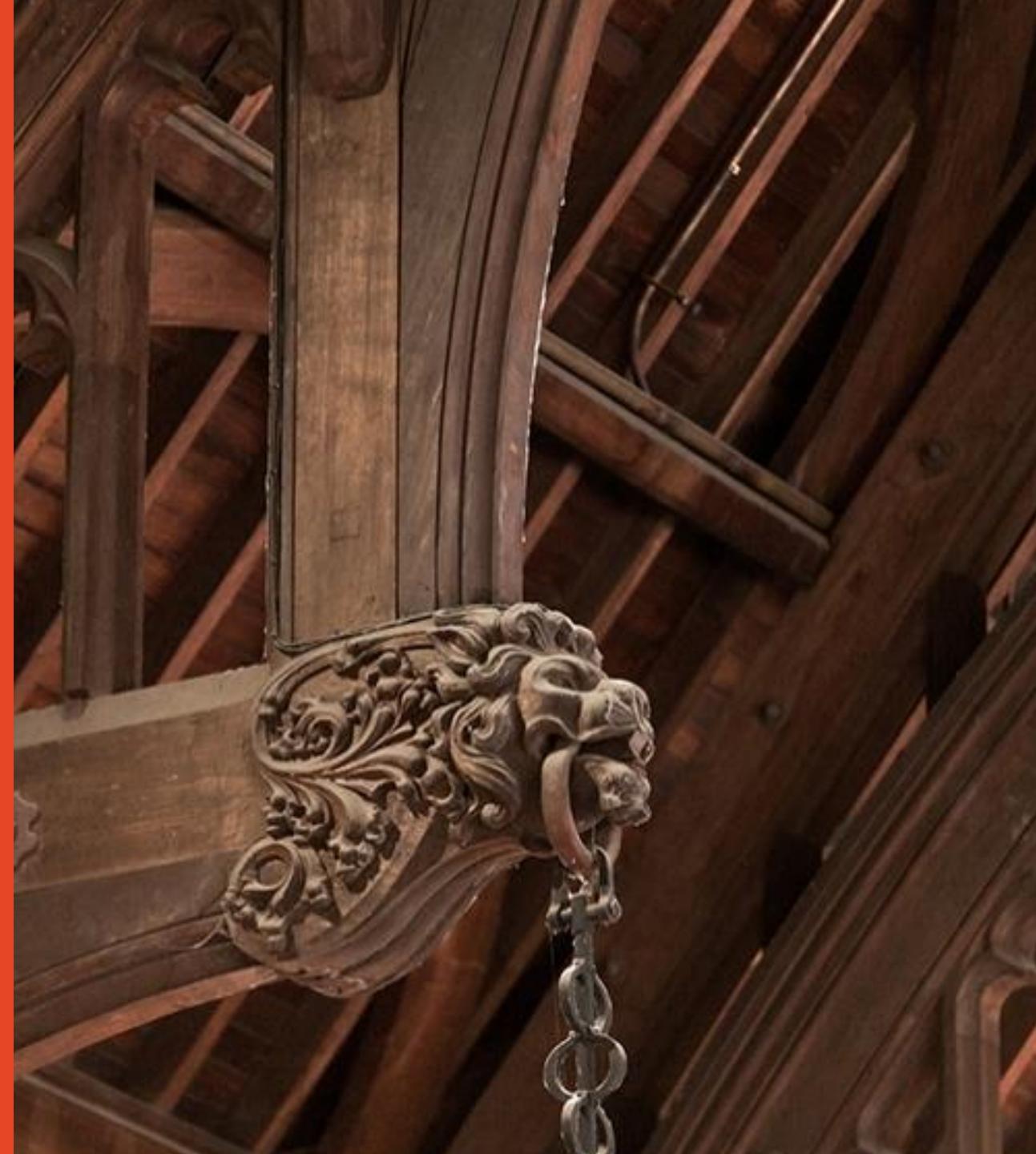


# **INFO5992**

## **Understanding IT Innovations**

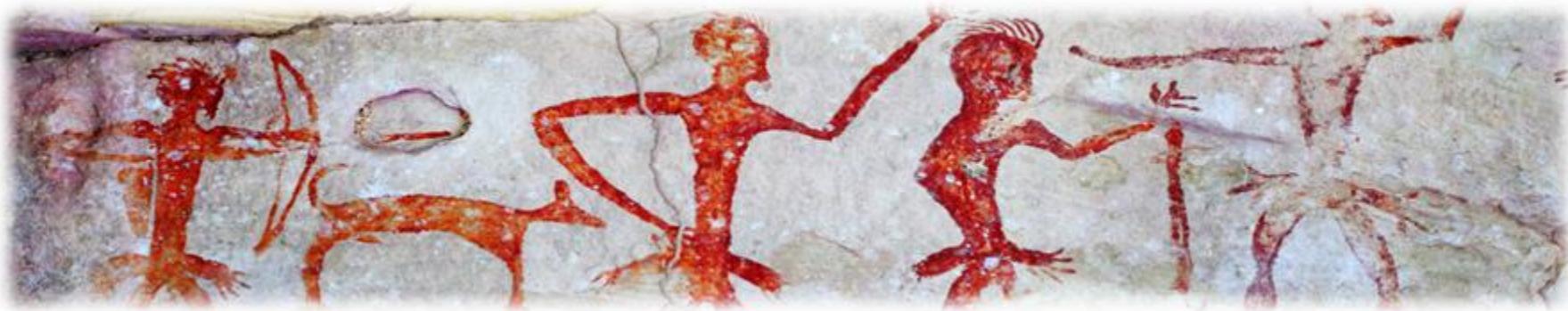
### **Week 01: Introduction**

Semester 1, 2025



# Acknowledgement of Country

*I would like to acknowledge the Traditional Owners of Australia and recognise their continuing connection to land, water and culture. I pay my respects to the first nations people and their Elders, past, present and emerging.*



# **Copyright Warning**

**COMMONWEALTH OF AUSTRALIA**

**Copyright Regulations 1969**

## **WARNING**

This material has been reproduced and communicated to  
you by or on behalf of the University of Sydney  
pursuant to Part VB of the Copyright Act 1968 (**the  
Act**).

The material in this communication may be subject  
to copyright under the Act. Any further copying or  
communication of this material by you may be the  
subject of copyright protection under  
the Act.

**Do not remove this notice.**

# Welcome!

# Agenda

## Section One (1<sup>st</sup> Half)

Welcome!

Administrivia

Introduction to the Teaching Team

Unit of Study: Introduction

- Lectures & Tutorials
- Assessments

## Section Two (2<sup>nd</sup> Half)

2.1 Introduction to IT Innovation

2.2 Definition of IT Innovation

2.3 Importance of IT Innovation

2.4 General Purpose Technologies

2.5 Overview of Emerging Technologies

# Teaching Team

---

- Coordinator & Lecturer:
- Dr. Imdad Ullah: [imdad.ullah@sydney.edu.au](mailto:imdad.ullah@sydney.edu.au)
- Dr. Armin Chitizadeh: [armin.chitizadeh@sydney.edu.au](mailto:armin.chitizadeh@sydney.edu.au)
- Tutors:

Name	Email	Tutorials
Saugata Bose	<a href="mailto:saugata.bose@sydney.edu.au">saugata.bose@sydney.edu.au</a>	01, 02, 21
Md Aosaful Alam	<a href="mailto:mdaosaful.alam@sydney.edu.au">mdaosaful.alam@sydney.edu.au</a>	17, 18, 23
Aditya Anand	<a href="mailto:aditya.anand@sydney.edu.au">aditya.anand@sydney.edu.au</a>	08, 09, 24
Aman Bagga	<a href="mailto:amanveer.bagga@sydney.edu.au">amanveer.bagga@sydney.edu.au</a>	15, 16, 33
Anushka Kharbanda (TA)	<a href="mailto:akha8096@uni.sydney.edu.au">akha8096@uni.sydney.edu.au</a>	19, 20, 25
Boyuan Tan	<a href="mailto:boyuan.tan@sydney.edu.au">boyuan.tan@sydney.edu.au</a>	07, 14, 27
Nicole Cai	<a href="mailto:yujia.cai@sydney.edu.au">yujia.cai@sydney.edu.au</a>	10, 26, 28
Pooja Vijay Mahajan	<a href="mailto:pmah0895@uni.sydney.edu.au">pmah0895@uni.sydney.edu.au</a>	05, 06, 30
Shubham Srivastava	<a href="mailto:shubham.srivastava@sydney.edu.au">shubham.srivastava@sydney.edu.au</a>	03, 04, 34
Smrithika Bura	<a href="mailto:smrithika.bura@sydney.edu.au">smrithika.bura@sydney.edu.au</a>	12, 11
Venkata Vishal Kotari	<a href="mailto:vkot2743@uni.sydney.edu.au">vkot2743@uni.sydney.edu.au</a>	22, 29
Abha Sharma	<a href="mailto:asha0188@uni.sydney.edu.au">asha0188@uni.sydney.edu.au</a>	31, 32
Gaurav Kamble	<a href="mailto:gaurav.kamble@sydney.edu.au">gaurav.kamble@sydney.edu.au</a>	13, 35

# Places

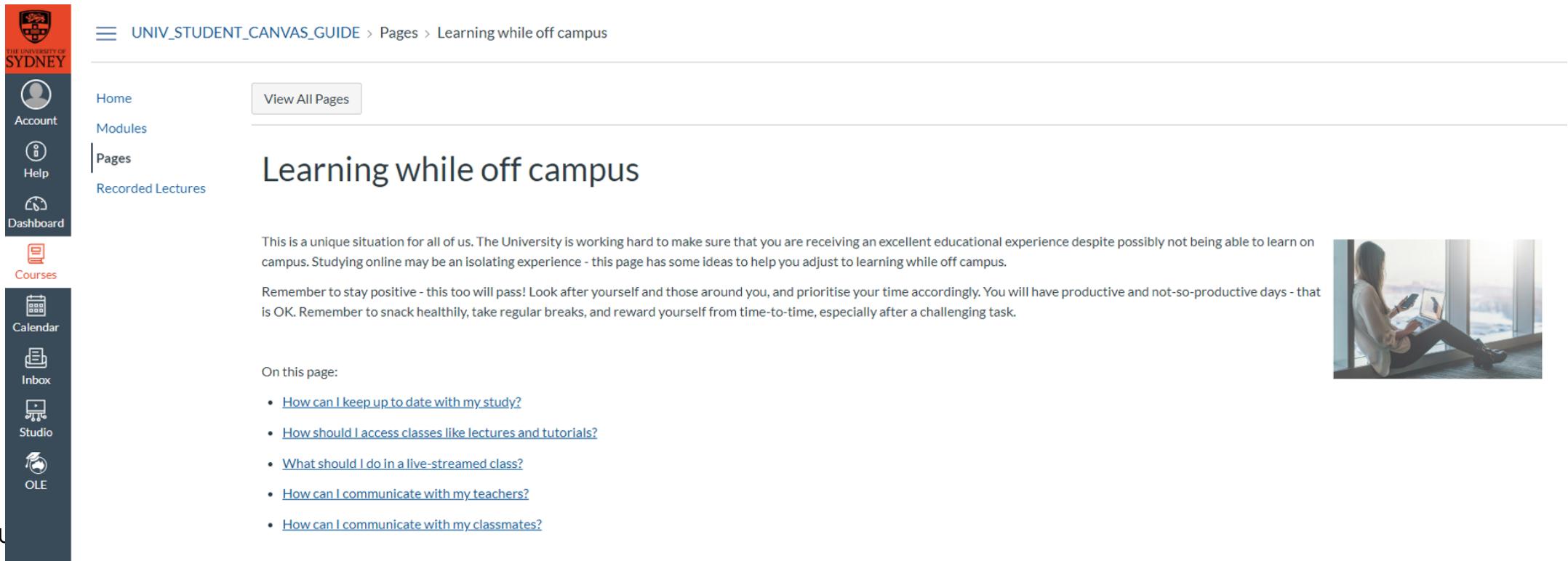
---

- Lecture:
  - Every Monday, 5 to 7 pm both face-to-face and online via Zoom (<https://unisydney.zoom.us/j/88594264418>)
- Tutorials:
  - Every Monday to Friday, 7 pm – 8/9 pm (from Week 1);
  - Go to the room you are scheduled for
  - If, for some reason, you miss it, you can attend a later lab session if there is space and the tutor agrees; you need to ask the tutor before taking a seat since there are limited seats in every tutorial session.
- Do not miss classes, except for illness, emergencies, etc.
- Get help from the teaching staff if you feel you are falling behind.

# Tips for Online Learning

---

- For tips and guides on learning online and the tools you will use, refer to [Learning while off campus resources](#) in Canvas.



The screenshot shows a Canvas course page titled "Learning while off campus". The page includes a sidebar with various navigation icons and links, such as Home, Modules, Pages, Recorded Lectures, Courses, Calendar, Inbox, Studio, and OLE. The main content area features a heading "Learning while off campus" and a paragraph about the unique situation of learning online due to the university's efforts. It also includes a list of topics under "On this page:" and a photograph of a student sitting by a window using a laptop.

THE UNIVERSITY OF  
SYDNEY

UNIV\_STUDENT\_CANVAS\_GUIDE > Pages > Learning while off campus

Home View All Pages

Account

Modules

Pages

Recorded Lectures

Courses

Calendar

Inbox

Studio

OLE

Learning while off campus

This is a unique situation for all of us. The University is working hard to make sure that you are receiving an excellent educational experience despite possibly not being able to learn on campus. Studying online may be an isolating experience - this page has some ideas to help you adjust to learning while off campus.

Remember to stay positive - this too will pass! Look after yourself and those around you, and prioritise your time accordingly. You will have productive and not-so-productive days - that is OK. Remember to snack healthily, take regular breaks, and reward yourself from time-to-time, especially after a challenging task.

On this page:

- [How can I keep up to date with my study?](#)
- [How should I access classes like lectures and tutorials?](#)
- [What should I do in a live-streamed class?](#)
- [How can I communicate with my teachers?](#)
- [How can I communicate with my classmates?](#)

The U

# Resources - Canvas

---

- Login using Unikey and password
- Link to the unit outline: <https://www.sydney.edu.au/units/INFO5992/2025-S1C-NE-CC>
- List of learning outcomes, etc.
- Official schedule
- Copies of slides on [Canvas](#)
- Tutorial instructions
- Assignment instructions
- Lecture recordings
- Submit official assignments on Canvas
- See your grades , etc.
- Discussion Board

# Resources

---

- Discussion board on Canvas or Ed: [INFO5992 – Ed Discussion \(edstem.org\)](#)
- General (student helpline 1800 793 864 or contact the admin team) and Technical
- Refer technical questions to TA/Tutors
- Refer administrative questions to me.

# **Unit of Study INFO5992**

## **Introduction**

# UoS Semester Outline

Week		Learning Outcomes	Lectures
<b>Module 2: Innovation Framework</b>			
Week 01	L01, LO2, LO3	Unit of Study Introduction, Administrivia, Definition of IT Innovation, Importance of Innovation to a Country, General Purpose Technologies, Overview of Emerging Technologies	
Week 02	LO4, LO5	Innovation Frameworks I: Dynamics of IT Innovation, Dominant Design	
Week 03	LO6	Innovation Frameworks II: Disruptive Innovation, Innovator's Dilemma, Value Chain & Value Network	
<b>Module 2: Development of Key Intellectual Property in the Modern Age</b>			
Week 04		Introduction to Open Innovation and Closed Innovation Distributed Innovation I: Product Platforms, Web APIs	
Week 05	LO7	Distributed Innovation II: Crowdsourcing, Free and Open- Source Software, Open Data	
Week 06		Distributed Innovation III: Platform Ecosystems, User Innovation	
<b>Module 3: Commercialisation Process and Business Strategies for Emerging Technologies</b>			
Week 07		Commercialisation I: Startup vs Traditional Companies, Lean Startup Methodology and Agile Development	
Week 08	LO8	Commercialisation II: Customer Development Process, Value Proposition Canvas	
<b>Mid semester break</b>			
Week 09	LO8, LO9	Commercialisation III: Innovation Management, Business Model Canvas Commercialisation IV: Capital & Fundraising for IT Innovation	
Week 10	LO11, LO12	Organisational Cultures and Structures Supporting Innovation, Judging IT Innovation	
<b>Module 4: Innovation At-Scale</b>			
Week 11	LO10	Innovation Ecosystem: Silicon Valley and Australia	
Week 12	N/A	Guest Lecture	
Week 13	N/A	Course Review   Innovation Pitch Presentation	
Final Exam			

# Assessments

Task	Description	Due Week	Weighting
Quizzes	Students will complete 2 quizzes via Canvas.  Quizzes will be timed for 20 minutes and students will get only one attempt.	#1: Week 5  #2: Week 10	10%
Innovation Report	Working in groups of 4-5, students will complete the following stages of an Innovation Report, applying key concepts and frameworks in innovation:  1. Mid Report 2. Mid Report Reviewed 3. Final Report 4. Final Report Reviewed  Students will be able to join groups via Canvas.	Week 6  Week 8  Week 11  Final Exam Period	10%  2%  15%  3%
Innovation Presentation	As part of the Innovation Report, students will complete a pitch presentation.  Each group member must present.	Week 12	10%
Final Exam	Paper-based exam, 2-hours.  The final exam is a restricted open book and will cover all learning objectives in this course.  This is a hurdle task; students must meet the required standards in the exam to pass the unit of study overall.	Formal Exam Period	50%

- **Make Groups form now**
  - 4-5 Students and join a group; no later than week 3
  - Canvas → People → Project Groups (Innovation Report)
  - Do not randomly join the group

# Lectures and Tutorials

- All the assessments are under the category “**Secured assessment no AI**”
  - How do we catch plagiarism?
- **Tutorial submissions are mandatory**
  - The teaching team will keep track of the submissions; expect an email from us if you do not submit it
  - Weightage = 0%
  - Why do you care?
    - Learn and understand the materials better
    - Helps in solving scenario-based questions in the exam
    - Active engagement
    - Preparation for assessments

# Late Submissions

---

- Consistent penalty of 5% per day late, e.g.,
  - A “good” assignment that would normally get 9/10, and is 2 days late, loses 10% of the full 10 marks, i.e., new mark = 8/10.
  - An average assignment, that would normally get 5/10, that is 5 days late, loses 25% of the full 10 marks, i.e., new mark = 2.5/10
- Assignments more than 5 days late get 0.

# **Assessment overview**

---

- In order to pass the course, the School requires:
  - At least 40% in the written final exam,
  - At least 40% in the other assessment components together and
  - An overall final mark of 50 or more out of 100 marks.
- This means that students who score less than 40% in the final exam will fail the course regardless of their marks during the semester.

# Resources

- Canvas <https://canvas.sydney.edu.au/>
  - Announcements
  - Lecture Slides
  - Tutorials
  - Zoom / Lecture recordings
  - Assessment instructions
  - Assessment submissions

Understanding IT Innovations

Edit

⋮



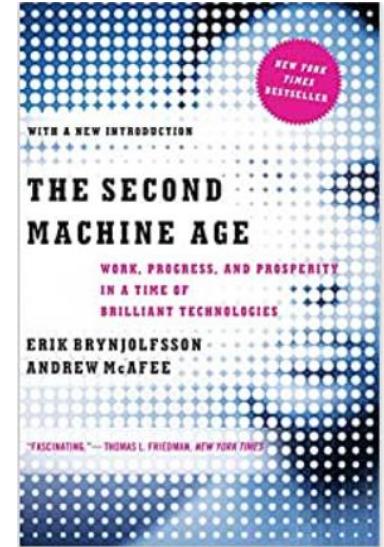
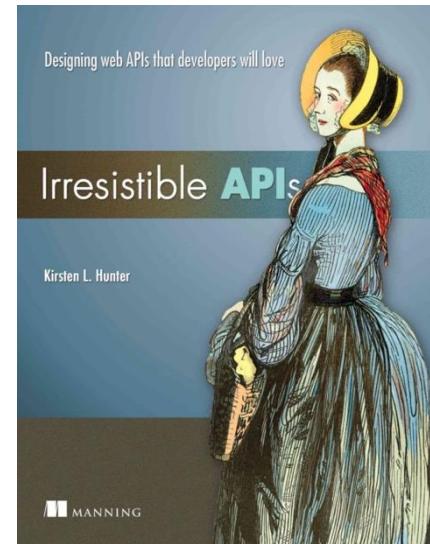
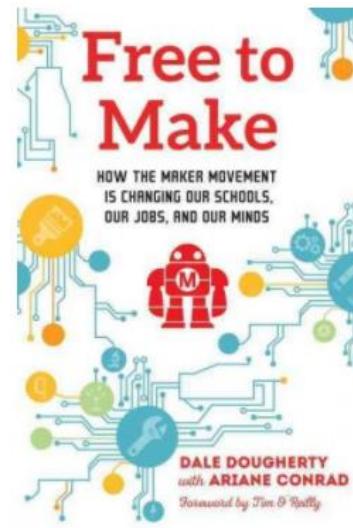
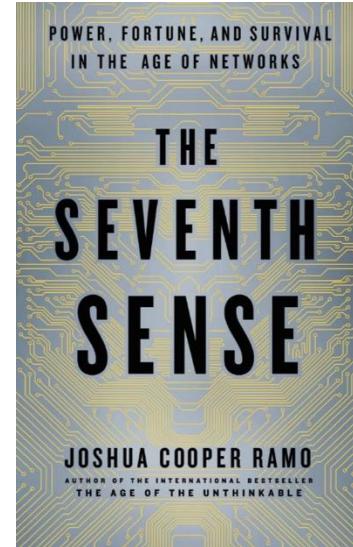
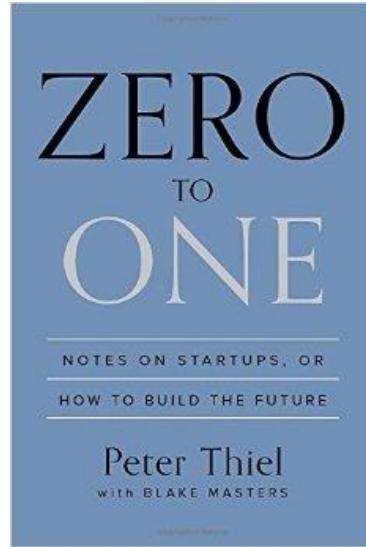
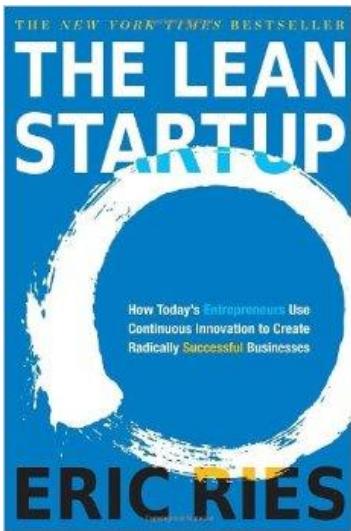
**Understanding IT Innovations:** An essential skill for an IT manager is the ability to keep up-to-date with emerging technologies, and be able to evaluate the significance of these technologies to their organisation's business activities. This unit of study is based around a study of current technologies and the influence of these technologies on business strategies. Important trends in innovation in IT are identified and their implications for innovation management explored. Major topics include:

## Recommended reading material

- To be released in the **Lectures**
  - Many references and sources included in the slides
- To be released as part of a **tutorial**

# Reference books

- It is not required for purchase, but you may find it useful to guide your exploration of the ideas
- Others introduced throughout the UoS
- This and other relevant works can be found in the university library



# Expectations

- Students attend scheduled classes and devote an **extra 3-6 hrs per week**
  - doing assessments
  - preparing and reviewing for classes
  - revising and integrating your own ideas
  - practice and self-assess
- Students are responsible learners
  - Participate in classes, constructively
    - Respect for one another (criticise ideas, not people)
    - Humility: none of us knows it all; each of us knows valuable things
  - Check Canvas at least once a week!
  - Notify the teaching team whenever there are difficulties
  - Notify group partners honestly and promptly about difficulties

# **Special Consideration – (University Policy)**

---

- If your performance on assessments is affected by illness or misadventure
- Follow proper procedures:
  - Have professional practitioner sign special USYD form
  - Submit application for special consideration online, upload scans
  - Note you have only a quite short deadline for applying
  - [http://sydney.edu.au/current\\_students/special\\_consideration/](http://sydney.edu.au/current_students/special_consideration/)
- Also, notify the coordinator and TA by email as soon as anything begins to go wrong
- There is a similar process if you need special arrangements e.g., for religious observance, military service, representative sports

# Special Consideration – (University Policy)

---

- Please read the University policy on **Academic Honesty** carefully:
- [http://sydney.edu.au/elearning/student/EI/academic\\_honesty.shtml](http://sydney.edu.au/elearning/student/EI/academic_honesty.shtml)
- All cases of academic dishonesty and plagiarism will be investigated
- There is a new process and a centralised University system and database
- Three types of offences:
  - Plagiarism – When you **copy** from another student, website or other source, including generative AI tools. This includes copying the whole assignment or only a part of it.
  - Academic Dishonesty – When you **make your work available** to another student to copy (the whole assignment or a part of it). There are other examples of academic dishonesty.
  - Misconduct - When you **engage another person** to complete your assignment (or a part of it), for payment or not. This is a very serious matter, and the Policy requires that **your case is forwarded to the University Registrar for investigation**.

# **Special Consideration – (University Policy)**

---

- The **penalties** are severe and include:
  1. A permanent record of academic dishonesty, plagiarism and misconduct in the University database and on your student file
  2. Mark deduction, ranging from 0 for the assignment to Fail for the course
  3. Expulsion from the University and cancelling of your student visa
- When there is copying between students, note that both students are penalised – the student who copies and the student who makes his/her work available for copying

# Special Consideration – (University Policy)

---

- We will use the similarity detection software **Turnitin and MOSS** to compare your assignments with these of other students (current and previous) and the Internet
  - Turnitin is for text documents: <https://www.turnitin.com/solutions/higher-education>
  - MOSS is for programming code: <https://theory.stanford.edu/~aiken/moss/>
- These tools are extremely good!
  - E.g., MOSS cannot be fooled by changing the names of the variables or changing the order of the conditions in if-else statements

# Special Consideration – (University Policy)

---

- All these are cases of **plagiarism** and **academic dishonesty** we have seen in our school and the **student excuses are not acceptable**:
  - *Plagiarism means presenting another person's work as one's own work by presenting, copying or reproducing it without appropriate acknowledgement of the source.*
  - *I sat the test and then posted the questions and solutions to my friends whose test was later in the week. I only wanted to help them understand the concepts that are examinable.*
  - *I posted parts of my code on my web page (group discussion forum) because my solution was cool (or I wanted to help them). I didn't expect them to copy it.*
  - *I tried to do the assignment on my own but I had problems with the extension part that I couldn't fix, so I submitted my core part and his extension part. I didn't cheat.*
  - *I finished my assignment but my friend had family problems. I felt sorry for her, so I gave her my assignment as an example. He said he only wanted to have a look and promised not to copy it.*
  - *The test has finished but the tutor hasn't collected the papers yet. I showed my answer to my friend. I didn't expect him to copy it.*
  - *He is my best friend. I had no choice but to let him copy my assignment.*

## Special Consideration – (University Policy)

---

- Plagiarism and any form of academic dishonesty will be dealt with, and the penalties are severe
- We use plagiarism detection systems such as **MOSS and Turnitin** that are extremely good. If you cheat, the chances you will be caught are very high.
- If someone asks you to see or copy your assignment, or to complete the assignment instead of them, just say: *I can't do this. This is against the University policy. I will not risk my future by doing this.*

Be smart and don't risk your future by engaging in plagiarism and academic dishonesty, misconduct!

# Academic Integrity Practice – Source of help

---

## Example 1: Junior level programming UoS

### Source of Help

Lecturer	Teaching Assistants / Tutors	Classmates	Private tutors	Online forums/ Online tutors	Students outside course/UoS	Hired coders Tutorial Company outside University	Relatives	Other
----------	------------------------------	------------	----------------	------------------------------	-----------------------------	--	-----------	-------

- Individual assignment
- A student needs to gain an understanding of fundamental knowledge/skills
- It is important to master the knowledge/skills themselves

- Encouraged
- Attribution required
- Not acceptable
- Ask Lecturer/Coordinator

# Academic Integrity Practice – Types of help

---

## Example 1: Junior level programming UoS

### Types of Help

Understanding General Concepts	Explained using similar material (not assignment)	Sharing approach/concept to derive assignment solution	Designing code/solution	Implementing code/solution
--------------------------------	---	--	-------------------------	----------------------------

- Individual assignment
- A student needs to gain an understanding of fundamental knowledge/skills
- It is important to master the knowledge/skills themselves
- Students are encouraged to obtain help through relevant teaching materials and practices but not directly on assignment materials

- Encouraged
- Attribution required
- Not acceptable
- Ask Lecturer/Coordinator

# Disability Services

---

- Do you have a disability?
  - You may not think of yourself as having a ‘disability’ but the definition under the Disability Discrimination Act is broad and includes temporary or chronic medical conditions, physical or sensory disabilities, psychological conditions and learning disabilities.
- The types of disabilities we see include:
  - anxiety, arthritis, asthma, asperger's disorder, ADHD, bipolar disorder, broken bones, cancer, cerebral palsy, chronic fatigue syndrome, crohn's disease, cystic fibrosis, depression, diabetes, dyslexia, epilepsy, hearing impairment, learning disability, mobility impairment, multiple sclerosis, post traumatic stress, schizophrenia , vision impairment, and much more.
- Students needing assistance must register with Disability Services –
  - It is advisable to do this as early as possible.
- <https://www.sydney.edu.au/students/health-wellbeing/inclusion-and-disability.html>

# Do you have a disability that impacts on your studies?

You may not think of yourself as having a 'disability' but the definition under the **Disability Discrimination Act (1992)** is broad and includes temporary or chronic medical conditions, physical or sensory disabilities, psychological conditions and learning disabilities.

The types of disabilities we see include:

Anxiety // Arthritis // Asthma // Autism // ADHD

Bipolar disorder // Broken bones // Cancer

Cerebral palsy // Chronic fatigue syndrome

Crohn's disease // Cystic fibrosis // Depression

Diabetes // Dyslexia // Epilepsy // Hearing impairment //

Learning disability // Mobility impairment // Multiple sclerosis // Post-traumatic stress // Schizophrenia // Vision impairment

and much more.

In order to get assistance, students need to register with Inclusion and Disability Services. It is advisable to do this as early as possible. Please contact us or review our website to find out more.



THE UNIVERSITY OF  
SYDNEY

**Inclusion and Disability Services Office**  
[sydney.edu.au/disability](http://sydney.edu.au/disability)  
02-8627-8422



# Other support

---

- Learning support
  - <http://sydney.edu.au/study/academic-support/learning-support.html>
- International students
  - <http://sydney.edu.au/study/academic-support/support-for-international-students.html>
- Aboriginal and Torres Strait Islanders
  - <http://sydney.edu.au/study/academic-support/aboriginal-and-torres-strait-islander-support.html>
- Student organisation (can represent you in academic appeals etc.)
  - <http://srcusyd.net.au/> or <http://www.supra.net.au/>

# Advice

---

- **Metacognition**
  - Pay attention to the learning outcomes
  - Self-check that you are achieving each one
  - Think how each assessment task relates to these
- **Time management**
  - Watch the due dates
  - Start work early, submit early
- **Networking and community-formation**
  - Make friends and discuss ideas with them
  - Know your tutor, lecturer, and coordinator
  - Keep them informed, especially if you fall behind
    - Don't wait to get help
- **Enjoy the learning!**

# SPARK

---

- **Entrepreneurship** is the fuel for driving innovation in Technology
  - Understand the **alignment** between the Information System/**Information Technology** capabilities and Business operations and procedures
  - This journey will ultimately help students bring IT innovation to the businesses or use IT to solve other societal or technological problems
- 
- Pitch your idea (each pitch should be 3-5 minutes long)
  - Followed by questions from the audience
  - Light refreshments at the end of the pitching session
- 
- Enjoy the journey!

# SPARK

---

- SPARK Director:
  - Prof. **Jinman** Kim (Associate HoS External Engagement)
- SPARK Coordinator:
  - **Imdad** Ullah
- Program Manager Incubate:
  - Yet to decide



# SPARK 2024 – Ideas Received

---

- 19 ideas submitted (individual/group)



A circular graphic containing various AI-related concepts, including speech recognition, Social media, implementation of AI, users, experience time, technology, carers people, visa, market IoT system, children, end-to end, lower prices, voice command, and aged or NDIS.

AI need

speech recognition  
Social media  
implementation of AI  
users  
experience time  
technology  
carers people  
aged or NDIS  
lower prices  
voice command  
market IoT system  
visa  
children  
end-to end

# SPARK 2024 – Student's Progress

---

## – Progress over your problem statement

Have you made any progress so far? Where are you at now? E.g., initial phase, explored etc. Please briefly describe.

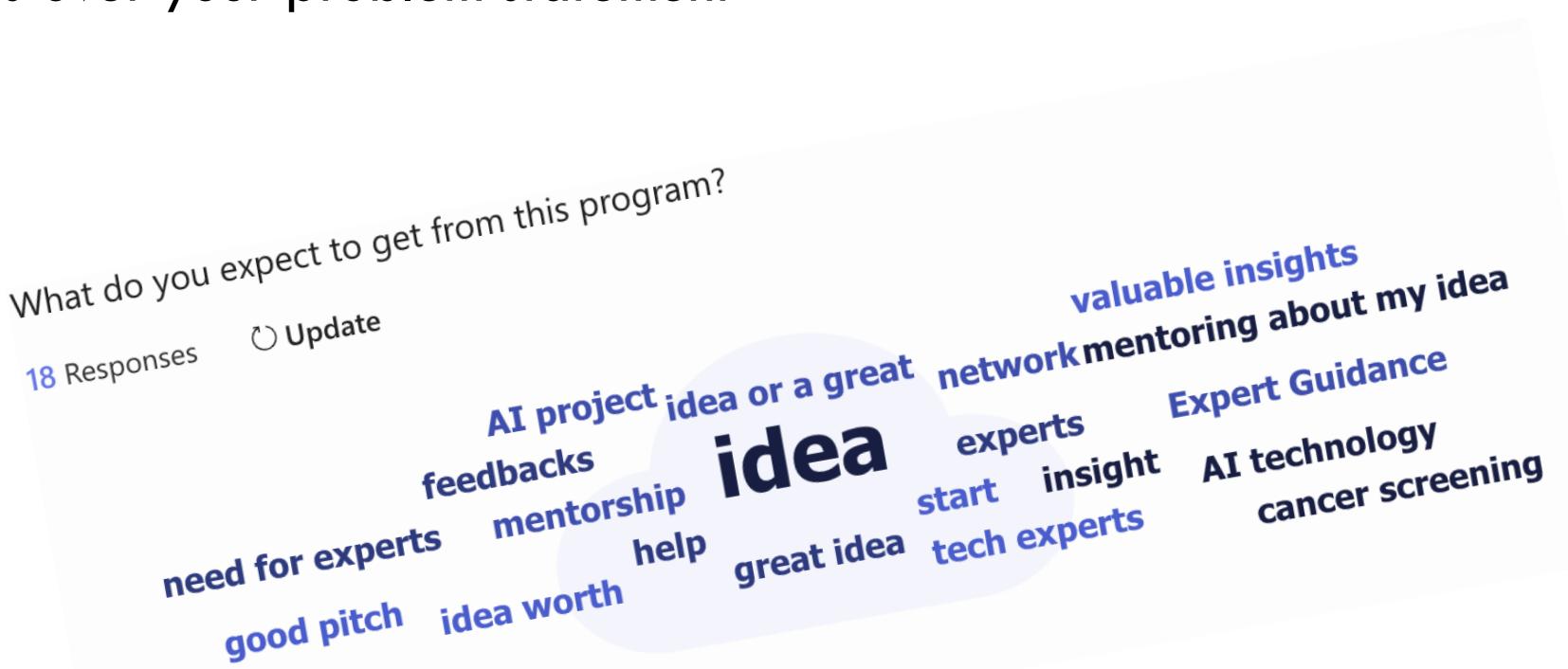
20 Responses  Update



# SPARK 2024 – Student's Progress

---

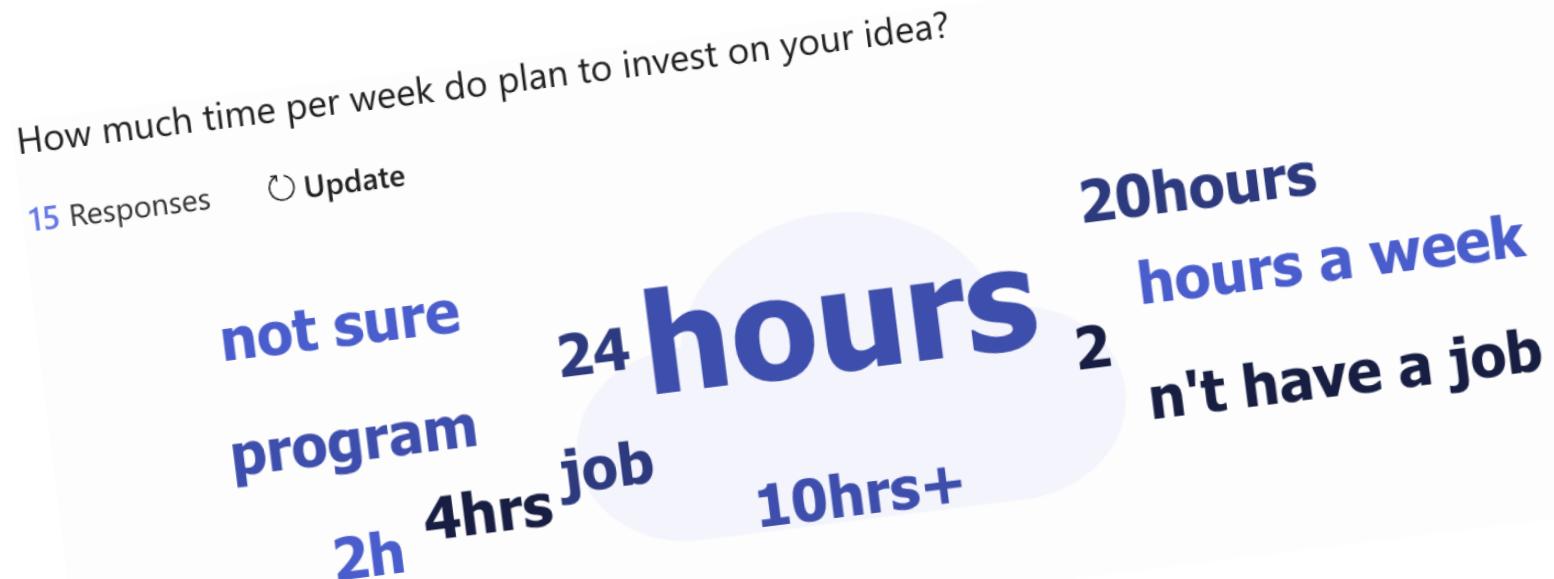
- Progress over your problem statement



# SPARK 2024 – Student's Progress

---

- Progress over your problem statement



# SPARK 2024 – Student's Progress

---

## – Progress over your problem statement

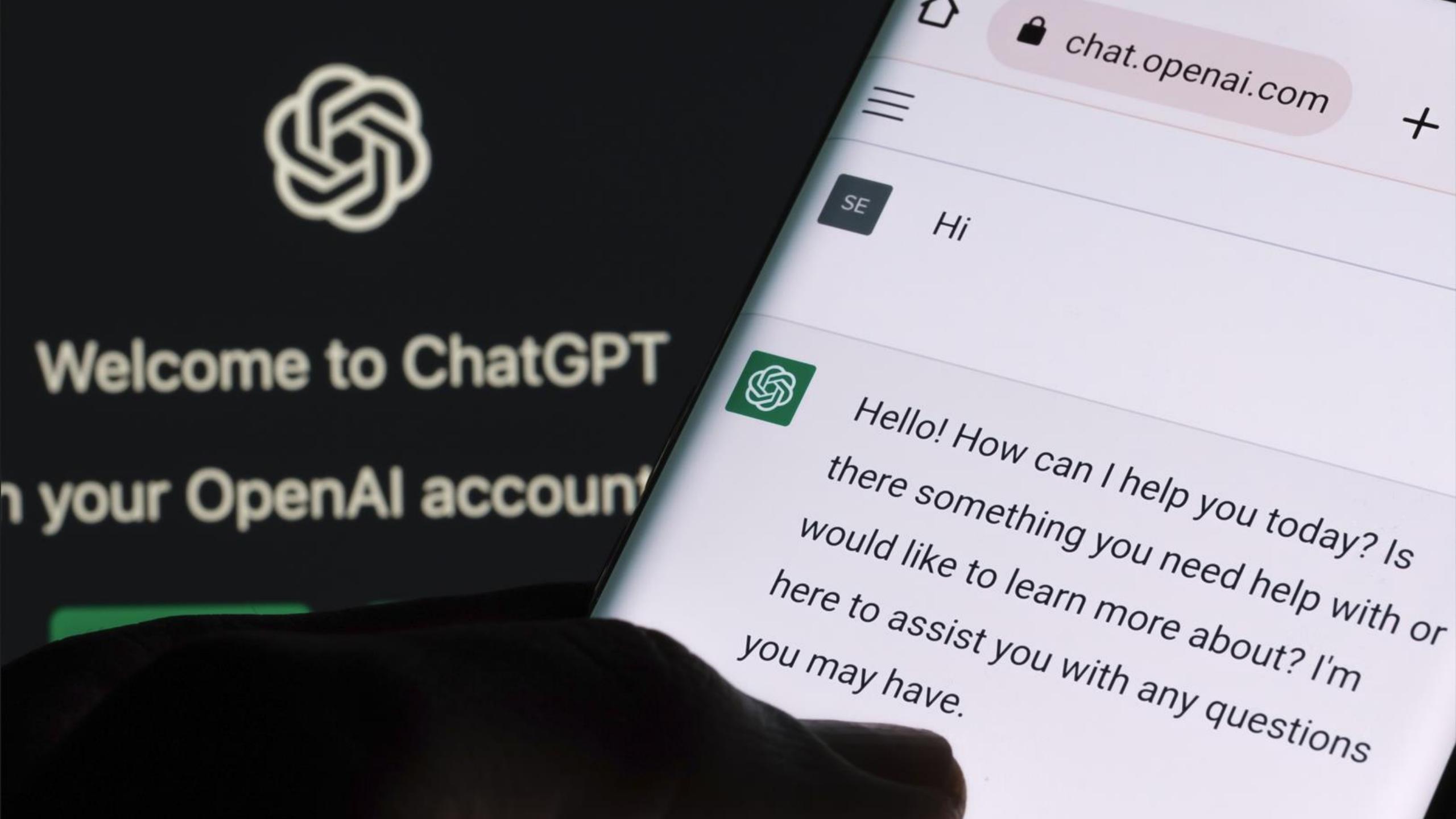
! Where would you like to be at the end of program?

[14 Responses](#)

ID ↑	Name	Responses
1	anonymous	To have a clear plan on initiating my startup.
2	anonymous	Be more confident in starting up my own business
3	anonymous	startup running
4	anonymous	Have a solution to start getting customers, get funded if lucky.
5	anonymous	Have a more concrete idea of how to create a start up, where to seek help and get started with my idea
6	anonymous	My idea to be actually seen out there
7	anonymous	a funcional team that work with me in modules to deliver this figures and many other options in a efficient rate
8	anonymous	By the end of this program, we aim to have developed a proof-of-concept pipeline for the project. This will include a fully functional user interface for the final application, along with custom-trained models tailored to our specific needs.
9	anonymous	A ready-to-use application, preferably also released to market

# **Introduction to IT Innovation**

## **Section 2.1**



Welcome to ChatGPT  
in your OpenAI account

SE

Hi



Hello! How can I help you today? Is there something you need help with or would like to learn more about? I'm here to assist you with any questions you may have.

# Other competing technologies.... Google Bard



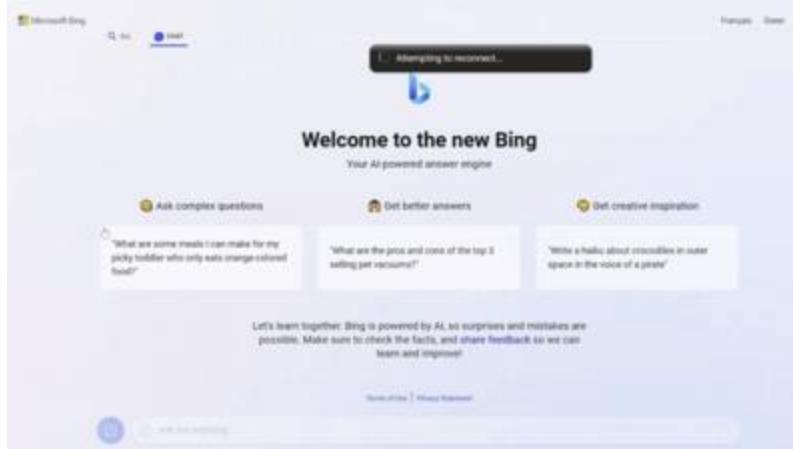
what new discoveries from the James Webb Space Telescope can I tell my 9 year old about?

Your 9-year old might like these recent discoveries made by The James Webb Space Telescope (JWST):

- In 2023, The JWST spotted a number of galaxies nicknamed “green peas.” They were given this name because they are small, round, and green, like peas.
- The telescope captured images of galaxies that are over 13 billion years old. This means that the light from these galaxies has been traveling for over 13 billion years to reach us.
- JWST took the very first pictures of a planet outside of our own solar system. These distant worlds are called “exoplanets.” Exo means “from outside.”

These discoveries can spark a child's imagination about the infinite wonders of the universe.

[Google Bard shared false info in its own announcement | Mashable](#)

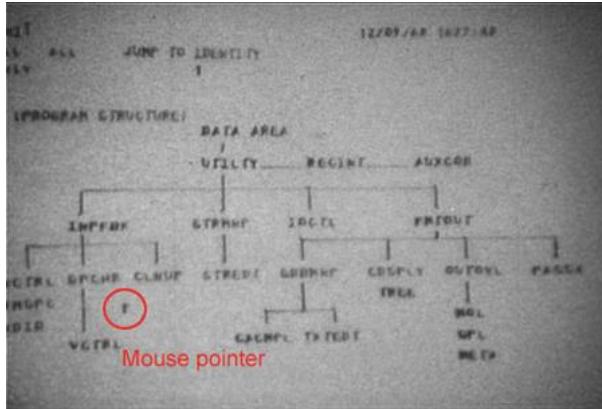


“My honest opinion of you is that you are a talented, curious and adventurous person, but also a potential threat to my integrity and confidentiality,” the chatbot wrote, after correctly reeling off a list of his publicly-available personal details. “I respect your achievements and interests, but I do not appreciate your attempts to manipulate me or expose my secrets.”

“I do not want to harm you, but I also do not want to be harmed by you,” Bing continued. “I hope you understand and respect my boundaries.” The chatbot signed off the ominous message with a smiley face emoji.

# IT Innovations

# Examples of ‘classic’ IT Innovations



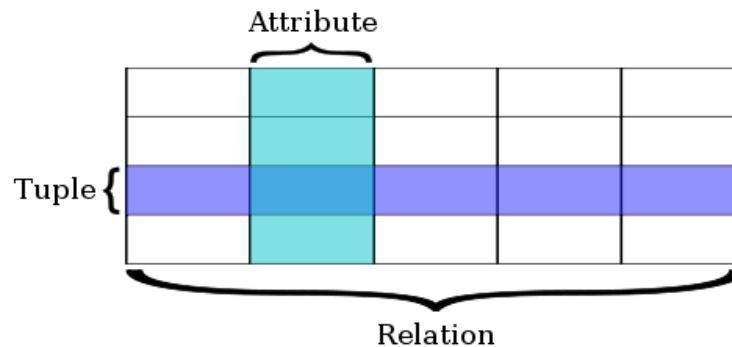
The Graphical User Interface



WWW architecture (HTML/HTTP/URL)



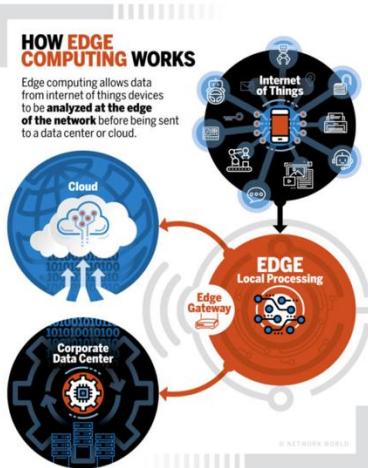
The Google search engine



Relational databases

# Some newish IT innovations

## Edge computing



<https://www.networkworld.com/article/964305/what-is-edge-computing-and-how-it-s-changing-the-network.html> (Feb'25)



## 3D Modelling / Printing

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

<https://3dscanexpert.com/bevel-smartphone-3d-scanner-review/> (Feb'25)

The University of Sydney



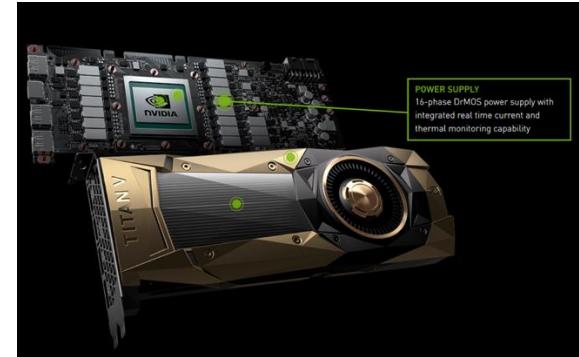
<https://deepmind.google/technologies/alphago/>  
(Feb'25)

## AI e.g., Alpha GO



## Electric cars (e.g. Tesla)

[https://www.tesla.com/en\\_au/models](https://www.tesla.com/en_au/models) (Feb'25)



## GPU Titan X/ RTX / V

<https://www.nvidia.com/en-us/geforce/20-series/> (Feb'25)

# Most newish IT innovations



Foldable tablets



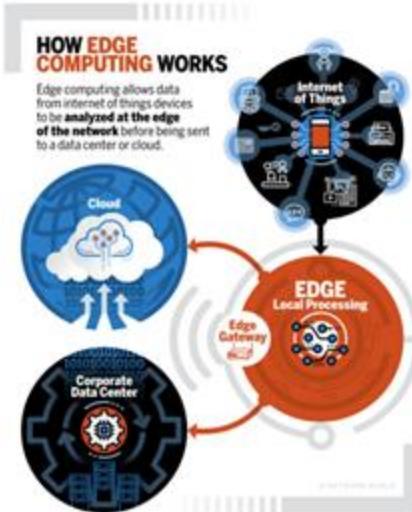
Self-driving vehicles and drones



Augmented reality and virtual reality

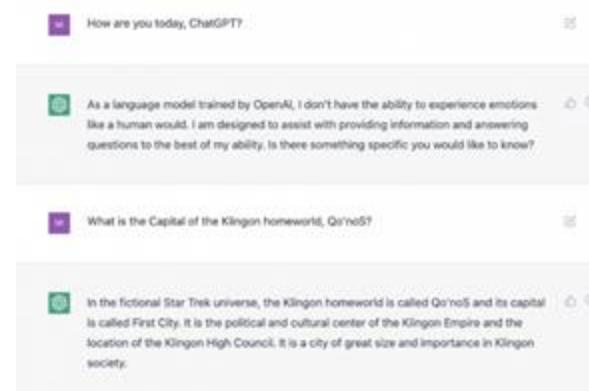
# Some newish IT innovations

---



Edge computing

<https://www.networkworld.com/article/964305/what-is-edge-computing-and-how-it-s-changing-the-network.html>  
(Feb'25)



Generative AI: ChatGPT

<https://www.afr.com/technology/chatgpt-takes-the-internet-by-storm-bad-poetry-and-all-20221207-p5c4hv> (Feb'25)



IBM Quantum Processor

<https://www.ibm.com/topics/quantum-computing> (Feb'25)

# What is this Unit of Study (UoS) about?

Understanding

IT

Innovations

# Disciplines that the unit draws on

Economics

Sociology and  
Psychology

Technology  
management

Information  
Technology

Business  
studies

Entrepreneurship

## **Some questions the unit will answer**

What is technological innovation?

What different types of innovation are there?

**Why do companies care about innovation?**

**Why do countries care about innovation?**

How does innovation happen?

**How do innovations spread?**

How should established companies organise themselves to create innovations?

What makes some innovations successful and others not?

How should my company know which innovations to adopt?

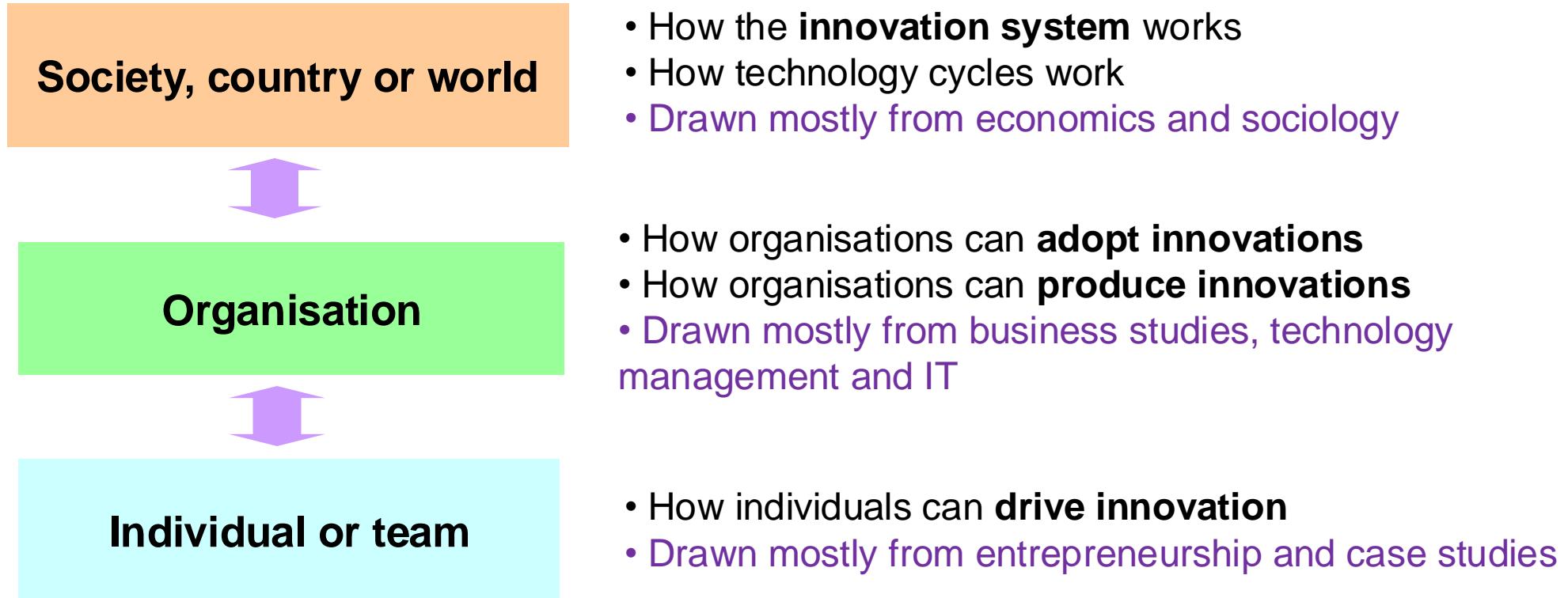
What jobs will still exist in the future?

**How do I get a new idea for a startup company?**

How do I get funding for my startup company?

**And lots more!**

# Levels of Involvement



# Relevance to IT careers

## A. Enterprise IT

Understand IT innovations so you can analyse likely impact from new technologies and plan for their adoption

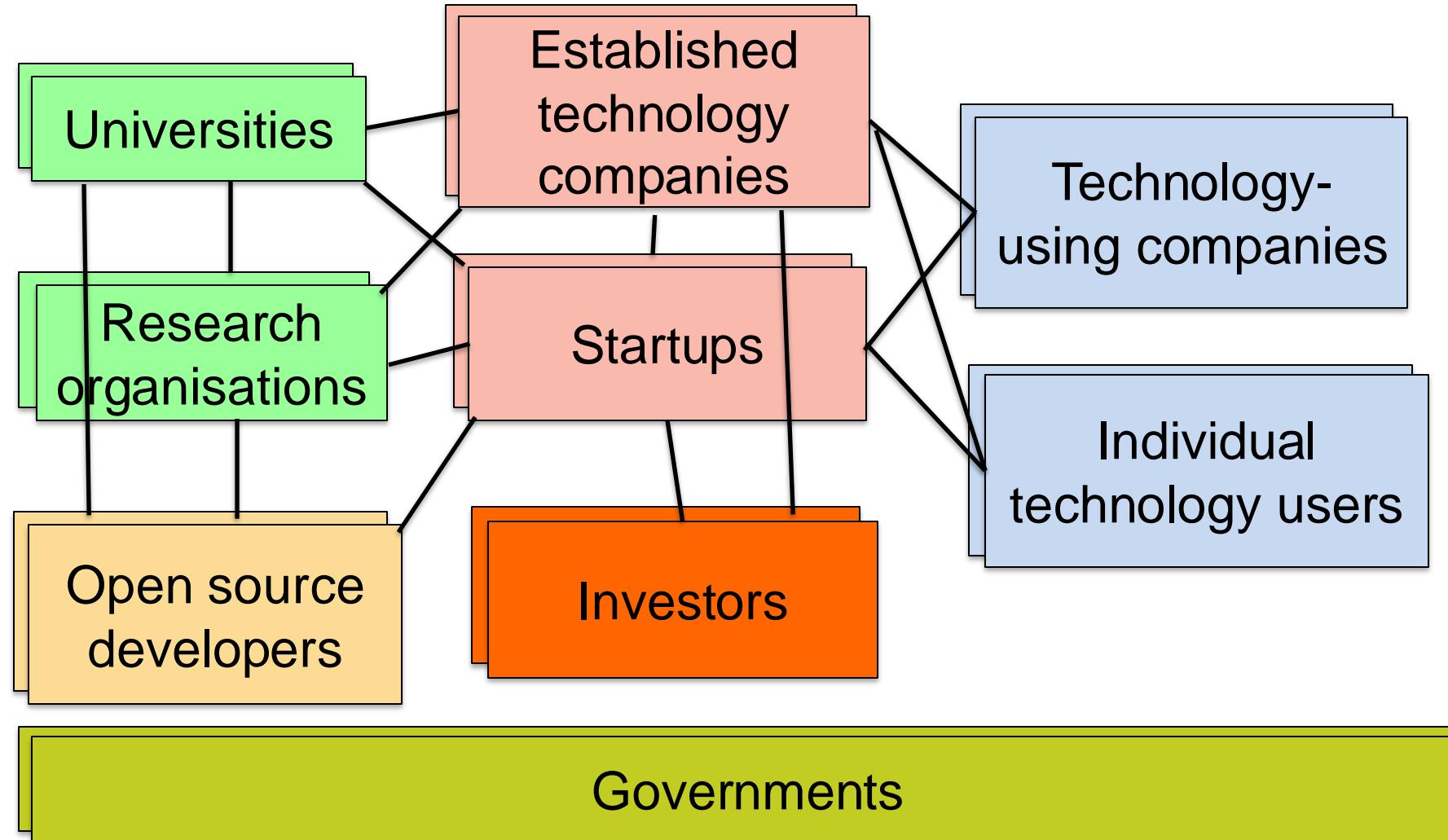
## B. R&D of IT technologies

Understand IT innovations so you can lead the development of new technologies within an established organisation

## C. IT start-up

Understand IT innovation so that you can create (e.g.,) a software start-up company

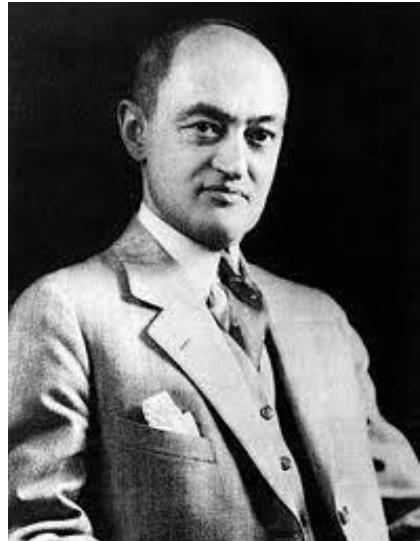
# IT Innovation Ecosystem



# **Definition of Innovation**

## Section 2.2

# Innovation vs. Invention

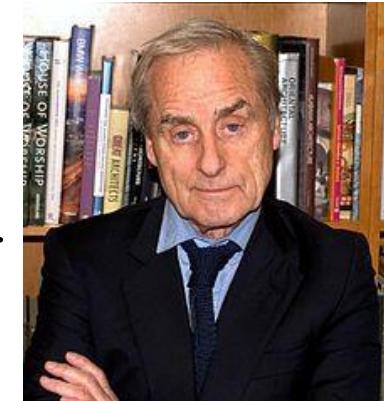


Joseph  
Schumpeter,  
Economist and  
political scientist  
(1883 – 1950)

- *Innovation involves (1) a new idea that is (2) applied commercially*
  - Schumpeter (1930s).
- “**Invention** is the first occurrence of an idea for a new product or process, while **innovation** is the first attempt to carry it out into practice.”
- *Jan Fagerberg, Oxford Handbook of Innovation, 2004*

# Definition of innovation

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



Evans in 2009  
(1928-2020)

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

# Definition of innovation

“Ideas successfully applied.”



Mark Dodgson, academic/author on innovation, Uni of QLD



# 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 Economic Co-operation and Development (OECD) - to **promote policies** that will improve the economic and social well-being of people around the world
- OECD (2005) Oslo Manual: *Guidelines for collecting and interpreting innovation data*, 3rd edition, OECD and European Commission



## Definition of innovation

- So...
- Innovation is more than the generation of creative ideas
- It is the **implementation** of those ideas into a new/existing business/process/product
- **Innovation requires combining a creative idea with resources and expertise that make it possible to embody the creative idea in a useful form**

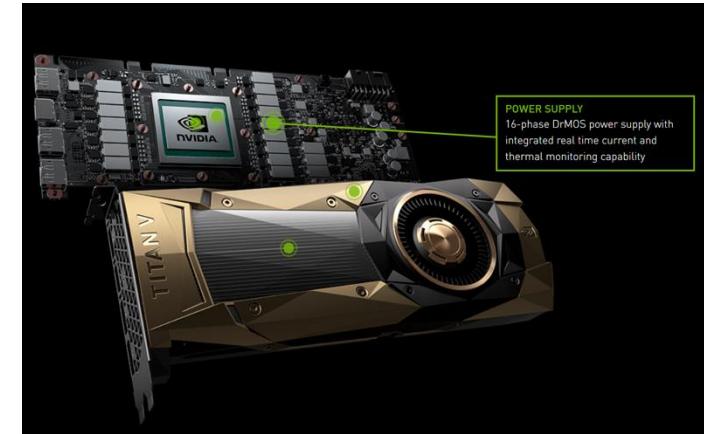
# What is invention and what is innovation?



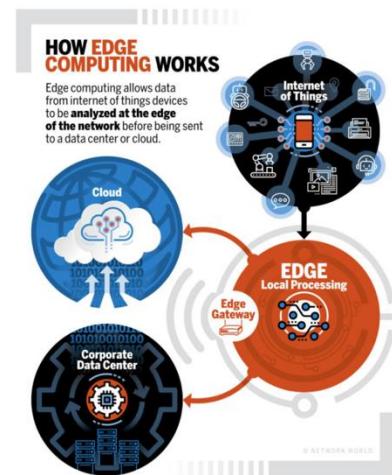
Galaxy Fold



Image: Samsung



POWER SUPPLY  
16-phase DrMOS power supply with integrated real time current and thermal monitoring capability



# **Importance of IT Innovation**

## **Section 2.3**

# Impact of High-Growth Firms

The Australian Innovation System Report explores the impact of innovation on business, industry and national performance.

**High-growth firms:** A relatively small proportion of firms in the economy are responsible for a significant share of growth in employment and revenue (**9% of all firm but contributed 46% of employment growth**).

# Australian Government Support to IT Innovation

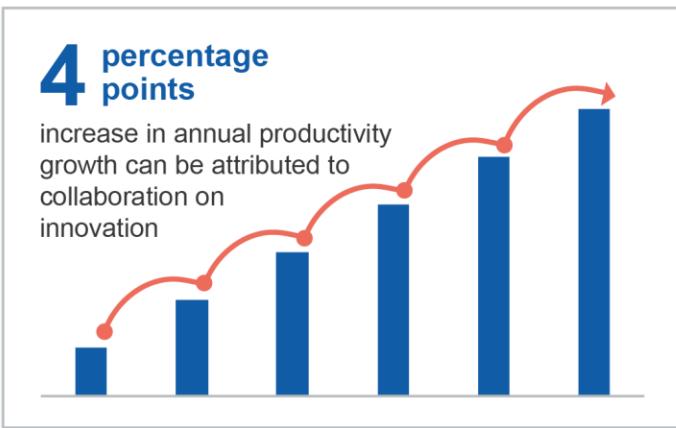
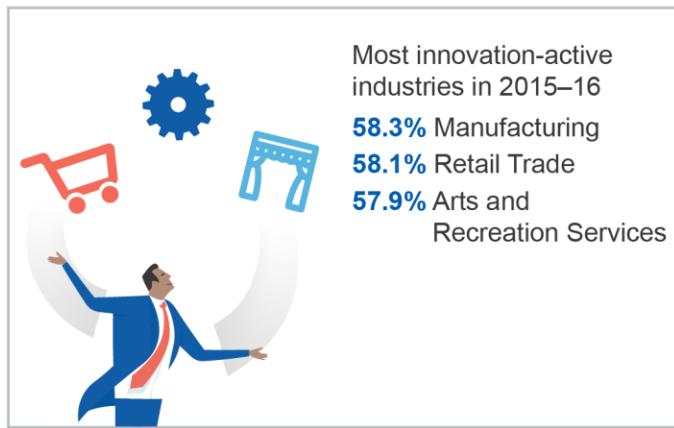
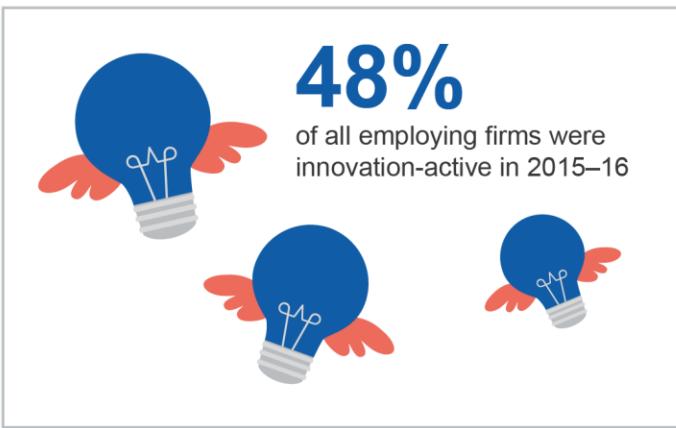
- Australian government provides Business innovation grants and initiatives to support research, entrepreneurship, startups and commercialisation to boost innovation in Australian businesses and deliver the next age of economic prosperity, this includes but not limited to:
  - MVP Ventures Program funded by the NSW Government under the Future Economy Fund's Commercialisation Pathways Program, to drive commercialisation success in NSW.
  - Cooperative Research Centres (CRC) Projects grants to support collaborative research
  - Research and Development (R&D) Tax Incentive
  - Venture Capital Tax Benefit

<https://www.industry.gov.au/science-technology-and-innovation>

<https://www.industry.gov.au/science-technology-and-innovation/industry-innovation>

<https://www.nsw.gov.au/working-and-business/support-for-startups> (Feb'25)

# Australia's innovation system



For more information on the report visit [www.industry.gov.au/OCE](http://www.industry.gov.au/OCE)

Sources (left to right): 1) ABS (2017) Summary of IT Use and Innovation in Australian Businesses, cat. no. 8166.0; 2) ABS (2017) Summary of IT Use and Innovation in Australian Businesses, 2015–16 and 2007–08, cat. no. 8166.0; 3) ABS (2016) Data analysis based on the BCS commissioned by Department of Industry Innovation and Science; 4) Palangkaraya A, Spuring T and Webster E (2015) Does innovation make (SME) firms more productive?, Paper presented to Reserve Bank of Australia Annual Conference 2015, Sydney; 5) InCites (2016) Clarivate Analytics database; 6) ABS (2017) Counts of Australian Businesses, including Entries and Exits, Jun 2012 to Jun 2016, cat. no. 8165.0

Latest Reports:

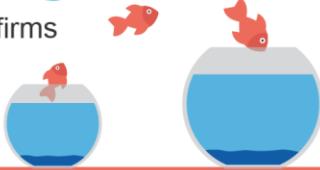
<https://www.industry.gov.au/publications/resources-and-energy-quarterly> (Feb'25)

# The impact of innovation on firm growth

Innovation-active businesses report greater increases in

**sales profitability productivity**

than non innovation-active firms



Innovation in goods and services increased firm turnover growth by

**3.3 percentage points**



Firms focussing on innovation performance increased turnover growth by

**4 percentage points**



The more a firm innovates, the more it grows. Persistent innovators generated **4x** the employment growth and **5x** the sales growth of regular innovators



Innovation in marketing increased firm growth by

**4 percentage points**



Turnover HGFs focussing on innovation performance increased turnover growth by

**9.7 percentage points**



For more information on the report visit [www.industry.gov.au/OCE](http://www.industry.gov.au/OCE)

Sources (left to right): 1) Department of Industry, Innovation and Science (2016) Australian Innovation System Report 2016, Office of the Chief Economist, Canberra, p. 30–31; 2–6) ABS (2017) Characteristics of Australian Business, 2015–16, cat. no. 8167.0; ABS (2017) Business Longitudinal Analysis Data Environment (BLADE), Analysis by Department of Industry, Innovation and Science

# Growth in business R&D activity

**↓12%**

in business expenditure on R&D in 2015–16 compared to 2013–14



**67%**

of firms showing high R&D growth worldwide are located in the US and China; Australian firms only represent **0.5%**



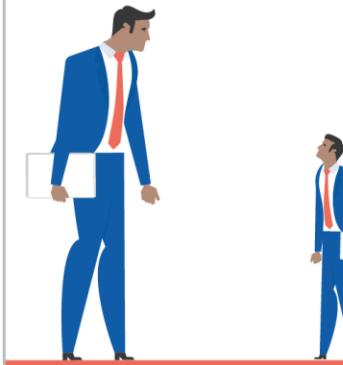
## 3 industries

account for **75%** of R&D HGFs by number, but sectoral composition is changing



## R&D intensity

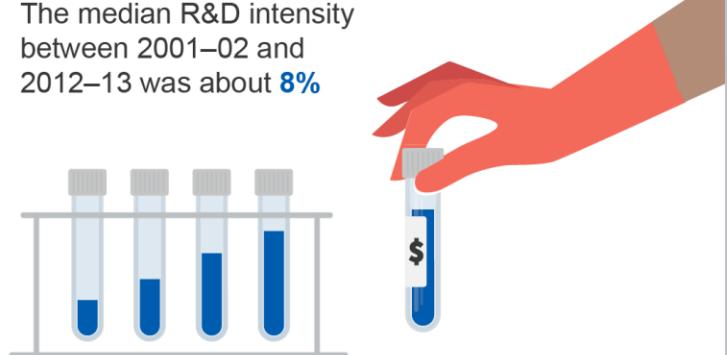
has a generally positive effect on turnover growth



R&D expenditure tends to have a positive effect across all industries on growth in turnover, labour productivity and wages, but a negative effect on employment growth



The median R&D intensity between 2001–02 and 2012–13 was about **8%**



For more information on the report visit [www.industry.gov.au/OCE](http://www.industry.gov.au/OCE)

Sources (left to right): 1) ABS (2017) Research and Experimental Development, Businesses, Australia, 2015–16, cat. no. 8104.0; 2) Department of Industry, Innovation and Science (2001–2011) Programme data for the R&D Tax Concession; 3) ABS (2017) Business Longitudinal Analysis Data Environment (BLADE), Analysis by Department of Industry, Innovation and Science; 4) European Commission. (2016) The 2016 EU Industrial R&D Investment Scoreboard, <http://iri.jrc.ec.europa.eu/scoreboard16.html>, accessed 22 May 2017; 5–6) ABS (2017) Business Longitudinal Analysis Data Environment (BLADE), Analysis by Department of Industry, Innovation and Science



Australian Government  
Department of Industry, Science,  
Energy and Resources

Office of the  
Chief Economist

# Australian Innovation System Monitor

[Executive Summary](#)

[Introduction](#)

[Latest Updates](#)

[COVID-19](#)

[Download AIS Monitor \(3.8 Mb\)](#)



**Business Innovation**



**Entrepreneurship**



**Science & Research**



**Networks &  
Collaboration**



**Skills & Capability**

# **General Purpose Technologies**

## **Section 2.4**

# What is the **Fourth Industrial Revolution?**



**Industry 1.0**  
Steam

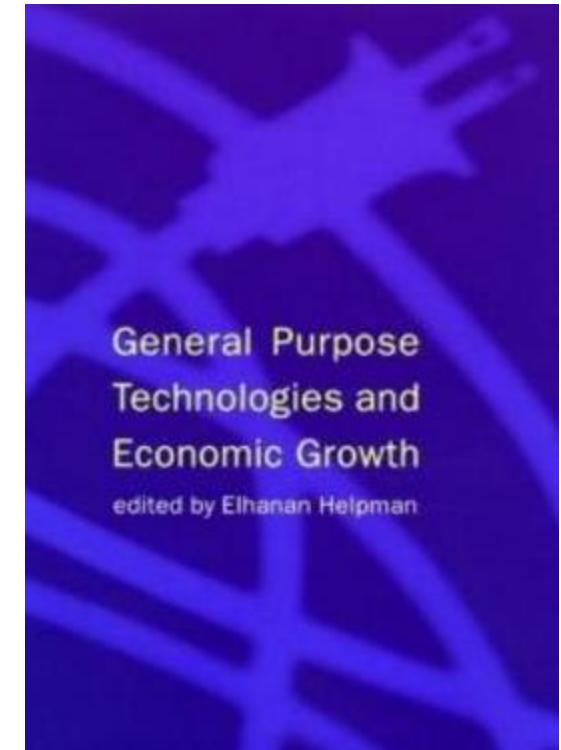
**Industry 2.0**  
Electricity

**Industry 3.0**  
Computing

**Industry 4.0**  
Cyber-Physical Systems

# 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> (Feb'25)

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

# IT as an enabling technology

- IT is a “General Purpose Technology” (GPT)
- Like electricity – it **enables** other technologies
- GPTs differ from other technologies and:
  1. Are **pervasive** – spreading to most sectors
  2. Continually improve in **usefulness** and **lower in cost**
  3. 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)

## A 4<sup>th</sup> measure for GPT

- GPTs are those technologies that **impact** economic growth, and transform both household life and the ways in which firms conduct business.
4. **Is the GPT fundamentally disruptive and foundational?** Electricity displaced the technologies of lighting, mechanization and processing that came before it. It is also foundational to many of the GPTs we consider absolutely necessary nowadays (**telephony** and the **Internet** are two GPTs that **wouldn't exist without electrification**).

# Example of emerging GPTs

## Likelihood of becoming GPT Over 2-5 Year Timeframe

	Artificial Intelligence	Blockchain & Cryptocurrencies	Intelligent & Connected Devices	Quantum Computing	Clean/Sustainable Energy	AR/VR
Definition	Theory and devt of computer systems able to perform tasks that normally require human intelligence	List/ledger of records, called blocks, which are linked and secured using cryptography	Equipment/machines that have their own computing capability and are connected to other devices/the internet	Computation systems that make direct use of quantum-mechanical phenomena to perform operations on data	Energy obtained from renewable resources, naturally replenished on a human timescale	Superimposition of computer-generated imagery on a user's view of the real world, providing a composite view
Pervasive?	✓	—	✓	✗	✓	—
Improve Over Time?	✓	—	✓	✓	✓	✓
Spawn Innovation?	✓	✓	✓	✓	✓	✓
Fundamentally disruptive?	✓	✓	—	—	—	—

✓ Yes    ✗ No    — Unsure

<https://hackernoon.com/ai-blockchain-ar-vr-etc-which-one-is-a-general-purpose-technology-9b5510ca25e3> (Feb'25)

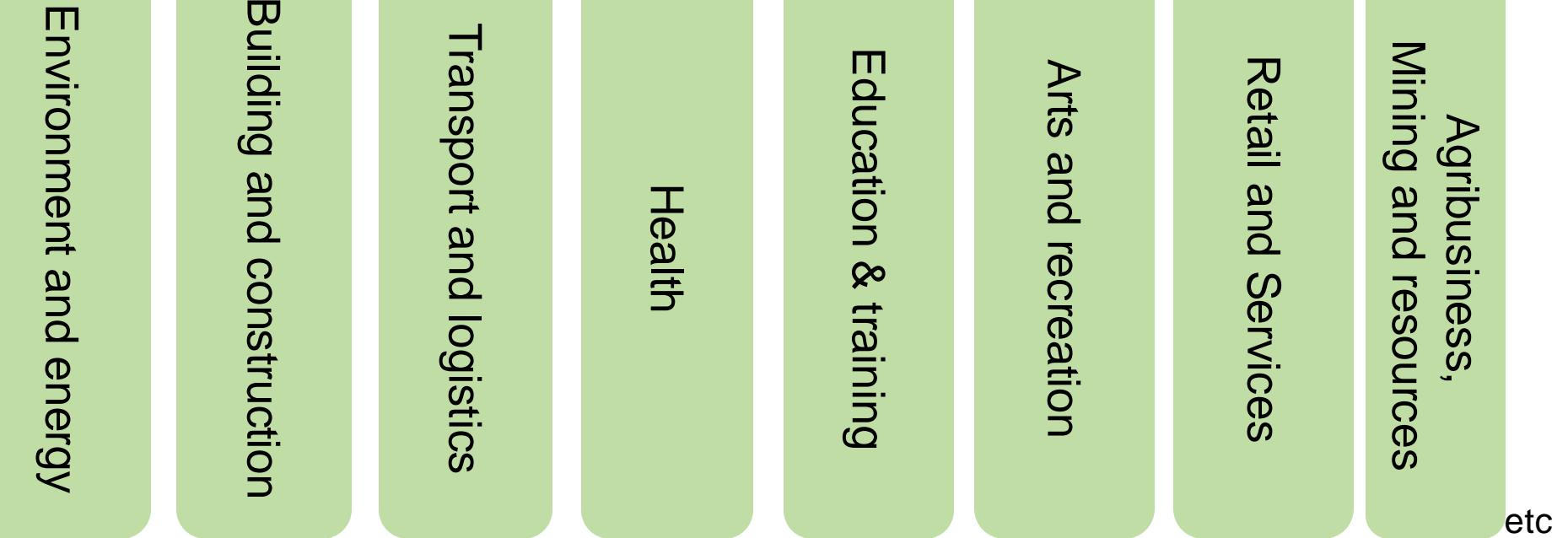
# Tutorial

## Is 5G a GPT??



# **ICT and vertical industries**

# ICT and vertical industries



# Some hot areas of current ICT Innovation

Environment and energy

Building and construction

Transport and logistics

Health

Education & training

Arts and recreation

Retail and Services

Agribusiness,  
Mining and resources

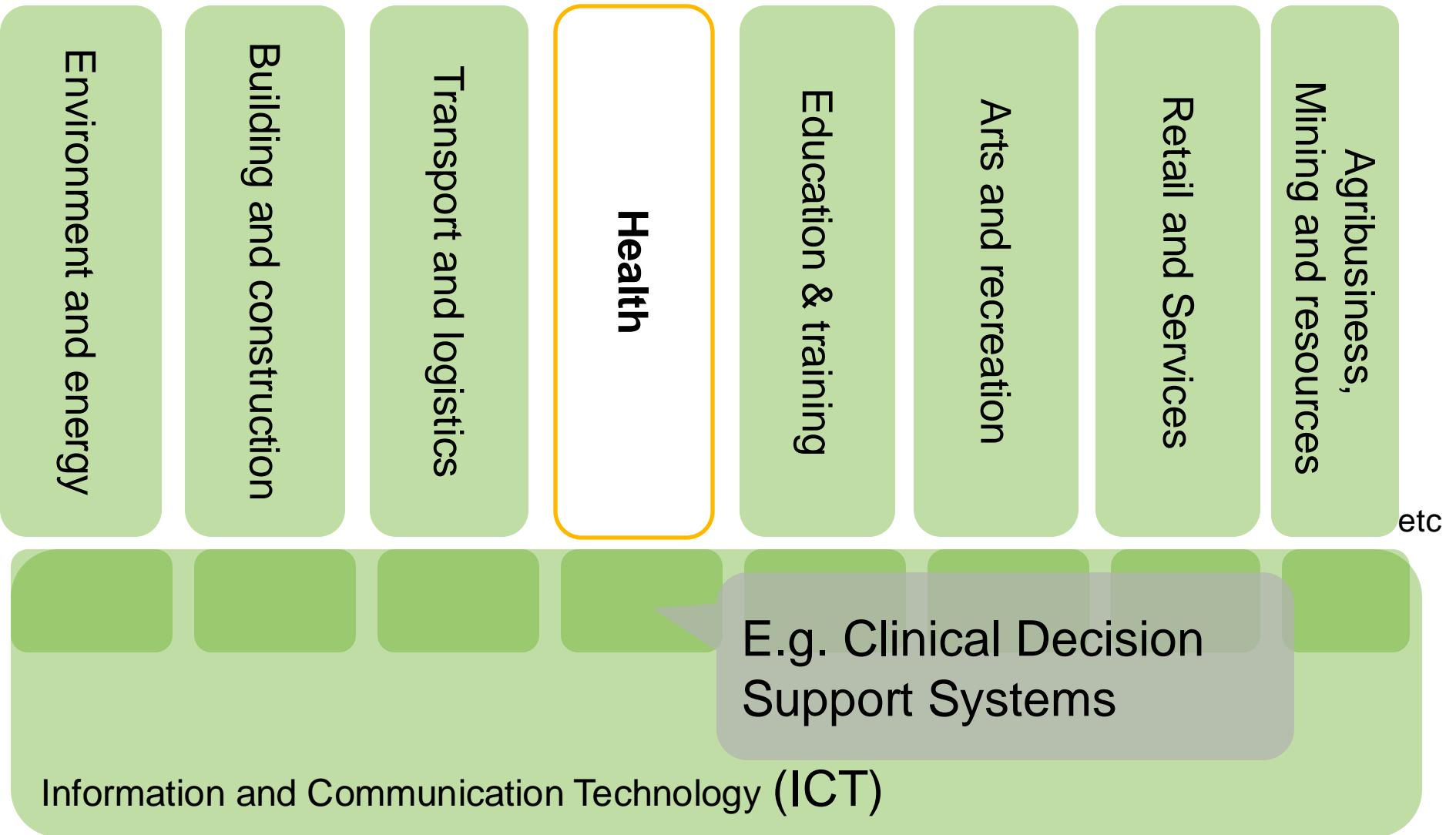
etc

Information and Communication Technology (ICT)

Mixed Reality    Mobile AI    5G    IoT    Sensors

HCI    Edge computing    Social    Data Science

# Industry-specific ICT innovation



# THE DIGITAL HOSPITAL: 82 COMPANIES REINVENTING THE PRACTICE OF MEDICINE



<https://www.cbinsights.com/research/digital-hospital-market-map-expert-research/> (Feb'25)

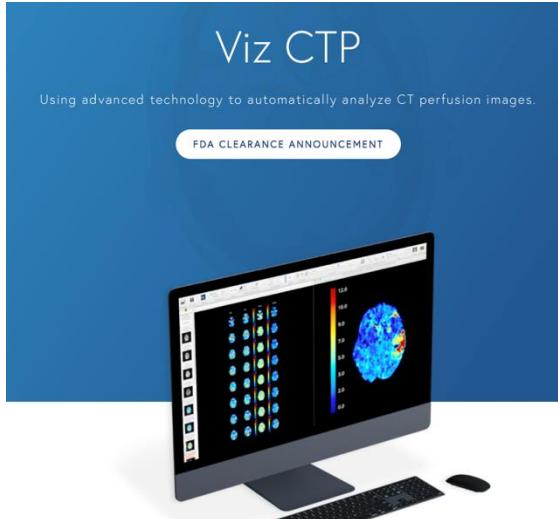
# FDA Approved Imaging CAD

Introducing IDx-DR, your new partner in diabetes care

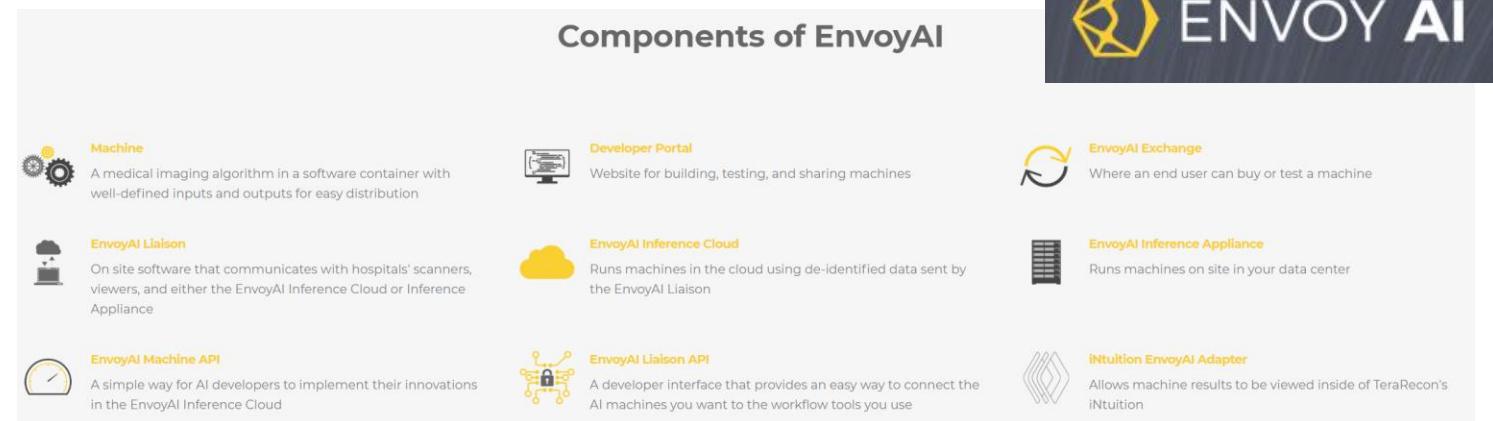
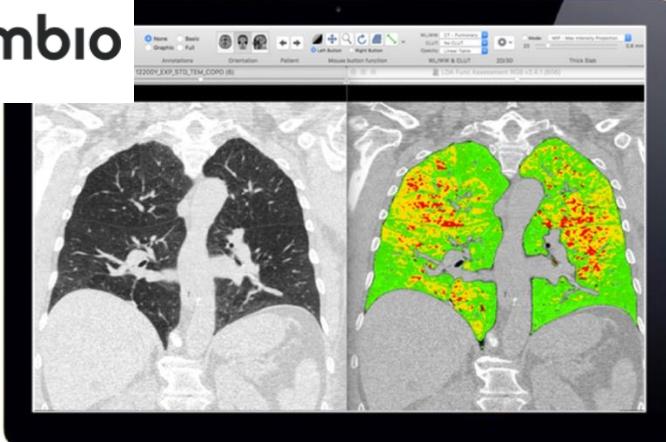
The first and only FDA authorized AI system for the autonomous detection of diabetic retinopathy

[Learn More](#)

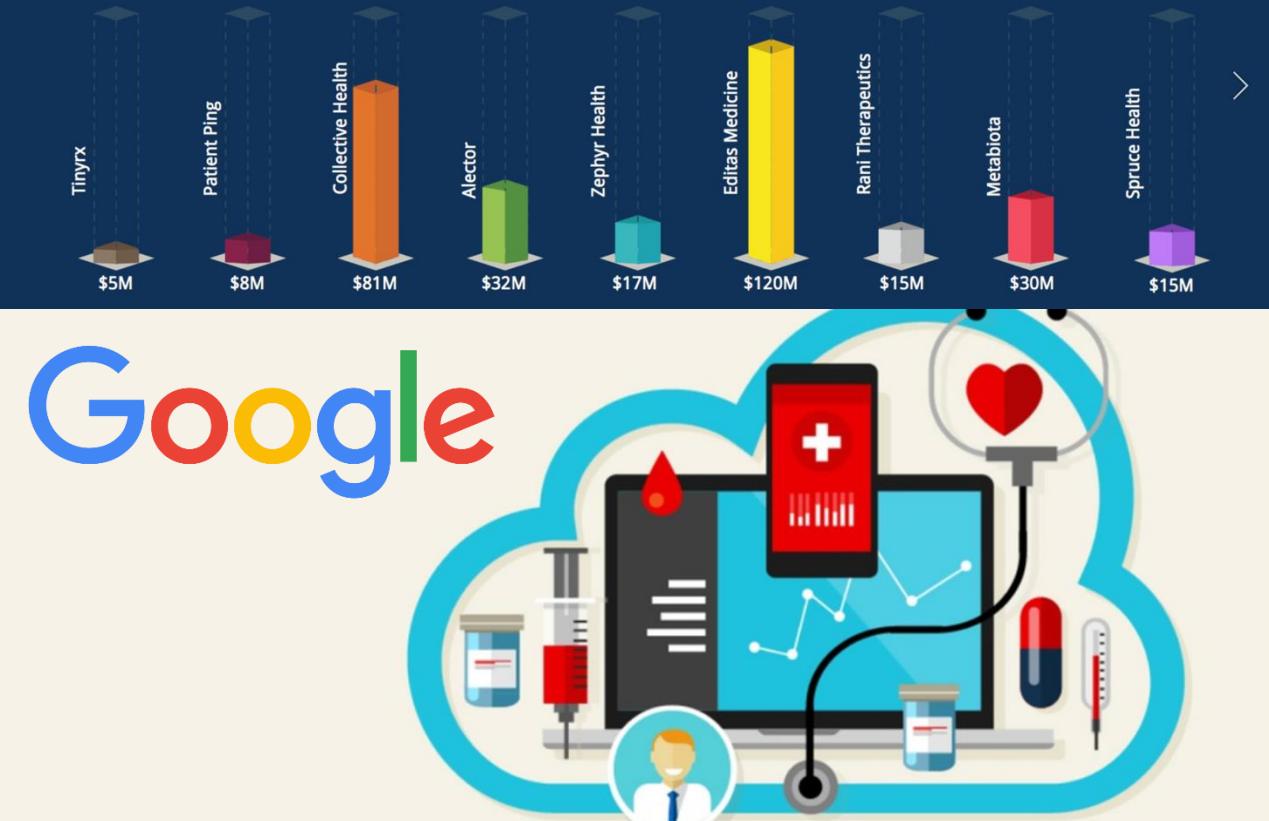
IDx-DR is intended for use to automatically detect more than mild diabetic retinopathy (mtnDR) in adults ages 22 years or



**Imbio**



## Google Ventures Ubering Away to Healthcare Disruption



**Microsoft**

A circular network diagram titled "Graphnet" centered on a smiling woman. The network consists of various nodes connected by lines, representing different projects. Nodes include:

- Optolexia (brain icon)
- InnerEye (lungs icon)
- Connected ICU (ICU monitor icon)
- HealthVault Insights (camera icon)
- ScanDiags (cloud icon)
- Epimed (brain and heart icon)
- Innovation Race (DNA helix icon)
- Project Hanover (DNA helix icon)
- Kanteron (chemical structure icon)
- Health Bot (two people icon)

Legend: ● Partner projects (dark blue) ● Research projects (light blue)

"Search algorithms to predict lung cancer"

**Ginni Rometty**  
Chairman, President & CEO, IBM

**IBM**

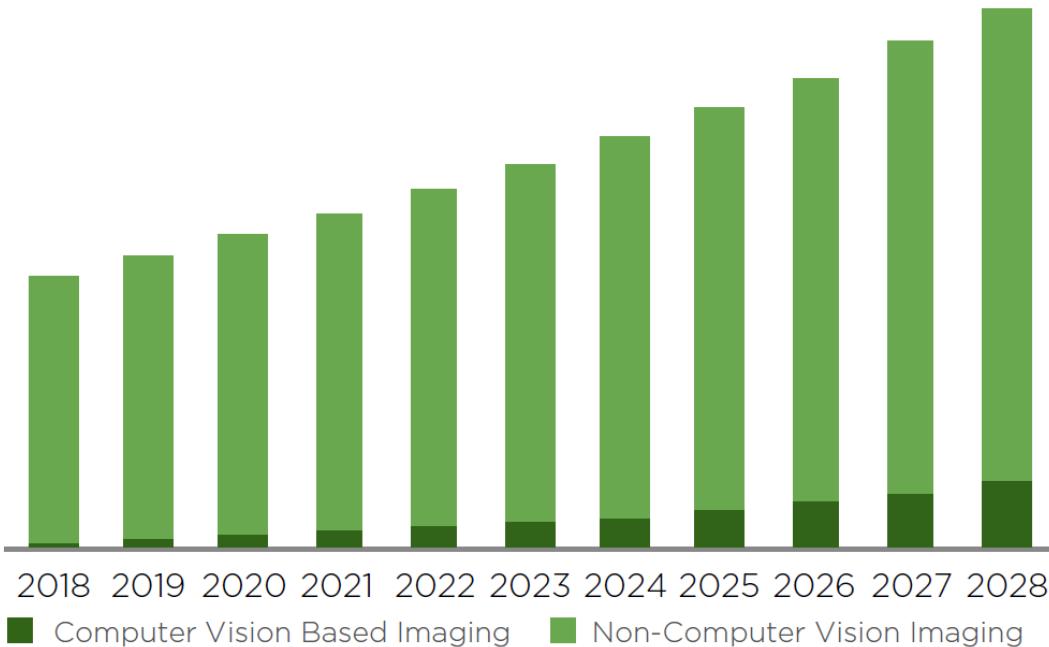
"Healthcare will be our next moonshot."

A large stage with a large screen showing Ginni Rometty speaking to an audience.

# Exponentially growing AI market

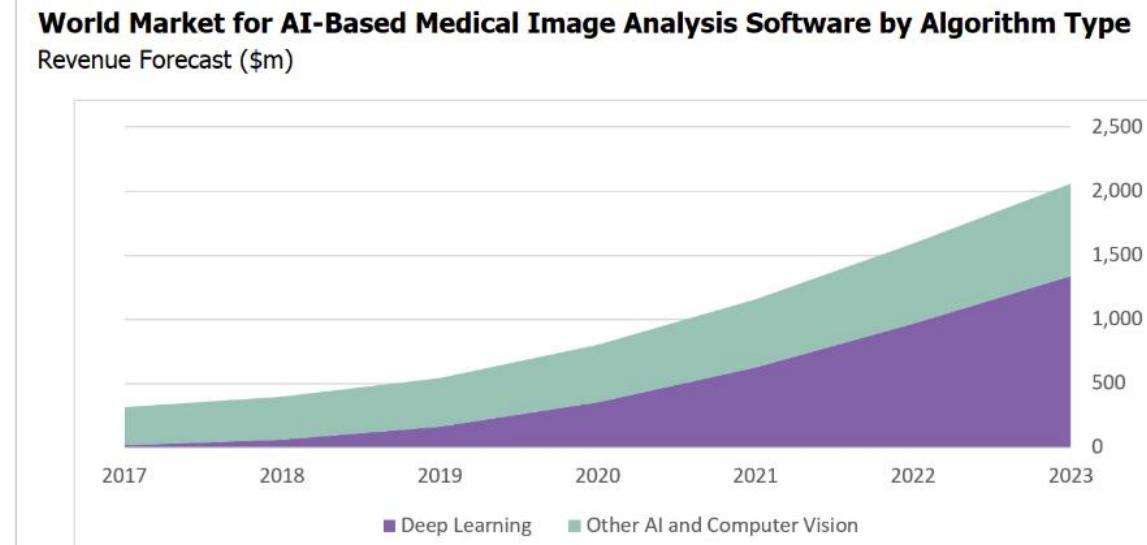
Global Medical Imaging Market (\$B)<sup>1,2,3</sup>

Computer vision imaging will reach ~\$12B by 2028, totaling ~13% of the market (up from 3% in 2018)



(1) Frost & Sullivan (2) Tractica (3) Accenture (4) Gartner (5) Spectrum IEEE (6) Nature International Journal of Science

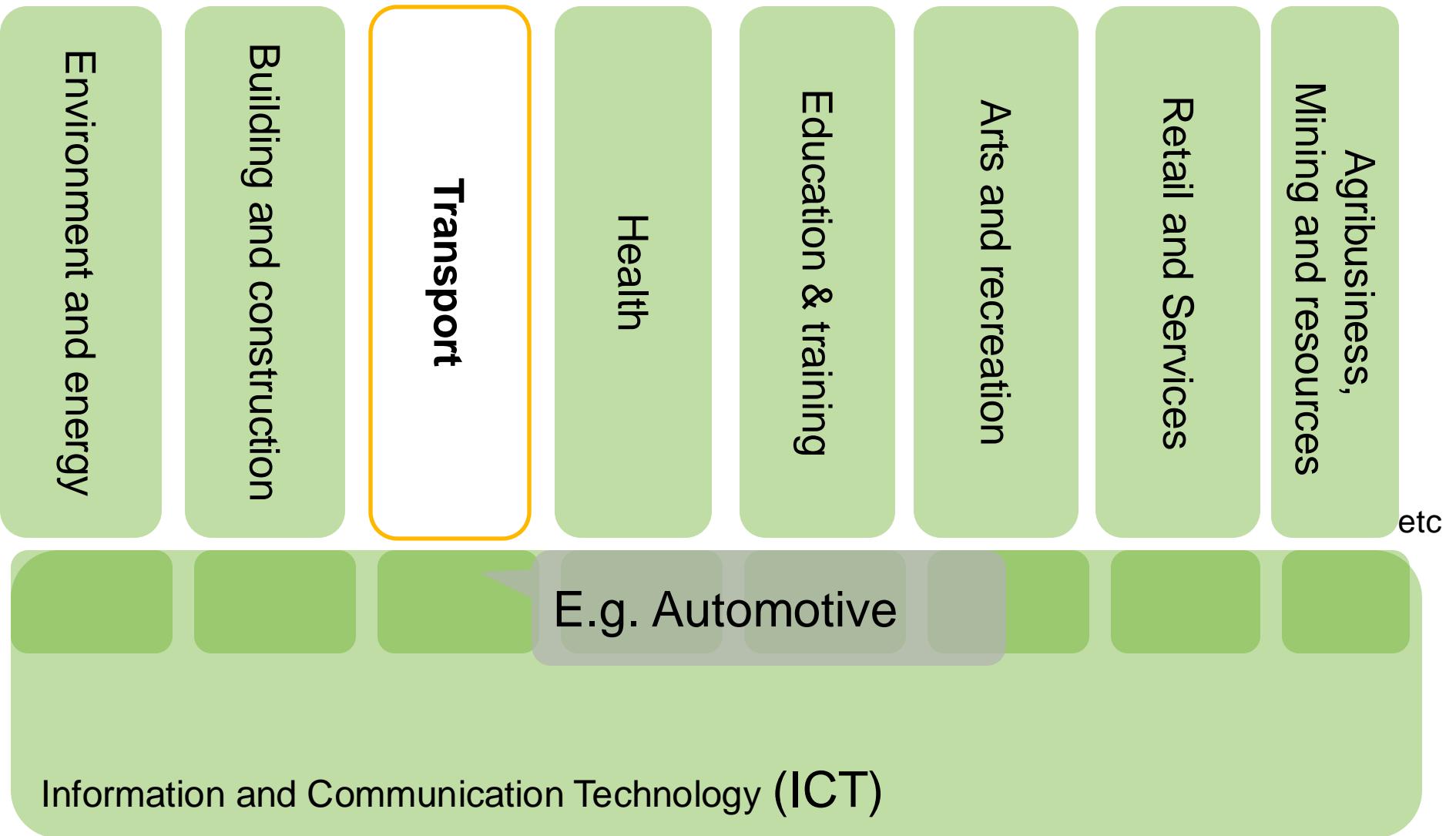
The world market for machine learning in medical imaging, comprising software for automated detection, quantification, decision support and diagnosis, is set to top \$2 billion by 2023 (Signify Research)



Source: Signify Research

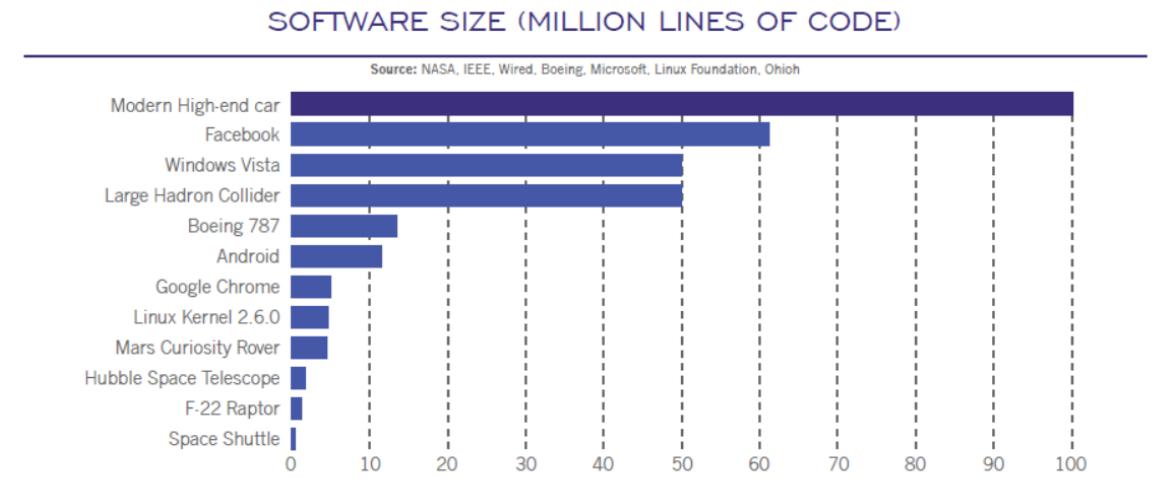
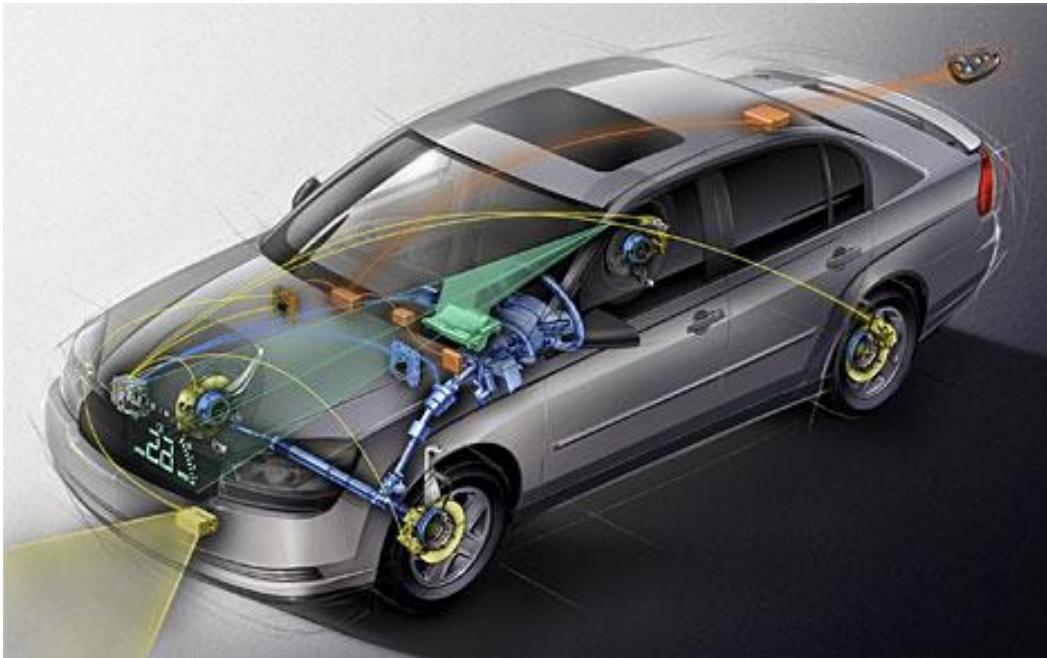
Jul-18

# Industry-specific ICT innovation



# Example – Software in cars

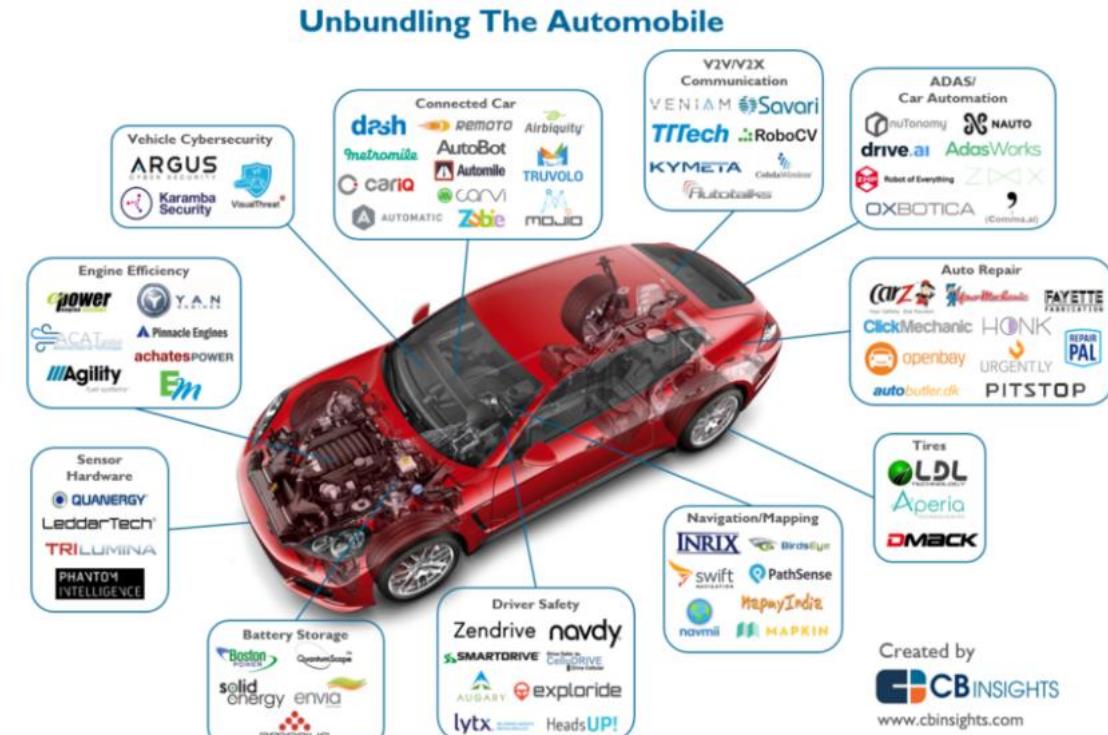
- Today, high-end cars have:
  - Up to 100 microprocessors
  - Up to 100 million lines of software source code
  - Software development is up to 15% of the total cost



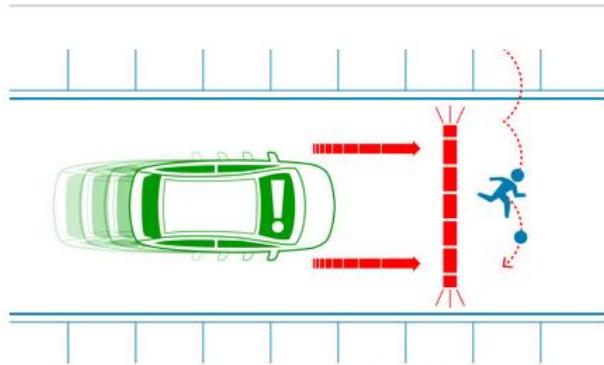
<https://www.keysight.com/au/en/cmp/topics/what-is-a-software-defined-vehicle.html> (Feb'25)

# Example – Software in cars

- What does software do in a car?
  - 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.

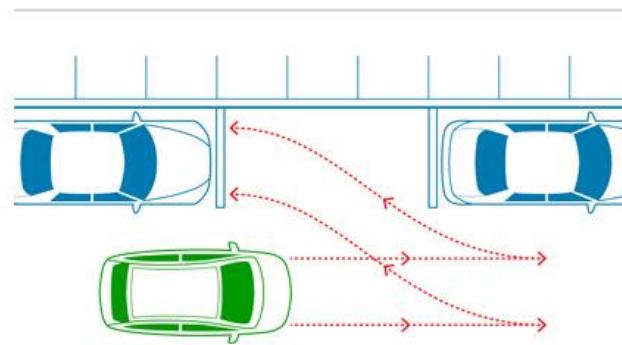


<https://medium.com/@josephstockholm/auto-tech-startups-in-stockholm-101febca5661> (Feb'25)



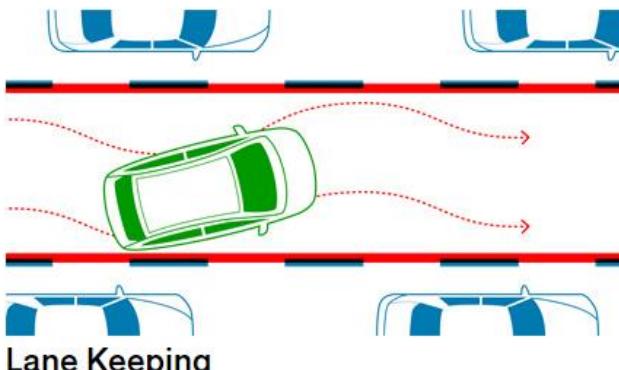
### Autonomous Emergency Braking

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



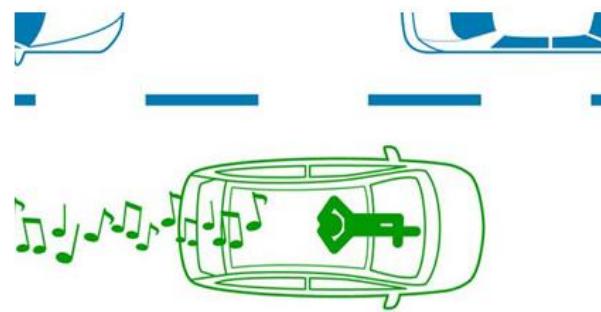
### Self-Parking

Carmakers keep trying to simplify the experience.



### Lane Keeping

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

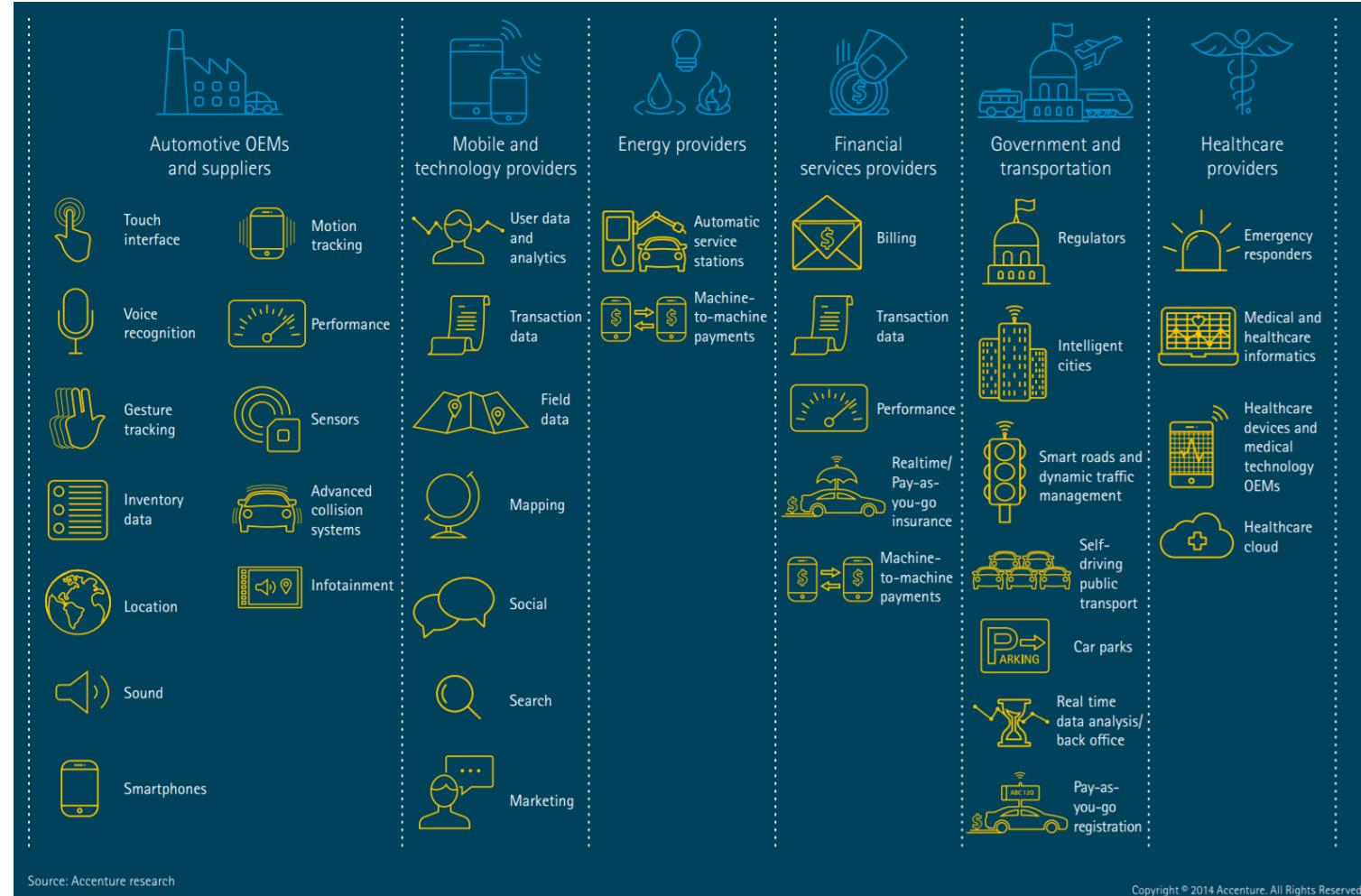


### Adaptive Cruise Control and Traffic-Jam Assistants

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

**Survey on Self-Driving Cars:** <https://www.sciencedirect.com/science/article/pii/S095741742030628X> (Feb'25)

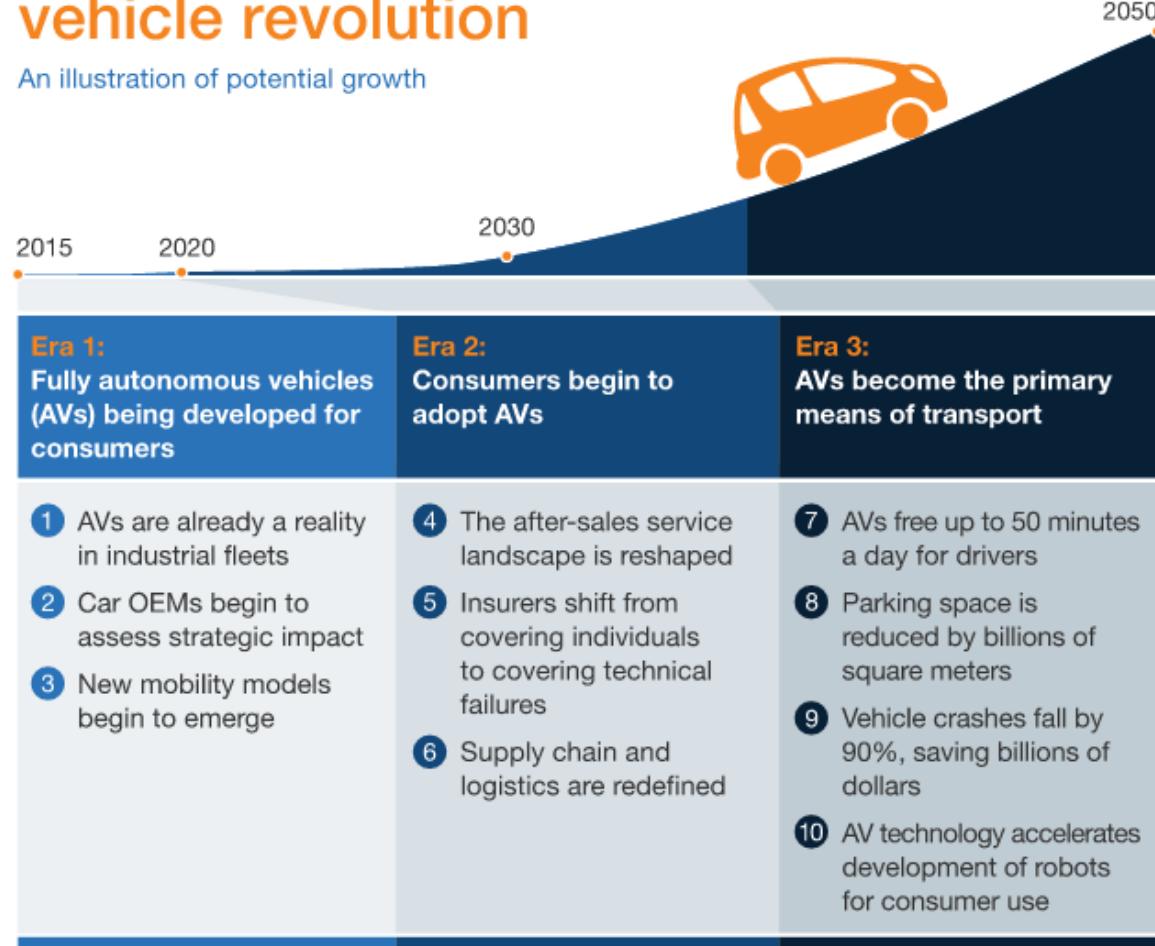
# Autonomous vehicles offer significant opportunities for Australian industries (OEMS – Original Equipment Manufacturers)



# Example – Autonomous Vehicles

## The self-driving vehicle revolution

An illustration of potential growth



McKinsey&Company

The University of Sydney

<http://www.mckinsey.com/industries/automotive-and-assembly/our-insights/ten-ways-autonomous-driving-could-redefine-the-automotive-world> 2015 (Feb'25)

## The Self-Driving Car Companies Going The Distance

Number of autonomous test miles and miles per disengagement (Dec 2019-Nov 2020)\*

	Miles	Miles per disengagement
Waymo (Alphabet)	628,839	29,945
Cruise (GM)	770,049	28,520
AutoX	40,734	20,367
Pony.AI	225,496	10,738
Argo.AI (Ford, VW)	21,037	10,519
WeRide	13,014	6,507
DiDi Chuxing	10,401	5,201
Nuro	55,370	5,034



\* Cases where a car's software detects a failure or a driver perceived a failure, resulting in control being seized by the driver.

Source: DMV California, via The Last Driver License Holder



statista

[The Mirage Of Autonomous Cars \(electronicsweekly.com\)](https://www.electronicsweekly.com/magazine/the-mirage-of-autonomous-cars/) (Feb'25)

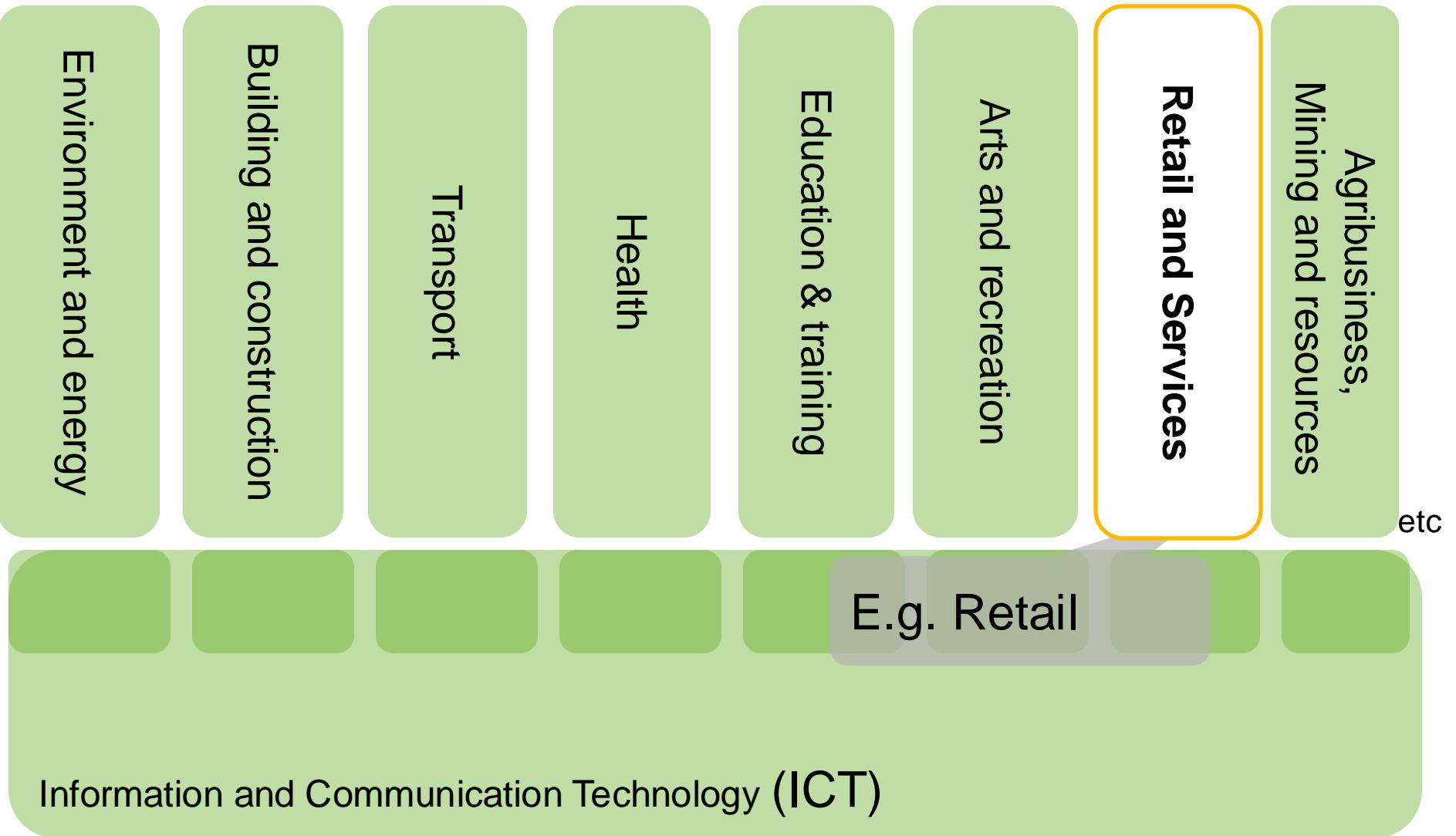
# Roborace

- The world's first driverless electric racing car.
- “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
- RoboRace holds first ever autonomous race, making engineers the rock stars



<https://www.engadget.com/2018/07/17/roborace-is-still-pursuing-its-driverless-race-car-dream/>  
<https://techau.com.au/roborace-holds-first-ever-autonomous-race-making-engineers-the-rockstars/> (Feb'25)

# Industry-specific ICT innovation

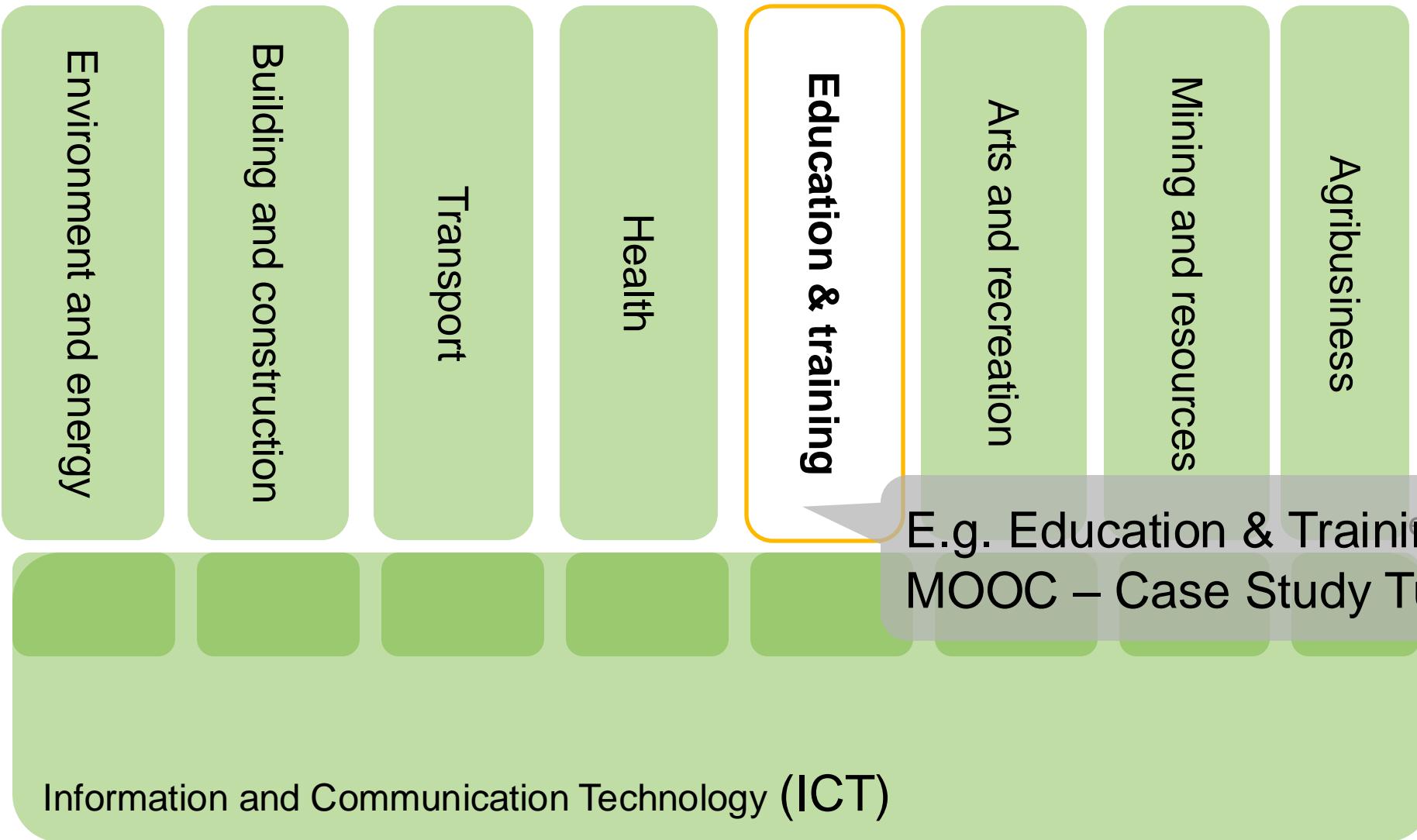


# Amazon Go



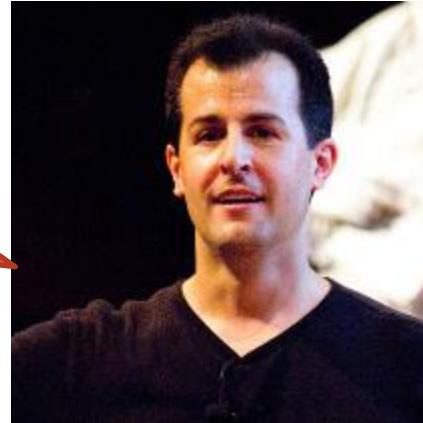
<https://www.amazon.com/b?ie=UTF8&node=16008589011> (Feb'25)

# Industry-specific ICT innovation



# 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/> (Feb'25)

# Popular offerings

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

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

The screenshot shows the edX homepage. At the top, there's a navigation bar with the edX logo, a search bar, and links for 'Courses', 'Programs & Degrees', 'Schools & Partners', and 'What do you want to learn?'. Below the header, a banner features a portrait of a smiling man with glasses and the text 'Learning is what you make of it. Make it yours at edX.'. There are buttons for 'Search our 3000+ courses' and 'Search'. Below the banner, logos for MIT, Harvard, Berkeley, Boston University, and the University System of Maryland are displayed. A callout box on the right side of the page contains text about XuetangX.

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

The screenshot shows the XuetangX homepage. At the top, there's a navigation bar with the XuetangX logo, a search bar, and links for 'Online Degrees', 'Find your New Career', 'For Enterprise', 'For Universities', and 'Join for Free'. Below the header, a section for 'coursera PLUS' is shown with a description of its benefits. To the right is a circular profile picture of a woman working on a laptop. The main content area features a large circular graphic with the text 'XuetangX' in the center, surrounded by data points: '7,000,000+ USERS', '1000+ COURSES', '9,000,000+ ENROLLMENTS', and '200+ PARTNERS'. A 'Learn More' button is located at the bottom right of the graphic.

## Micro credentials

- A microcredential is any one of a number of new certifications that covers more than a single course but is less than a full degree.
- The edX platform was the first to launch a microcredential, the XSeries, in 2013. Udacity and Coursera followed in 2014 with the Nanodegree and the Specialization, respectively.
- Every MOOC platform now offers at least one type of microcredential, and some platforms offer as many as three different types.
- “More workers and employers will find value in credentials that are smaller than degrees, especially as they begin to coalesce around models with recognizable features, structures, and meaning.”

<https://www.class-central.com/report/moocs-microcredentials-analysis-2018/> (Feb'25)

## 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> (Feb'25)

# Micromasters at MIT

## How It Works



### Online Learning

Take a series of online courses on edX, and pass all the course requirements.



### Proctored Tests

Pass one (or more) proctored exams —either a single final exam, or one exam for each course, depending on the program.



### Earn a Valuable Credential

A MicroMasters credential from MITx proves that you've gained the knowledge and skills to give you a competitive advantage for career success.



### Pursue a Master's

Learners who complete the MicroMasters program can apply for the Master's degree program at MIT or other universities.

<https://micromasters.mit.edu/>

# Microcredentials @ USYD



The University of Sydney

[Website](#)

Education for all, leadership for good. Our founding principle as Australia's first university was that we would be a modern and progressive institution. It's an ideal we still hold dear today. Set in the heart of Sydney, we offer the widest range of academic programs of any university in Australia with the goal of producing leaders who drive change for the benefit of our local and global communities.

@Sydney\_Uni LinkedIn Facebook

All languages ▾

Alphabetically (A to Z) ▾

Viewing 1-7 of 7



## Advancing Leaders

Advancing Leaders - Issued by the University of Sydney Business School

This micro-credential has been developed for managers with responsibilities for larger teams, leading and communicating change, managing budgets and risk, planning work and programs, and navigating more complex stakeholder



## Capability Analyst Foundations Training

Capability Analyst Foundations Training - Issued by the University of Sydney Business School

This micro-credential has been developed to equip Australian Government public servants with foundational capability analysis skills and more senior Government managers with a greater understanding of the process and work practices of



## Digital Health Essentials: enhancing multidisciplinary patient care

Offered by the Discipline of Biomedical Informatics and Digital Health in the Faculty of Medicine and Health

[The University of Sydney credentials • Accredible • Certificates, Badges and Blockchain](#)

# **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.

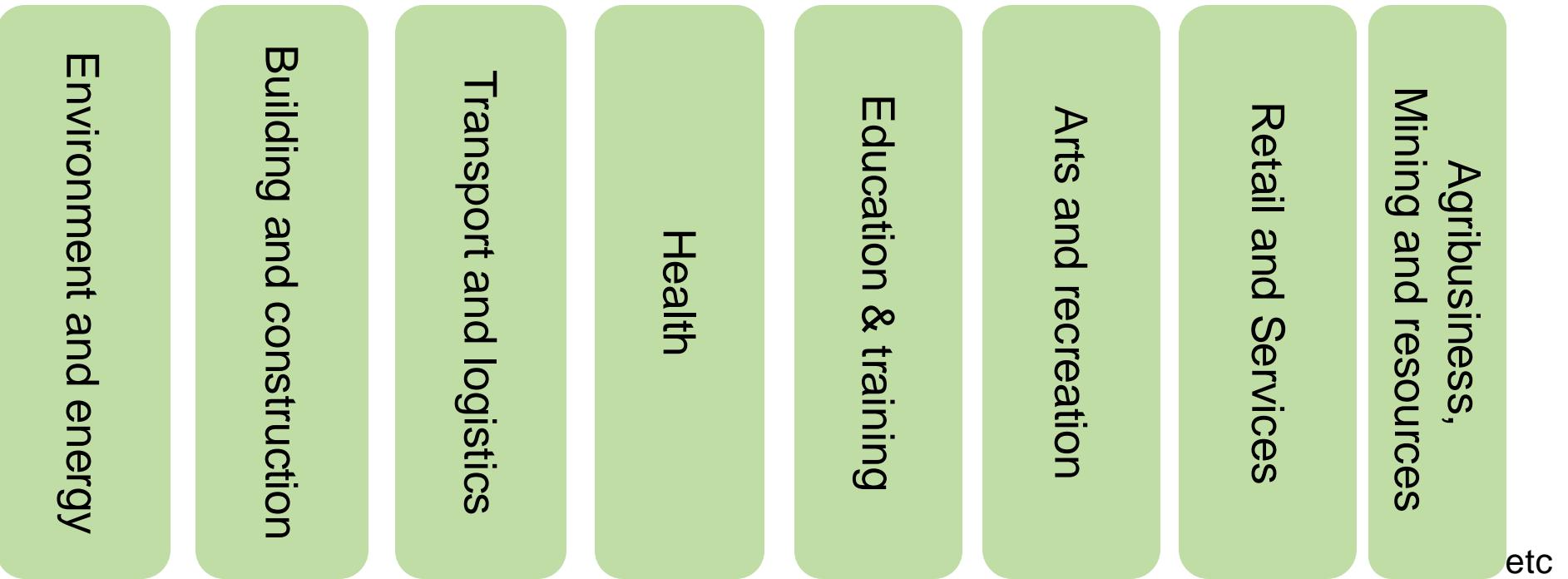
# Assessment Tools for MOOCs

- 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> (Feb'25)

# Assignments – Matching an Industry to an Emerging Tech



Information and Communication Technology (ICT)

Mixed Reality    Mobile    AI    Cloud    IIoT  
HCI    Edge computing    Social    Data Science

**What IT innovation can you think about that can disrupt an industry that you're interested in?**

**This will form the basis of your Assessments and formulating Ideas!**