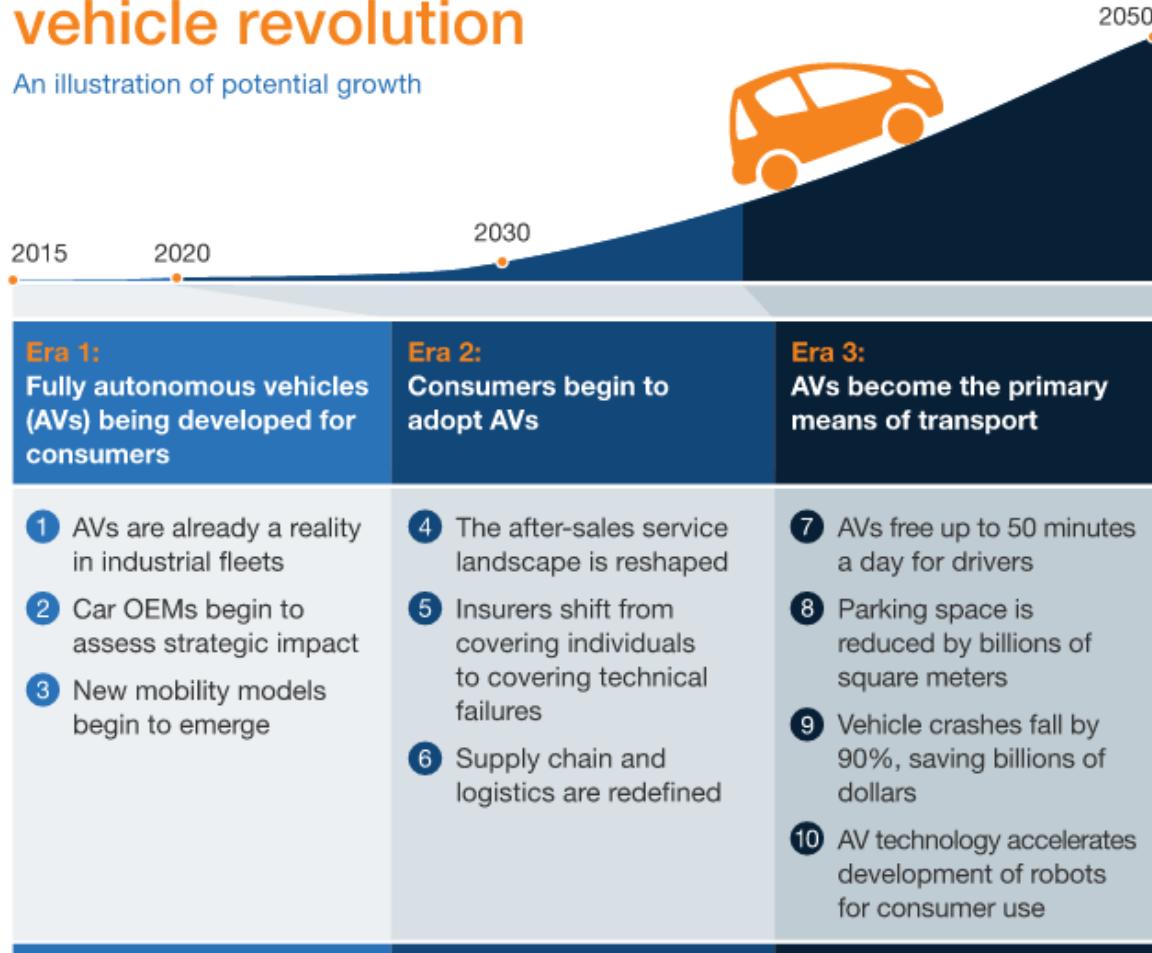


- or instance, the "love/hate" graphics above made a computer vision algorithm believe a stop sign was really a speed limit notice.

# Example – Autonomous Vehicles

## The self-driving vehicle revolution

An illustration of potential growth

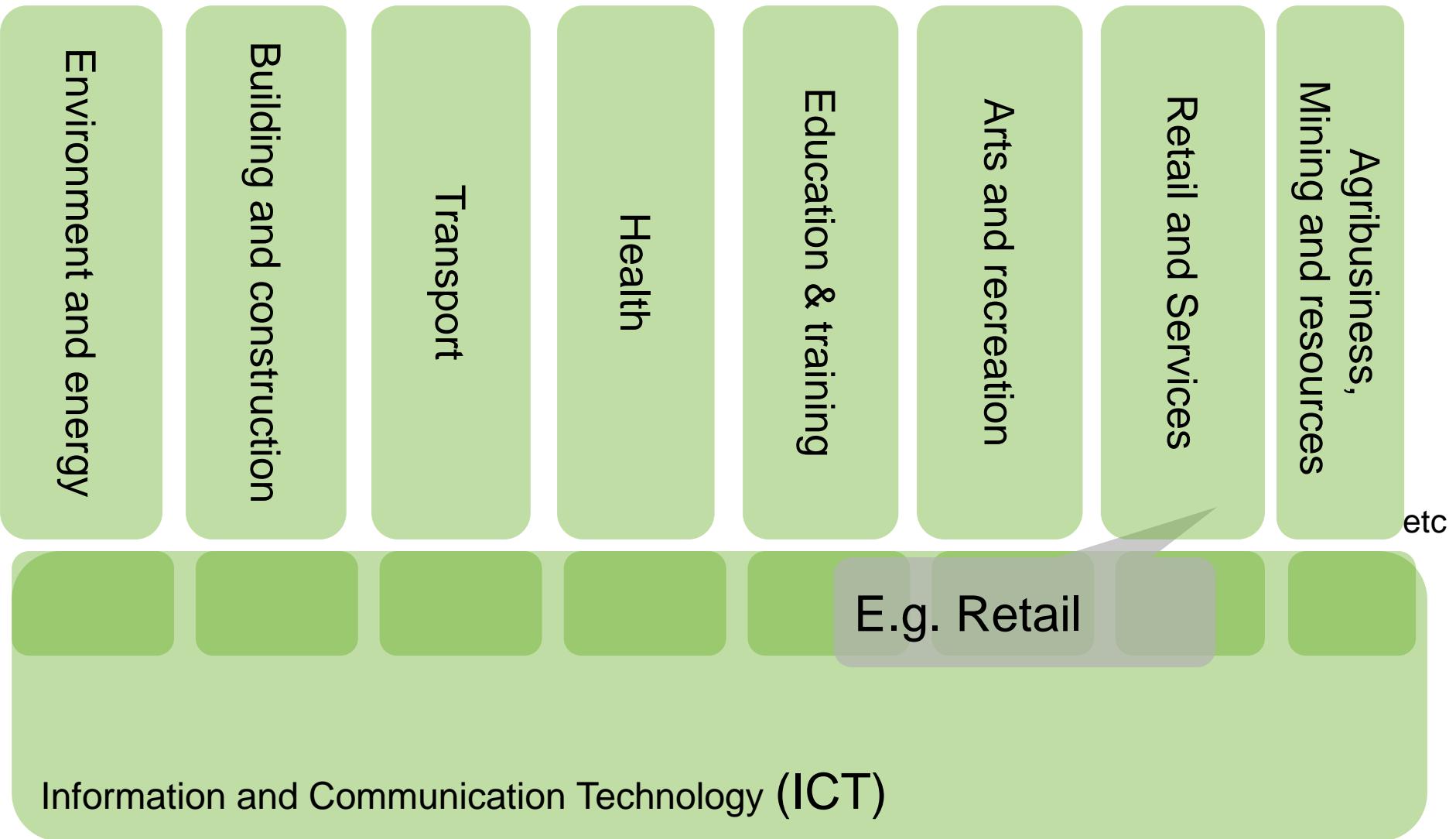


McKinsey&Company

[http://www.mckinsey.com/industries/au  
tomotive-and-assembly/our-  
insights/ten-ways-autonomous-driving-  
could-redefine-the-automotive-world](http://www.mckinsey.com/industries/automotive-and-assembly/our-insights/ten-ways-autonomous-driving-could-redefine-the-automotive-world)

2015

# Industry-specific ICT innovation



# Amazon Go



<https://www.businessinsider.com.au/amazon-go-grocery-walk-out-technology-store-phone-app-no-lines-cashiers-2016-12?r=US&IR=T>

# Industry-specific ICT innovation

Environment and energy

Building and construction

Transport

Health

Education & training

Arts and recreation

Mining and resources

Agribusiness

E.g. Education & Training  
MOOC – Case Study Tutorial

Information and Communication Technology (ICT)

# Massive Open Online Courses

***"We're nearing the point where it's a superior educational experience, as far as the lectures are concerned, to engage with them online"***



David Malan, Harvard computer scientist

- If that's true, traditional universities will have to show that most of the other things they offer on campus can't be replaced by technology.

<https://www.technologyreview.com/s/533406/what-are-moocs-good-for/>

# Popular offerings

- Coursera – 30 million
- edX – 14 million
- XuetangX – 9.3 million
- FutureLearn – 7.1 million
- Udacity – 5 million

CLASS CENTRAL

 78M  
Students

 800+  
Universities

 9.4k  
Courses

By the Numbers: MOOCs in 2017

<https://www.class-central.com/report/mooc-stats-2017/>

<https://www.edx.org/>

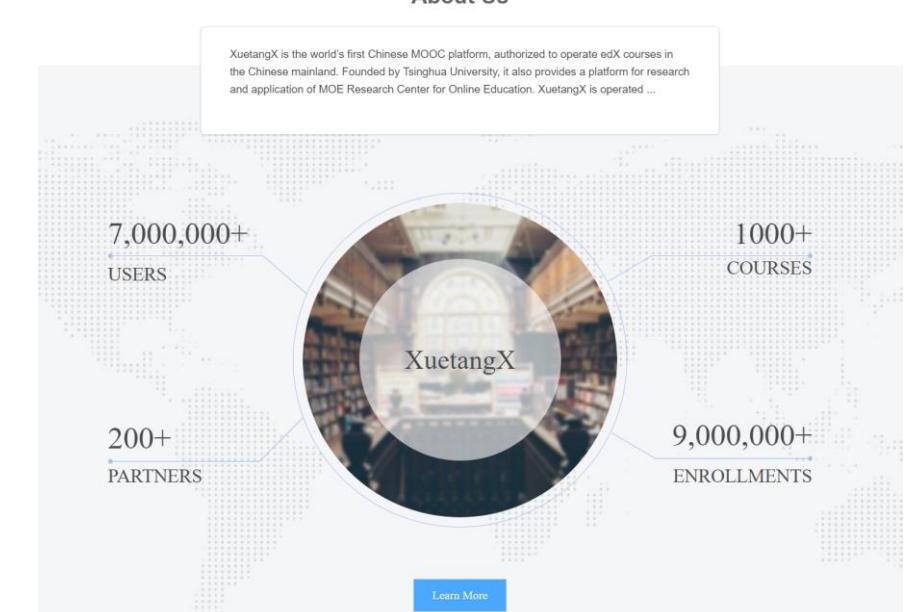


The edX homepage features a woman smiling while using a laptop on a couch. The text "Best Courses. Top Institutions. Learn anytime, anywhere." is displayed. Below the image are logos for MIT, Harvard University, Berkeley, and The University of Texas System. A "Find Courses" button is visible.

The World's Best Courses.  
Online, for Free.

Sign Up Now

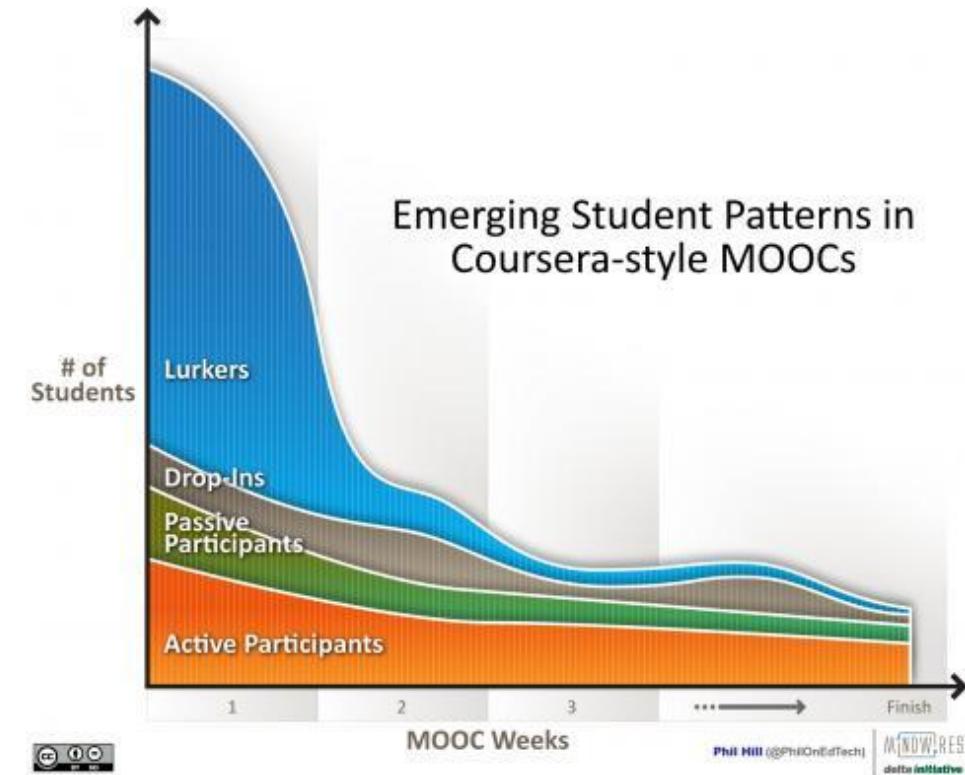
<https://www.coursera.org/>



<http://www.xuetangx.com/>

# Online Teaching Revolution

- **Lurkers** — These students are the majority of xMOOC participants, where people enroll but just observe or sample a few items at the most.
- **Drop-Ins** — These are students who become partially or fully active participants for a select topic within the course, but do not attempt to complete the entire course. Some of these students are focused participants who use MOOCs informally to find content that help them meet course goals elsewhere.
- **Passive Participants** — These are students who view a course as content to consume and expect to be taught. These students typically watch videos, perhaps take quizzes, but tend to not participate in activities or class discussions.
- **Active Participants** — These are the students who fully intend to participate in the MOOC, including consuming content, taking quizzes and exams, taking part in activities such as writing assignments and peer grading, and actively participate in discussions via various forms of social media.



<http://edf.stanford.edu/readings/emerging-student-patterns-moocs-graphical-view>

## MicroMasters - a three-way arrangement between educator, student and employer

- “MicroMasters” certificate programs on edX, to which 1.7 million students have registered in a year.
- MicroMasters certificates (MMs) are online, examined and graded, credit-eligible graduate-level courses that involve about a quarter of the coursework of a traditional Masters degree. At edX they cost about \$1,000.
- But, as important as expanding educational access is, what’s at stake here is even more radical and future-disruptive. Because, it’s apparent most students won’t pursue the full degree. They’ll walk with the MM.
- Each MicroMasters is sponsored by at least one industry partner, currently a list of 40 which includes GE, MicroSoft, IBM, Hootsuite, Fidelity, Bloomberg, Boeing, WalMart, PWC, Booz-Allen Hamilton, and Ford.

<https://www.forbes.com/sites/adamgordon/2018/02/13/voice-of-employers-rings-out-as-moocs-go-from-education-to-qualification/#e7fdd1f564b6>

# MOOCs and USYD

The screenshot shows the Coursera platform displaying a specialization page. At the top, the Coursera logo is visible along with navigation links for Institutions, Catalog, Search catalog, Share (with social media icons), For Enterprise, Log In, and Sign Up. The main banner features a woman with glasses and orange hair, with the text "Build Learning Skills to Excel at University" and a subtitle "Learn to solve problems, think critically, and communicate effectively in your university courses." Below the banner, a sidebar on the left provides links for "About this Specialization", "Courses", "Creators", and "FAQ". A large blue button labeled "Enroll Starts Mar 13" is prominently displayed. The main content area describes the specialization as a high-level academic skills course designed to increase preparedness for university studies. It highlights the creation by THE UNIVERSITY OF SYDNEY and offers financial aid for eligible learners. The page also details the structure with 5 courses, projects, and certificates, and specifies it as a Beginner Specialization requiring no prior experience.

<https://www.coursera.org/courses?languages=en&query=university+of+sydney>

# **Using Technology to create contents**

- Videos
- Graphics
  - Decorative Graphics
  - Relational Graphics
  - Transformational Graphics
  - Interpretive Graphics
- Simulations and Games
- Social platforms, including Blogs, Forums, Chatting, Video Conferencing, etc
- Software such as Python, Web, etc.

# Features in MOOC Platforms

**Table 1. Key features for artificial intelligence in education (AIED), across a sample of major massive open online course (MOOC) platforms.**

Features	edX	Coursera	Google Course Builder	Class2Go	udemy	Lernanta
<b>Video lectures</b>						
Where are they stored?	YouTube	Coursera	YouTube	YouTube and Amazon S3	udemy or YouTube	N/A
Quizzes integrated with video?	No	Yes	No	Yes	No	N/A
Discussion on video page?	Yes	No	No	No	Yes	N/A
Additional files and features	Subtitles	Subtitles files	Subtitles files	Subtitles	Subtitles video and slide mashup	N/A
<b>Quizzes</b>						
Are there quizzes outside of videos?	Yes	Yes	Yes	Yes	No	N/A
Question types						
Multiple choice	✓	✓	✓	✓		
Short answer	✓	✓	✓			✓
Numeric				✓		
No. of attempts allowed	Limited	Limited	Unlimited	Limited	N/A	N/A
<b>Discussion forums</b>						
Can posts be rated?	Positive	Positive/negative	N/A	None	None	None
<b>Grading and analytics</b>						
Student's view of progress	Raw marks with graph	Raw marks	None	Raw Marks	Progress percentage	Progress percentage
Teacher's view of progress	Unknown	Unknown	CSV* export Google analytics (CSV)	Multiple types of detailed CSV reports	N/A	Can see and edit progress

\*CSV = comma-separated value.

# Assessment Tools for MOOCs

- Peer Assessment
  - students are organized anonymously into small groups to grade each other's submissions. The groups are double-blind and random
- Automated Essay Grading
  - Machine learning at edX
  - Given a rubric and 15 graded assignments, the system learns when the marks are given and when not
- Proctoring MOOC Exams
  - testing centers for on-site proctoring
  - require that students hold up a picture ID on camera prior to beginning the exam; someone then remotely watches the student
  - checking the speed and style of typing against previous samples from the same student

[Short article] Linda L. Briggs, “Assessment Tools for MOOCs, Campus Technology”, 2013  
<https://campustechnology.com/Articles/2013/09/05/Assessment-Tools-for-MOOCs.aspx>

# Personalised Learning Plan

- How Mark Zuckerberg's philanthropy led to the company's newest product
- PLP – each student learns at her own pace.

The screenshot shows a web-based Personalized Learning Plan interface. At the top, there are tabs for 'GOALS' and 'REFLECTIONS'. Below this, the 'SUBJECTS' dropdown is set to 'THIS YEAR'. The interface is divided into four main sections corresponding to different subjects:

- English 9:** Shows Cognitive Skills (4.5), Power Focus Areas (3/7), and Additional Focus Areas (2/5). Tasks include 'Personal Narrative' (Completed), 'Film Review' (Sent Back), 'Argumentative Presentation' (Completed), 'Socratic Seminar' (In Progress), 'Literary Analysis Essay' (Incomplete), and 'Persuasive Speech' (Incomplete).
- Physics:** Shows Cognitive Skills (5.0), Power Focus Areas (2/7), and Additional Focus Areas (5/5). Tasks include 'Energy Models' (Submitted), 'Wave / Sound Project' (Completed), 'Electric House' (In Progress), and 'Design Your Own Physics Experiment' (Incomplete).
- Math 9:** Shows Cognitive Skills (2.5), Power Focus Areas (4/7), and Additional Focus Areas (2/5). Tasks include 'Graphing Stories' (Completed), 'Infographic' (Submitted), 'Booming Populations' (In Progress), 'Solid!' (Incomplete), and 'Prove Yourself' (Incomplete).
- Modern World 1:** Shows Cognitive Skills (2.0). Tasks include 'Art as Expression' (Completed), 'Dystopian Narrative' (Completed), 'Cold War DBQ' (In Progress), and 'Crash Course' (Incomplete).

<https://www.theverge.com/2015/9/3/9252845/facebook-education-software-plp-summit>

<https://www.recode.net/2017/7/10/15771676/priscilla-chan-facebook-philanthropy-mark-zuckerberg-initiative-cure-diseases>

<https://www.slideshare.net/muditgoel01/personalized-learning-plan-by-summit-public-schools-and-facebook>

## Tutorial 2

### Importance of IT innovations in the Education sector

# Tutorial

- Identify the key enabling IT solutions, common across all the articles, (software, hardware, etc) that are used in the education and the training sector.
- Discuss the evolution of the education industry due to the introduction of MOOCS. You may apply ‘Innovation System’ concept, where you consider all the stakeholders involved in an innovation, into your discussion.
- Following from b., Micromasters is a new program three-way arrangement between educator, student and employer. What is the innovation in this new program, and how does it differentiate itself? Why is such a model only available via MOOCS?
- Peer-assessment for MOOCS is an area which needs further development – what are its challenges and emerging / existing solutions?
- [Optional/Homework] Now look at the PLP. Similarly, identify the key enabling IT innovations for PLP, and how the technologies are used to enable a different style of learning.

## Creative Destruction



<https://www.slideshare.net/SocialBizForum/mueller-01-07>

# Fortune 500 Companies

- list of the largest U.S. companies by revenue (income).
- 41 companies in 2017 ranking are computer software and information companies
- Facebook, eBay, Microsoft, Google, Netflix, NVidia, Activision Blizzard.
- Many other companies in the list rely on IT, e.g., Tesla

[https://en.wikipedia.org/wiki/List\\_of\\_Fortune\\_500\\_computer\\_software\\_and\\_information\\_companies](https://en.wikipedia.org/wiki/List_of_Fortune_500_computer_software_and_information_companies)

Company	Type	2017 ranking
Apple Inc	Computers, Office Equipment	3
Amazon.com	Internet Services and Retailing	12
Alphabet Inc.	Internet Services and Retailing	27
Microsoft	Computer Software	28
IBM	Information Technology Services	32
Dell Technologies	Computers, Office Equipment	41
Intel	Semiconductors and Other Electronic Components	47
Hewlett Packard Enterprise	Information Technology Services	59
Cisco Systems	Network and Other Communications Equipment	60
HP Inc.	Computers, Office Equipment	61
Oracle	Computer Software	81
Facebook	Internet Services and Retailing	98
Qualcomm	Semiconductors and Other Electronic Components	119
Jabil Circuit	Semiconductors and Other Electronic Components	152
Xerox	Computer Peripherals	162
CDW	Information Technology Services	199
Cognizant	Information Technology Services	205
Texas Instruments	Semiconductors and Other Electronic Components	206
Western Digital	Computer Peripherals	217
Micron Technology	Semiconductors and Other Electronic Components	226
Applied Materials	Semiconductors and Other Electronic Components	265
The Priceline Group Inc	Internet Services and Retailing	268
eBay	Internet Services and Retailing	310
Netflix	Internet Services and Retailing	314
Expedia	Internet Services and Retailing	317
salesforce.com	Computer Software	326
Harris Corporation	Network and Other Communications Equipment	363
Computer Sciences Corporation	Information Technology Services	379
Leidos Holdings	Information Technology Services	381
Nvidia	Semiconductors and Other Electronic Components	387
Activision Blizzard	Computer Software	406
NCR Inc.	Computers, Office Equipment	409
Sanmina	Semiconductors and Other Electronic Components	414
Amphenol	Network and Other Communications Equipment	424
Motorola Solutions	Network and Other Communications Equipment	433
LAM Research	Semiconductors and Other Electronic Components	440
Adobe Systems	Computer Software	443
Symantec	Computer Software	465
NetApp	Computer Peripherals	468
Booz Allen Hamilton	Information Technology Services	481
Yahoo!	Internet Services and Retailing	498

Digital is the main reason just over half of the **companies** on the Fortune 500 have **disappeared** since the year 2000

Pierre Nanterme  
CEO of Accenture



<https://www.weforum.org/agenda/2016/01/digital-disruption-has-only-just-begun/>

## Recap Week 1 - Innovation as “Creative Destruction”



Schumpeter

- Creative destruction – waves that restructure entire industries and markets in favour of those who grasp and adapt to technological **changes** faster!
- The fact that nearly 9 of every 10 Fortune 500 companies in 1955 are gone, merged, or contracted demonstrates that there's been a lot of market disruption, churning, and **Schumpeterian creative destruction** over the last six decades.
- The **Fortune 500** is an annual list compiled and published by **Fortune** magazine that ranks **500** of the largest United States corporations by total revenue for their respective fiscal years.

<http://www.aei.org/publication/fortune-500-firms-1955-v-2016-only-12-remain-thanks-to-the-creative-destruction-that-fuels-economic-prosperity/>

# IT Innovation as Creative Destruction

- “Why software is eating the world” (2011)
- More major businesses/industries are being run on software and delivered as online services
- Technology required to transform industries through software finally works and can be delivered globally
- Front end: billions of people with smartphones
- Back end: software tools to launch global software-powered start-ups with no need for infrastructure
- So, software innovation is now **key** to innovation in many industries

<https://medium.com/software-is-eating-the-world>

M. Andreessen, Why software is eating the world, WSJ, 2011 <http://www.wsj.com/articles/SB1000142405311903480904576512250915629460>



Marc Andreessen  
Co-founder of Netscape  
Co-founder of Andreessen-Horowitz  
Early investors in Facebook, Groupon, Twitter, Skype, Zynga, Foursquare, etc

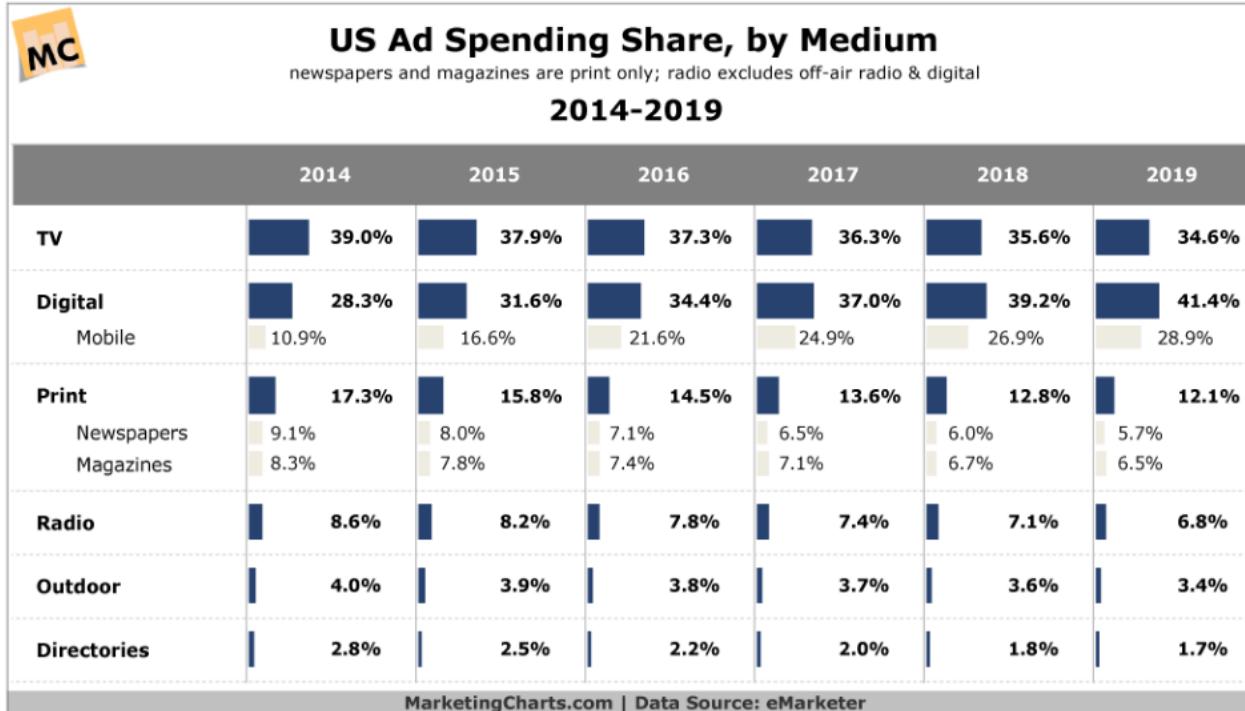
# IT Innovation as Creative Destruction

- Examples:
  - Largest bookseller in world is a software company
    - (Amazon – while Borders went bankrupt)
  - Largest video service is a software company
    - (Netflix – while Blockbuster went bankrupt)
  - Dominant music companies are software companies
    - (Apple, Spotify, Pandora – traditional record companies exist to provide them with content)
  - Fastest growing game company is a software company
    - (Zynga who make Farmville)
  - Largest direct marketing company is a software company
    - (Google)



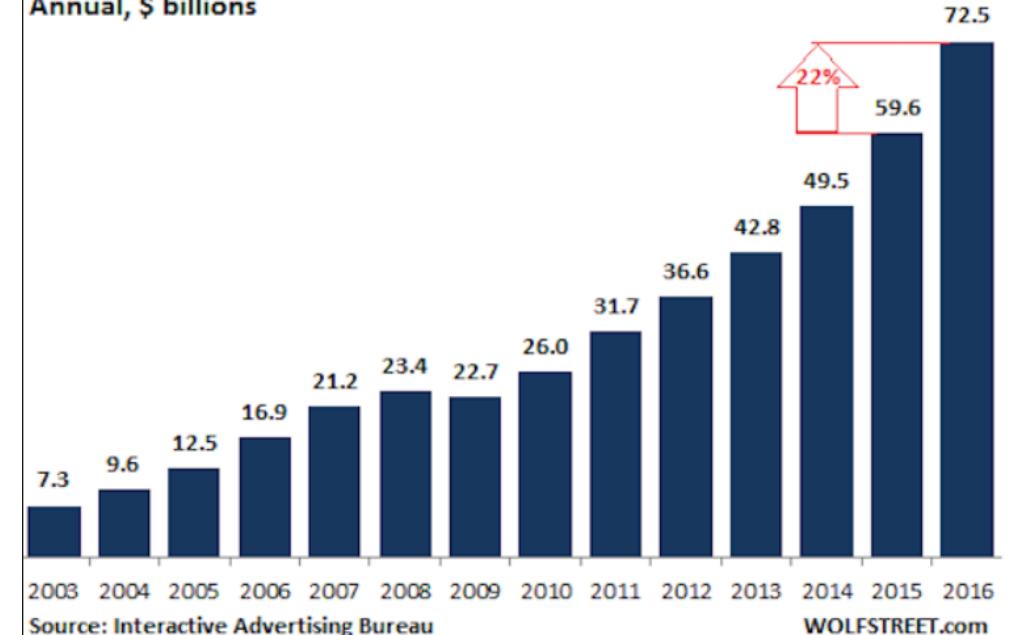
# IT Innovation as Creative Destruction

- Improvements in IT can change whole industries – e.g. Media industry



<http://www.marketingcharts.com/online/mobile-to-surpass-print-ad-spend-in-2015-58798/attachment/emarketer-us-ad-spend-share-by-medium-2014-2019-sept2015/>

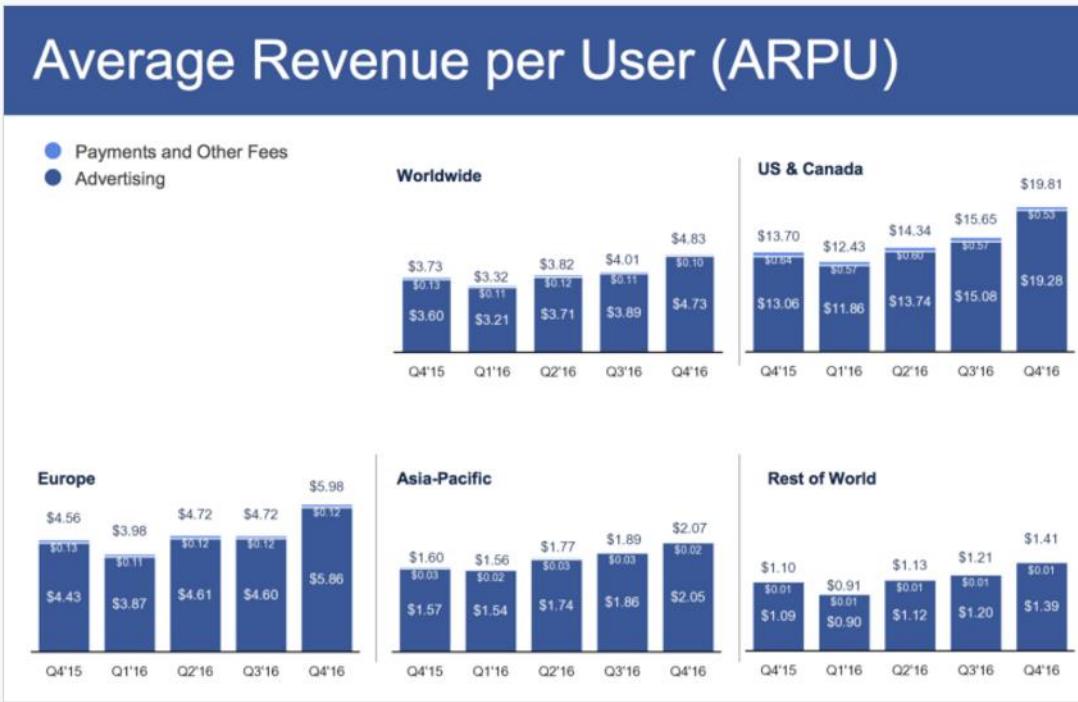
US Internet Advertising Revenues Surge  
Annual, \$ billions



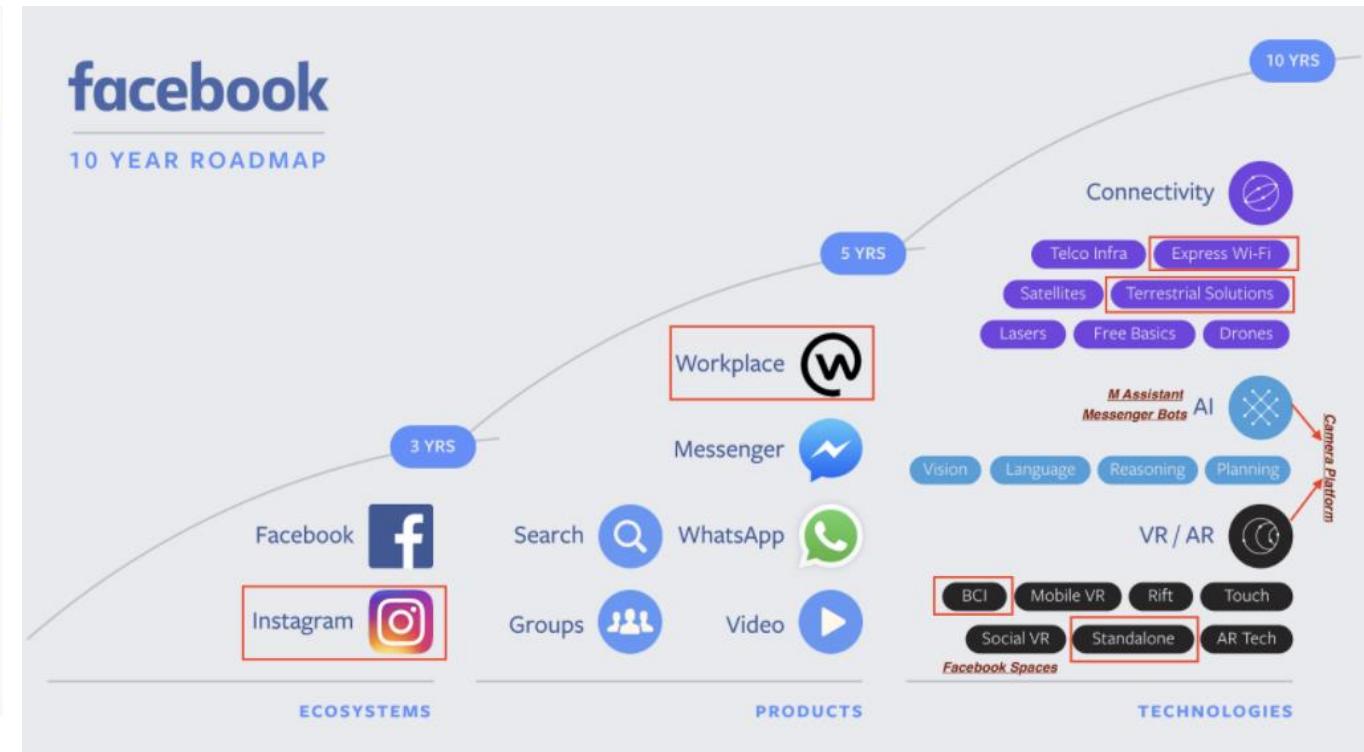
Creation of one industry  
Destruction of another

# IT Innovation as Creative Destruction

## – Facebook as an example



<https://techcrunch.com/2017/02/01/facebook-q4-2016-earnings/>



<https://www.f8.com/>

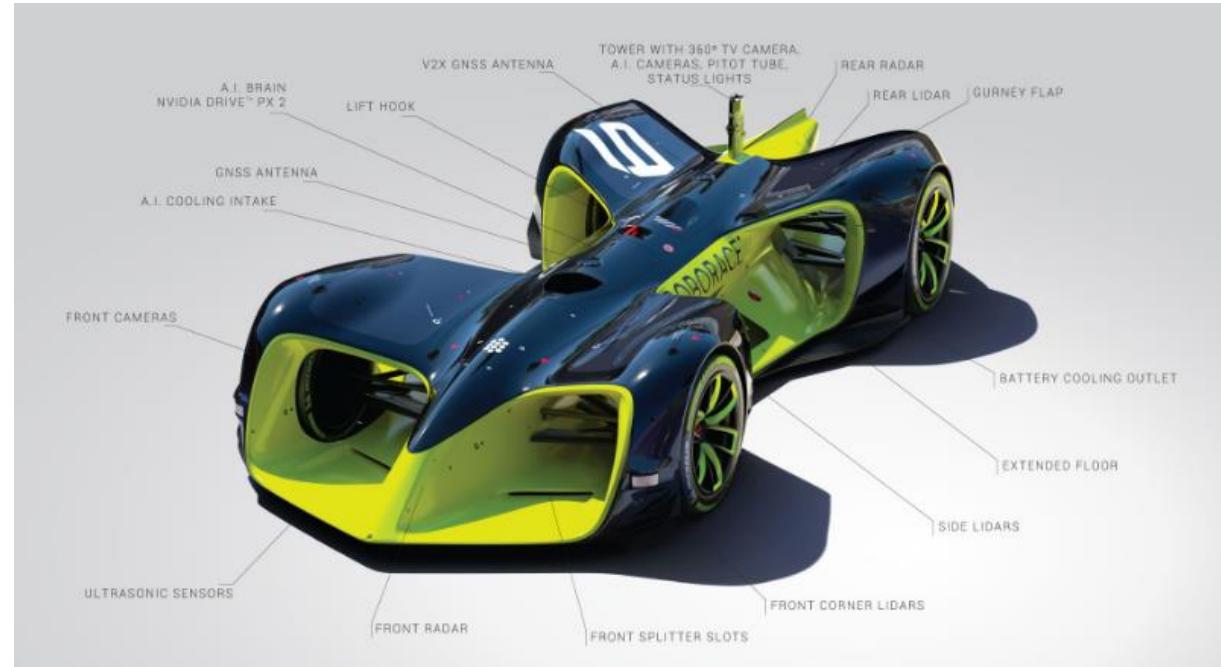
## **IT Innovation as Creative Destruction**

- Do you agree with the concept of software eating the world?
- Do you agree with the concept on the innovations that will be important?



# Roborace

- The world's first driverless electric racing car.
- The first Roborace 'shows' will take place during the 2016/2017 Formula E season.
- “I passionately believe that the future of cars is about software; driverless, electric and connected and Roborace will help to make that a reality.”
- Denis Sverdlov, CEO of Roborace



# **Types and Source of innovation**

# Different dimensions

## Different dimensions in talking about an innovation...

- 1) What **type** of thing is being innovated?
- 2) How **different** is it from what's already available?
- 3) What **impact** will it have on the **consumer**?
- 4) What **impact** will it have on the **market or industry**?
- 5) What **scope** of the product/service/process does it affect?
- 6) What **impact** will the innovation have on the **producers**?

# Different dimensions

- 1) **What type** of thing is being innovated?
  - Product innovation vs process innovation vs business model innovation
- 2) How **different** is it from what's already available?
- 3) What **impact** will it have on the **consumer**?
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# Product innovation

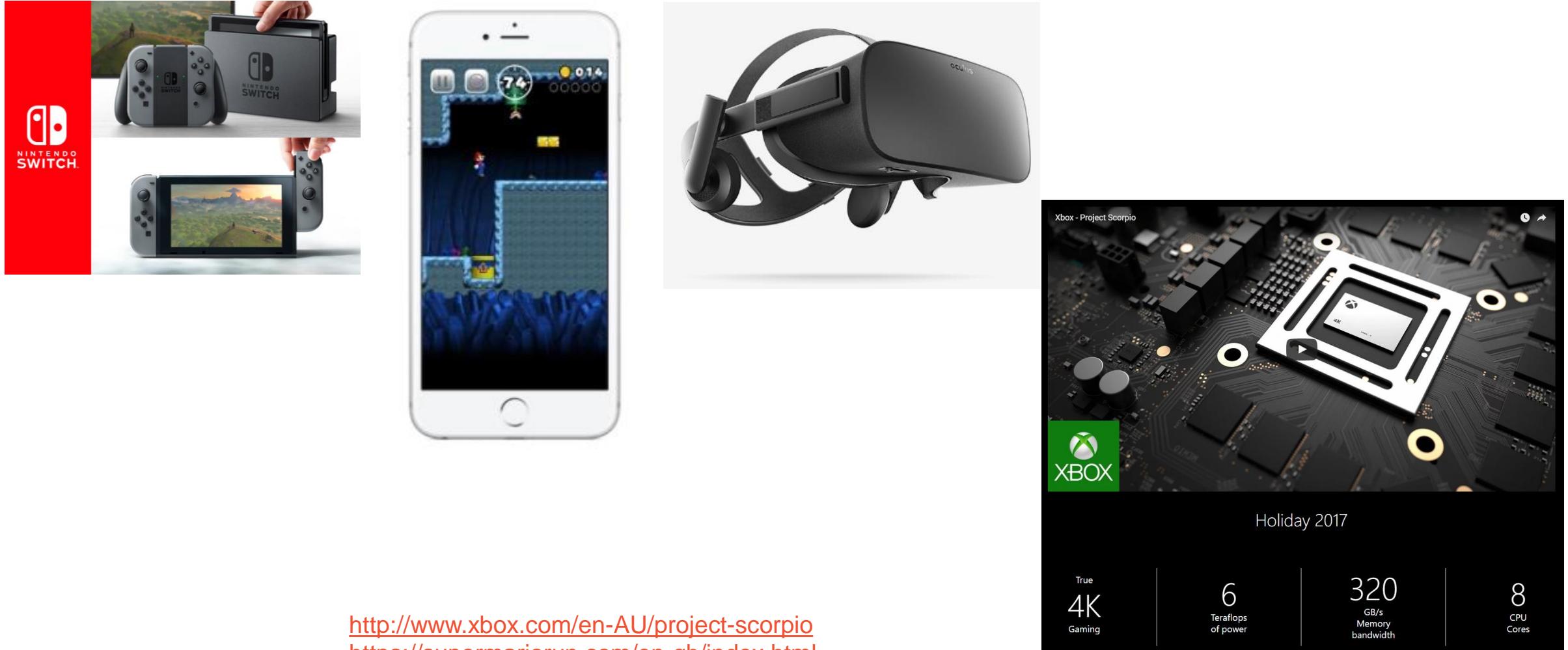
- the development of **new products, changes in design of established products, or use of new materials or components** in the manufacture of established products
- Examples:
  - New software innovation e.g., search algorithm
  - New hardware/software features in cars, e.g., intra-car communication

# Product innovation: Example - Video Games



Source: gizmodo.com

# Product innovation: Example - Video Games

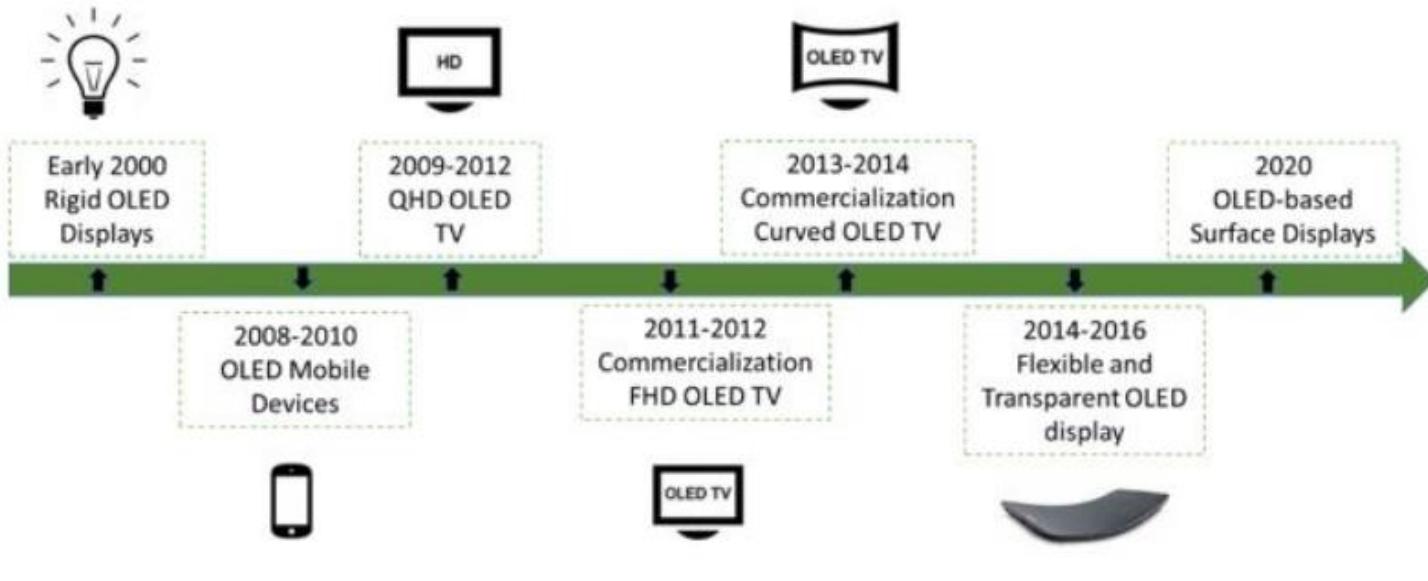


<http://www.xbox.com/en-AU/project-scorpio>  
<https://supermariorun.com/en-gb/index.html>  
<https://www.oculus.com/>

# Product innovation: Example - iPod



# Product innovation: Example - OLED



<https://www.technavio.com/blog/the-pros-and-cons-of-buying-an-oled-tv-before-2019>

# Process innovation

- Process innovation involves the discovery and implementation of a new or improved **production or delivery method**
- The process could be related to production/engineering or related to business processes
- Examples:
  - Process for making a prototype product



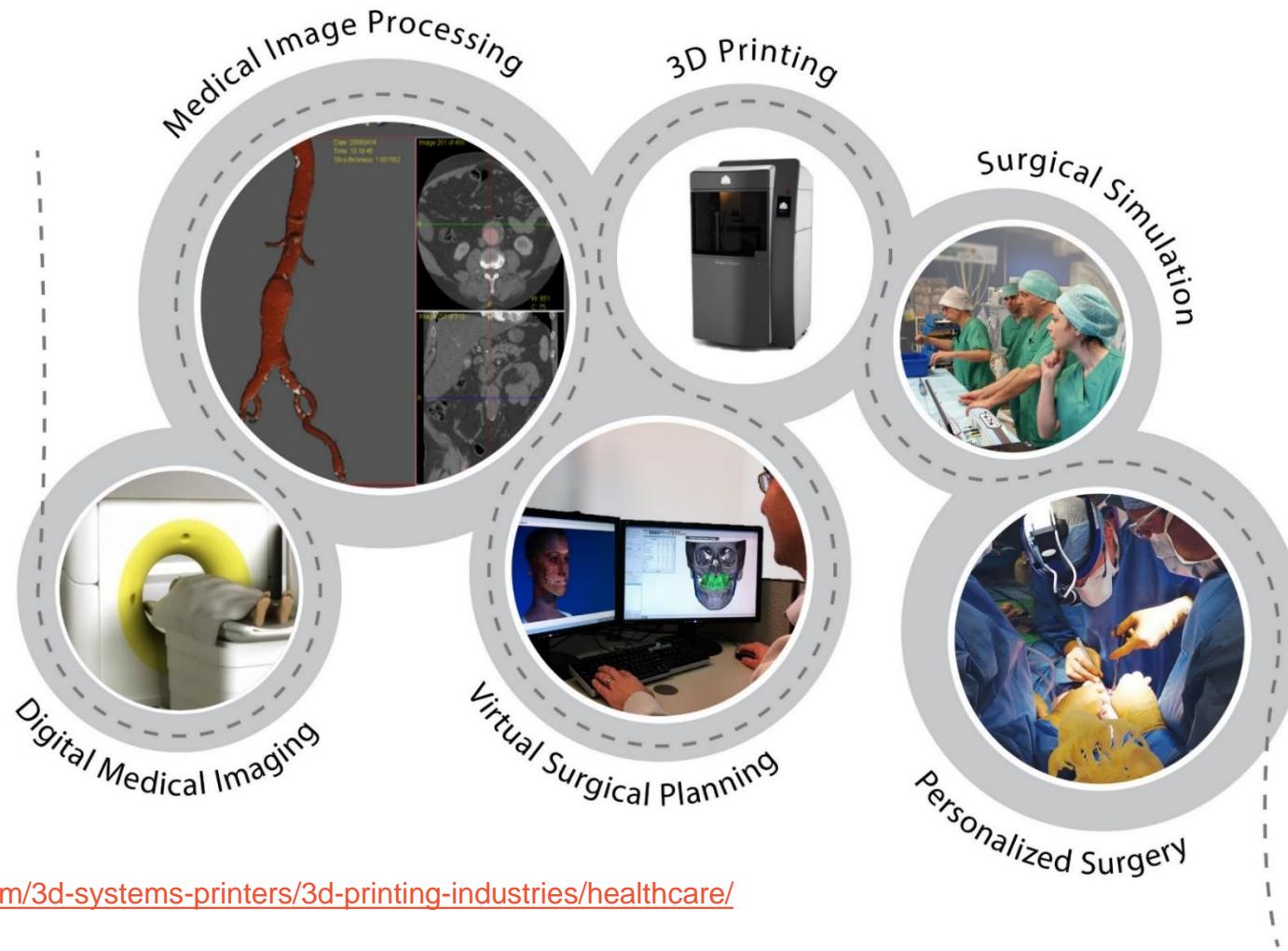
Injection moulding

Source: <http://www.avplastics.co.uk/injection-moulding-history>



3d printing

# Product and Process innovation Example: Personalised Surgery



# Business Model Innovation

- New and radically new business models
- Many web-based innovations are built around business model innovations enabled by technology, e.g.,
  - Uber, Airbnb – sharing economy
  - Freemium – paying for premium
  - Google – personalized ads
  - Groupon – group buying
  - Amazon Web Services – cloud services

“All it really meant was how you planned to make money”



Michael Lewis, Financial Journalist  
<https://hbr.org/2015/01/what-is-a-business-model>

# Different dimensions

1) **What type** of thing is being innovated?

- Product/service innovation vs process innovation vs business model innovation

2) How **different** is it from what's already available?

- Radical vs incremental innovation

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5) What **scope** of the product/service/process does it affect?

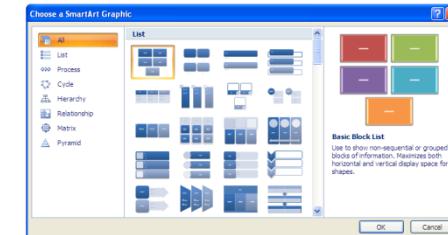
6) What **impact** will the innovation have on the **producers**?

# Radical vs incremental innovation

- The *radicalness* of an innovation is the degree *to which it is new and different from existing products and processes.*
  - E.g. 3D printer



- *Incremental innovations* may involve only a minor change from (or adjustment to) existing practices.
  - E.g. a new feature in Microsoft Word
- The radicalness of an innovation is relative; it may change over time or with respect to different observers.



# Different dimensions

1) **What type** of thing is being innovated?

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- Life-changing vs incidental innovation

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- Disruptive vs sustaining

More in later lecture

5) **What scope** of the product/service/process does it affect?

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5) **What scope** of the product/service/process does it affect?

- Architectural vs component innovation

More in later lecture

6) **What impact** will the innovation have on the **producers**?

# Architectural vs Component Innovation

- An **architectural innovation** entails changing the overall design of the system or the way components interact.
  - e.g. cloud computing
  - e.g. sharing economy platforms
- A **component innovation** involves changes to one or more components of a product system without significantly affecting the overall design.
  - e.g. changing the algorithm for face detection in a camera for higher performance
  - e.g. smartphone generations...
- Most architectural innovations also require changes in the underlying components.

# Different dimensions

1) **What type** of thing is being innovated?

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- Competence-enhancing vs competence-destroying innovation

# Competence-Enhancing vs Competence-Destroying Innovation

- **Competence-enhancing** innovations build on the firm's existing knowledge base
  - E.g., Intel's Pentium 4 built on the technology for Pentium III.
- **Competence-destroying** innovations render a firm's existing competencies obsolete.
  - E.g. Kodak invented the first digital camera
  - But they struggled to make the transition from analog film to digital photography as most of their competence related to analog film (rather than micro-electronics).
- Depends on the perspective of a particular firm.
  - E.g. digital cameras were not competence-destroying for Sony or Canon as they already had microelectronics expertise.

## Summary of topics covered

- Definition of innovation:
  - Innovation involves idea + application of that idea (“ideas successfully applied”)
- The importance of innovation:
  - Innovation is important for countries and companies
  - Innovation as driver of competitive success
  - Innovation as creative destruction (Schumpeter)
  - IT as enabler of innovation in other fields (eg logistics, bio-informatics)
  - “Why software is eating the world”
- Different dimensions for understanding types of innovation

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