ICT Graduates for the Future | Digital transformation
ACDICT

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Borges’ Map
The world becomes its own map
What the Google self-driving car sees
Self-mapping: Things describe themselves
Streetline: Smart parking spaces
Self mapping: Things describe themselves
Waze: Paris traffic through a day
Self-interpreting
NYU Center for Data Science: What a smart cycle helmet perceives
Borges’ Map

Our understanding of the world, embedded in the world

Artificial Intelligence

Internet of Things

Big Data

Mobility
Moravec’s paradox
“The hard problems are easy and the easy problems are hard”

It is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility

- Hans Moravec *Mind Children* 1988 (emphasis added)
Image recognition
Stanford ImageNet contest (100,000 images); ArXiv2015 algorithm
Perception breakthrough
ImageNet contest error rates

Captioning video
Andrej Karpathy’s Neuraltalk2 running on a laptop

a man in a suit and tie standing in front of a building
Sensorimotor control: Industrial robots
The standard architecture: programmed, deterministic non-scalable
Sensorimotor control
Boston Dynamics’ “Spot:” mobile, autonomous, dexterous, robust
Maps & Explorers
Patterns of disruption

Maps

Information (gathered from billions of sensors)

Big Data (globally, ~35 zettabytes)

Intelligence (delivered to many/most people)

AI: (neural networks) (computed in thousands of data centers)

Explorers

Built-in sensors

(Relatively)
small data

Built-in sensors

(Relatively)
small data

AI: neural nets, optimizers

Actuators

AI: neural nets, optimizers

Actuators

A single, unbounded, scalable system

Passive: provides context, insight
  • Like a business ecosystem

Disrupts capital

Autonomous systems, loosely connected

Active: decision-making agents
  • Like people

Disrupts labour
What does this mean for Australia?
Good news, the great de-coupling in the US, hasn’t occurred in Australia (… yet)

Source: (US Data) Federal reserve bank of St. Louis; Erik Brynjolfsson and Andrew McAfee; From “The Great Decoupling, June 2015; (Australian Data) Economist Intelligence Unit, Australian Bureau of Statistics
Fourth industrial revolution will see some jobs removed, some changed and some created

<table>
<thead>
<tr>
<th>Automated</th>
<th>Augmented</th>
<th>Additional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jobs that predominantly involve routine activities are at the highest risk of being completely automated.</td>
<td>Jobs with both routine and non-routine tasks will be augmented - automating routine tasks while allowing the worker to focus on the non-routine.</td>
<td>Brand new job categories will emerge over the coming decades as technology change introduces new needs.</td>
</tr>
<tr>
<td>Remaining non-routine activities only relevant as complementary to routine activities will not be required post-automation.</td>
<td>This change will see improved productivity of human capital – leading to increased output or reduced demand for labour.</td>
<td>New job roles will require new abilities and qualifications with a focus on technical abilities and soft skills.</td>
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</tbody>
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- Jobs eliminated
- Jobs changed
- Jobs created
Automation of routine tasks will happen before non-routine, reducing demand for labour across manual & cognitive roles.

Source: The Second Machine Age by Brynjolfsson and McAfee, BCG Analysis
We are increasingly seeing the progressive replacement of human workers with robot employees

Robotic bartenders
Take drink orders from customers via tablets located around the bar

Robotic hotel receptionists
Save on labour costs and increase check-in efficiency

Robo-advisors
Provide automated, algorithm based portfolio management advice

Robotic surgery
Can improve surgical outcomes by reducing human error

Fully robotic manufacturing
Reduces labour costs and improves health and safety outcomes

Autonomous cars
Can sense their environment and navigate without human input
BCG analysis suggests in Australia, 35% of work automated; around 72% of all FTEs substantially impacted by 2035.

**Australia 2035**
16.9m FTEs

- Not automated: 65%
- Automated: 35%

**Mostly Unchanged**
4.8 FTEs (28% of workforce)
688k FTEs automated

**Substantially impacted**
12.1m FTEs (72% of workforce)
5.2m FTEs automated

Note: Underlying population 15 to 64 year olds
Source: Australian Bureau of Statistics; Department of Employment; O*Net; BCG analysis
New job families and fields will emerge as a result of disruptive tech creating demand for new skill types

<table>
<thead>
<tr>
<th>New Jobs</th>
<th>Functional skills</th>
<th>Soft skills</th>
<th>Sources of skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine compliance manager</td>
<td>Ensure robots / AI comply with business rules</td>
<td>Creativity</td>
<td>Acquire</td>
</tr>
<tr>
<td>Connectivity advisor</td>
<td>Models networks to help position products or clients in best place</td>
<td>Entrepreneurship</td>
<td>• Ongoing education</td>
</tr>
<tr>
<td>Preventative health helper</td>
<td>Examines all aspects of client’s life and crafts bespoke plan</td>
<td>Empathy</td>
<td>• On the job experience</td>
</tr>
<tr>
<td>Automated systems tech</td>
<td>Deals with non-routine errors that automated systems can’t handle</td>
<td>Communication</td>
<td>Express</td>
</tr>
<tr>
<td>Professional triber</td>
<td>Assembles teams of freelancers into short term project teams</td>
<td>Problem solving</td>
<td>• Certifications</td>
</tr>
<tr>
<td>Virtual reality designer</td>
<td>Analyses experiences and replicates in augmented reality</td>
<td></td>
<td>• Industry training and recognition</td>
</tr>
<tr>
<td>3D scanning / printing tech</td>
<td>Specialises in the design and creation of 3D finished parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drone coordinator</td>
<td>Oversees drone traffic and flight operations for deliveries</td>
<td></td>
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</tr>
</tbody>
</table>

Source: BCG Industry 4.0 Report, CSIRO The Future of Work
Technical skills will be in demand for shorter periods of time increasing the demand for continuing education.

Longevity of technical skills is decreasing...

Engineering technical skills half life (years)

- 10 yrs
- 5 yrs
- 2.5-5 yrs

Date of approximation

Relevant technical knowledge (hours)

- 4800 hr avg. to complete degree
- Educational hours required to sustain competency
- 10 yr half life
- 5 yr half life
- 2.5 yr half life

Educational hours required

- 5 hrs/week
- 10 hrs/week
- 20 hrs/week

Grad grad +5 grad +10

Source: IEEE skills prediction, BCG analysis

Hiring practices requiring a 4 year tertiary education to enter a field may decrease as the need for incremental education to keep knowledge 'current' becomes the new standard.
People will have more jobs and careers than previously

Means that millennials can expect 17 jobs and 5 careers across their lifetime

- National average job tenure: 3.3 years
- Average lifetime jobs (assuming work from 18-75): 17
- Average lifetime careers (assuming 3 jobs/career): ~5

1. Assumptions as made by McCrindle research and reported in: “Job Mobility in Australia”, 18.06.15
Source: McCrindle Research; HILDA Study
And will diversify income streams outside of primary job

~1.6m workers in Australia earning additional income outside of primary job

Increase in moonlighting as platform-savvy younger cohorts enter workforce

Australian's willingness to earn additional income via platforms

- Freelance business owner
- Temp workers
- Moonlighters: Traditional job with additional freelance income
- Independent contractors

Workers (m)

Australians' willingness to earn additional income via platforms

- All Australians: 4% Already used, 64% Willing to use, 32% Not willing
- 25-34y: 10% Already used, 71% Willing to use, 19% Not willing

1. Edelman Berland, "Freelancing in Australia: A National Survey of the New Workforce", 15.10.14
2. The New Work Order, FYA, 2015

Note: "Moonlighters" are composite category from "moonlighters" (primary traditional job) and "diversified workers" (mix of traditional employers and freelance work).

Source: Foundation for Young Australians; Edelman Berland
Traditional culture requires changes along five dimensions

<table>
<thead>
<tr>
<th>From...</th>
<th>To...</th>
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| **Risk averse**                              | • Encourage a willingness to take risks and "fail-fast" / "test and learn" mindset  
                                            | • Establish comfort around uncertainty and possibility of failure        |
| **Channel centricity**                       | • Innovate based on customer insights along customer journey          
                                            | • Shift mindset on peer group; benchmark against best-in-class experience across industries |
| **Siloed**                                   | • Nurture a culture that is open & collaborative – shifting away from command, control & power centers, encourage sharing, celebrate for others |
| **Rigid**                                    | • Encourage flexibility and iteration in processes                     
                                            | • Remove bureaucracy for short decision making cycle and fast implementation |
| **Focus on running the business**            | • Establish an atmosphere of continuous innovation / improvement to keep pace with evolving working norms and customer expectations |
| • Avoid uncertainty and risk-taking; concerned about consequences of failure |                                                                               |
| • Technology, product or channel centric thinking |                                                                           |
| • Develop product/service from technology vs. customer need |                                                                         |
| • Individual KPI/division KPI                |                                                                         |
| • Limited communication/sharing across divisions/groups |                                                                     |
| • Focus on following a set process           |                                                                         |
| • Decisions need to go through long process and many layers to be made |                                                                         |
| • Reward efficiency and proficiency of BAU / status quo |                                                                 |
Recommended further reading from ACS, CSIRO et al

TOMORROW'S DIGITALLY ENABLED WORKFORCE

Megatrends and scenarios for jobs and employment in Australia over the coming twenty years

Stefan Hadjioannou, Andrew Reeson, Lochlan Rudd, Alexandra Bratisova, Leonie Hodgetts, Claire Mason, Naomi Baughen

January 2016

5 THE SCENARIOS

The scenario planning model requires the identification of axes which represent continuums of possibilities at a future date (DOS in this study). The axes capture critical uncertainty and impact in the megatrend narratives. In reality there are countless sources of uncertainty and impact buried within the trends and megatrends. However, the scenario cannot capture everything that matters in detail. Rather, they create a simplified model of a much more complex reality.

To do this we select axes which have the highest level of impact and uncertainty. We have identified the extent of task automation and the extent of institutional transformation for the two axes (Figure 15).

Both ends of the technological change axes describe a future with more automation in the workplace than exists today. However, there is much uncertainty about the reach of automation — from slightly more to vastly more. There is a future where the promises of artificial intelligence come to fruition and the vast majority of human tasks are performed better, faster, more solely and more cheaply by robots. This highly automated workplace creates job opportunities and requires skills very different from those that exist today. There is also a future where artificial intelligence has failed to deliver on its promises and in which some job tasks have been automated, but many have not. In this future the jobs and skills required are not too much different from now. Which one of these two futures outcomes will have an impact on Australia's labour markets?
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Thank you