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INTRODUCTION

Our Working Future is Volume 406 in the ‘Issues in Society’ series of educational resource books. The aim of this series is to offer current, diverse information about important issues in our world, from an Australian perspective.

KEY ISSUES IN THIS TOPIC
Technology is already dramatically reshaping Australia’s workforce across a range of industries. Recent studies estimate that up to half of Australian jobs face a high probability of being replaced by computers in the next 20 years. What are the jobs under threat and where are the jobs of the future to be found?

This book explores the digital disruption of employment through computerisation and automation; technological and structural change in the labour market; ways Australia can adapt to industry transformation through innovation; and future skills and higher learning options for young people.

Could a robot do your job? How can we innovate in order to meet the demands of our working future?

SOURCES OF INFORMATION
Titles in the ‘Issues in Society’ series are individual resource books which provide an overview on a specific subject comprised of facts and opinions.

The information in this resource book is not from any single author, publication or organisation. The unique value of the ‘Issues in Society’ series lies in its diversity of content and perspectives.

The content comes from a wide variety of sources and includes:

- Newspaper reports and opinion pieces
- Website fact sheets
- Magazine and journal articles
- Statistics and surveys
- Government reports
- Literature from special interest groups

CRITICAL EVALUATION
As the information reproduced in this book is from a number of different sources, readers should always be aware of the origin of the text and whether or not the source is likely to be expressing a particular bias or agenda.

It is hoped that, as you read about the many aspects of the issues explored in this book, you will critically evaluate the information presented. In some cases, it is important that you decide whether you are being presented with facts or opinions. Does the writer give a biased or an unbiased report? If an opinion is being expressed, do you agree with the writer?

EXPLORING ISSUES
The ‘Exploring issues’ section at the back of this book features a range of ready-to-use worksheets relating to the articles and issues raised in this book. The activities and exercises in these worksheets are suitable for use by students at middle secondary school level and beyond.

FURTHER RESEARCH
This title offers a useful starting point for those who need convenient access to information about the issues involved. However, it is only a starting point. The ‘Web links’ section at the back of this book contains a list of useful websites which you can access for more reading on the topic.
MORE THAN FIVE MILLION AUSSIE JOBS GONE IN 10 TO 15 YEARS

More than five million jobs, almost 40 per cent of Australian jobs that exist today, have a moderate to high likelihood of disappearing in the next 10 to 15 years due to technological advancements, a CEDA report has found.

Australia and the world is on the cusp of a new but very different industrial revolution and it is important that we are planning now to ensure our economy does not get left behind, CEDA Chief Executive Professor the Hon. Stephen Martin said when releasing CEDA’s major research report for 2015, Australia’s future workforce?

Professor Martin said as part of the report, NICTA researchers have examined the probability of job losses due to computerisation and automation in Australia and in each local government area (including Sydney and Melbourne) across the country.

“This research shows that in some parts of rural and regional Australia in particular there is a high likelihood of job losses being over 60 per cent,” he said.

Professor Martin said there will be new jobs and industries that emerge but if Australia is not planning and investing in the right areas we will get left behind.

“The pace of technological advancement in the last 20 years has been unprecedented and that pace is likely to continue for the next 20 years,” he said.

“While we have seen automation replace some jobs in areas such as agriculture, mining and manufacturing, other areas where we are likely to see change are, for example, the health sector, which to date has remained largely untouched by technological change,” he said.

“Creating a culture of innovation must be driven by the private sector, educational institutions and government. However, government must lead the way with clear and detailed education, innovation and technology policies that are funded adequately.

“Our labour market will be fundamentally reshaped by the scope and breadth of technological change, and if we do not embrace massive economic reform and focus on incentivising innovation, we will simply be left behind in an increasingly competitive global marketplace.

“Currently the commitment needed to link education and innovation policy with funding is appalling compared to other countries and Australia’s industry innovation strategy is woefully underfunded compared to global competitors.

“For example the five Industry Growth Centres announced last year by the Federal Government should be critical in driving innovation but only $190 million has been allocated over four years.

“In comparison, the UK Catapult Centres, which they are based on, have been allocated almost $3 billion over the same period.

“The German Fraunhofer Network, the Netherlands’ Top Sectors Strategy and US National Manufacturing Institutes have had even larger allocations.

“If we expect to compete with countries such as these as a smart and innovative economy then we need to get serious about how we invest in driving innovation.”

Professor Martin said we also need to reconsider how we deal with reskilling workers as particular fields of employment disappear.

“The CEDA report highlights the policy approach
“Our labour market will be fundamentally reshaped by the scope and breadth of technological change, and if we do not embrace massive economic reform and focus on incentivising innovation, we will simply be left behind in an increasingly competitive global marketplace.”

taken by Denmark to reskill mature age workers,” he said.

“The Danish approach is three-pronged – greater flexibility around hiring and firing, generous unemployment benefits and substantial programs to help unemployed people gain new skills. Often these programs start before a person is even retrenched.

“In comparison Australia has the lowest levels of unemployment benefits of the OECD for a single person recently unemployed and often programs to assist with skills training do not start until a person has been unemployed for some time.

“The Danish model is underpinned by the same mutual obligation approach to Australia but rather than send people off on work-for-the-dole projects, it is training people with the skills their economy needs.

“The Danish policy, while more expensive initially, makes long-term economic sense because it ensures people return to the workforce more quickly and with the skills the economy needs.

“As more job restructuring occurs in the Australian economy this type of policy is going to be vital.

“It is likely some tough decisions about the Australian labour market will need to be made in the next decade; we’ve already had a taste of this with the decline of the car manufacturing industry.

“However, if we develop the right policies now, we have the potential to reduce the impact of these challenges and ensure our economy remains robust.”


BEAUTY AND THE GEEK: JOBS OF THE FUTURE UNVEILED

Connectivity, entrepreneurialism and a rising population will shape three million new jobs by 2030. A new study by Bernard Salt has uncovered the distinct skill sets which represent Australia’s future jobs in the digital age.

Developed by KPMG Demographics and commissioned by nbn, the Super connected jobs report explores how the potential for universal access to fast broadband can shape the future Aussie workforce and liberate employees from the confines of set working hours or places.

It predicts significant growth and transformation in existing jobs such as beauty therapists and personal trainers as well as a changing perception for stereotypically ‘geek’ jobs such as computer programmers and high tech start-ups which will become less niche and more mainstream.

Key findings include:

- **Three million more jobs by 2030** – With three million new jobs since 2000, it is likely the Australian workforce will increase by another three million more workers in the next 15 years to 2030. There will be a growing emphasis on part-time working women as well as longer careers for older workers.

- **A culture of entrepreneurialism** – The rise of new technology and digital disruption will facilitate a level of entrepreneurialism unlike ever before. This will influence the economy with the rise of ‘Silicon Cities and Beaches’ outside of metro areas, as more small and agile businesses pop-up with new ways to disrupt, improve and create value.

- **It’s not only about ‘robot polishers’** – While the invention of the motorcar created jobs in car cleaning, future jobs won’t mean everyone suddenly enters the robot cleaning business. Jobs of the future will stem from what is in most demand due to changing skill sets, population increase and the potential for ubiquitous access to fast broadband via the nbn network.

- **Connectivity the common thread** – While digital disruption will create new business models, the majority of Australian job growth will come from ‘the jobs of today’. Connectivity will impact all types of jobs, even those not strictly in the technology space. New tools and new ways of communicating will influence all jobs of the future, no matter if you are a teacher, plumber, doctor or photographer.

Author of the Super connected jobs report, demographer Bernard Salt said:

“Australians are on the dawn of a disruptive ‘Uber-work’ era. Super connectivity made available via the nbn network will deliver a greater balance between work and lifestyle pursuits as we redefine how, when and where we will work.

“We could also see the rise of new Silicon cities or beaches in regional hubs around the country as...”

The report predicts significant growth and transformation in existing jobs such as beauty therapists and personal trainers as well as a changing perception for stereotypically ‘geek’ jobs such as computer programmers and high tech start-ups which will become less niche and more mainstream.
universal access to fast broadband drives a culture of entrepreneurship and innovation outside our capital cities.”

Who are the workers of the future?

• The Care Givers – includes support services such as social worker and personal services like beauty therapists, nannies and fitness instructors. A future Care Giver fitness instructor will pitch for work using an Uber-like app and conduct group workouts via HD video-conferencing.

• The Technocrats – knowledge-workers who are highly skilled, highly trained and well-remunerated. The spectrum of jobs includes electrical engineers, medical researchers and business entrepreneurs. A future Technocrat could conduct an international collaboration via high speed broadband, to collaborate, develop and commercialise a research project.

• The Specialist Professions – knowledge-workers that maintain systems and deliver outcomes including accountants, dentists, urban planners and teachers. A future Specialist Professional such as a doctor will conduct more of their work remotely and use technology to diagnose and treat patients.

• The Doers – skilled jobs for those who ‘do’, such as plumbers, carpenters and electricians. No matter how much we automate, there will still be a requirement for waiters in the future. A future Doer will use technology to create new ways of communicating with clients, ordering materials, allocating work and processing payment.

• The Creatives – this group of workers is driven by what pleases as opposed to what delivers the best return on effort. Stylist, social media engineer, photographer and yoga instructor are all Creative jobs that in the future will draw on access to high speed broadband for inspiration, instant connections with peers and clients and hassle-free large data transfers.

WHAT ARE THE JOBS OF THE FUTURE?

An extract from the nbn report, Super Connected Jobs: Understanding Australia’s future workforce, written by Bernard Salt

This of course raises the issue of how the Australian workforce might change in the future and especially in the decade following the full roll out of the nbn (the ten years to 2030).

What will be the jobs of the short to medium term future? There is a tendency when discussing ‘jobs of the future’ to focus on the extreme, the niche and the exotic.

One recent study cited the new job of ‘robot polisher’ in much the same way as the invention of the motorcar created jobs in car cleaning. (Although why won’t there be a robot polishing robot?) There may well be robot polishing jobs in the future but this will not be a source of job growth.

The issue is not what new jobs will be created in the future but rather what jobs will be most in demand. And how will these most demanded jobs be shaped and reshaped by access to ubiquitous fast broadband via the nbn™ network?

Jobs rising faster than the workforce average during the 21st century cluster into five distinct skill sets that represent typical jobs of the future. The example jobs cited are those that have, or are aligned to, the jobs that have gained market share in the workforce.

1 THE CARE GIVERS

The Australian population is ageing giving rise to demand for more care givers.

The Australian population is ageing giving rise to

FIGURE 2: SELECTED GROWTH OCCUPATIONS AND TOTAL WORKFORCE

Care Giver job of the future

A personal trainer pitches for work using an uber-like app. The trainer sets up group workout sessions where participants join in from the lounge rooms and workplaces via HD video conferencing. The trainer follows up with participants for a one-on-one Skype call to talk through exercise regime and diet plans. Billing is completed in real time with the client and personal trainer using a special Trip Advisor type app. Both client and personal trainer marvel at how they managed to get anything done ‘the old way’.


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demand for more care givers. But Australian values are also shifting. With greater prosperity as a nation Australians are choosing to share that prosperity through greater allocations to welfare. And the composition of the workforce is changing. More and more women are working which means there is a rising market for household services. The care giver jobs of the future include social worker, aged-care worker, childcare worker and youth worker.

But there is also a rising demand for support jobs in meal replacement (e.g., take-away food), household maintenance work like gardening and lawn mowing, as well as personal services like massage therapist, manicurist, beauty therapist, fitness instructor and nanny; all of which are accounting for an increased share of the workforce.

2 THE TECHNOCRATS

Technocrats sit at the core of what might be termed the knowledge worker segment. There are other knowledge workers but they are less central to the operational design and management skills needed to run the businesses of the future.

The technocrats are highly skilled, highly trained and are well-remunerated. In another world technocrats might have been called geeks or nerds; today references are more diplomatic. Technocrats control the know-how that drives the methods of production. Without the technocrats the robots and the automatons subside and business ceases to evolve. The technocrats have highly developed skill sets in science, technology, engineering and mathematics.

Business entrepreneurs fall within the core STEM (science, technology, engineering, mathematics) skill set of the Technocrat class through the addition of entrepreneurialism. There is no real difference between creating an app and creating a business. And so Technocrats have STEEM skills where the extra E is for entrepreneurship.

Jobs in this space that appear to be expanding based on census analysis include electrical engineer, civil engineer, engineering manager, industrial engineer and mining engineer. But it would also include computer programmer, data scientist, medical researcher and even webpage designer. The Technocrats use their skill sets to create, analyse, manage and improve consumer products and services.

3 THE SPECIALIST PROFESSIONALS

Also in the knowledge worker category are the professions and the regulators because these jobs require a university education or some other technical qualification.

However these are not jobs at the creative edge of knowledge work; these are specialist jobs that are required to maintain systems (including compliance) and to deliver outcomes. A medical researcher Technocrat might discover and commercialise a new health
Specialist Profession job of the future

The Specialist Profession job of the future might include for example the GP or the solicitor who will increasingly utilise new technology to assist in diagnosis. IBM Watson for example is advising medical practitioners with regard to suggested diagnoses. Solicitors might access artificial intelligence machines to scan documents for the discovery process looking for key words or phrases. The role of the teacher may change as they become facilitators of learning rather than merely sticking to a set lesson plan. Learning will be ‘flipped’ as students research ‘how to’ lessons on Google and YouTube and then come to class to discuss and to workshop ideas. Learning in the future will be more about research and collaboration than about absorption and instruction.

application but that application must be administered by health care professionals like doctors and monitored and regulated by other professionals.

The Australian population will increase by close to six million by 2030; this will create demand for jobs that are a function of increased population levels including health, teaching, accounting and public administration professionals. Specialist profession jobs of the future include jobs in finance accounting, general medical practice, dentistry, pharmacy, oncology, gerontology, urban planning, policy advice, occupational health and safety, primary school teaching, secondary school teaching, university lecturing and vocational trade teachers.

These are the specialist profession jobs that have expanded most rapidly so far this century and that will expand further in the future.

4 THE DOERS

It is likely the number of people working in the Australian workforce will expand from 12 million to 15 million over the period to 2030 regardless of the level of automation in other parts of the workforce.

Many jobs of the future will have some connection into a technology base but many will not. There will still be a requirement for waiters in 2030. Many of the jobs of the future will be existing jobs scaled up to service a bigger population base but perhaps with newer technology these jobs will deliver better efficiency.

Job losses on a large scale takes decades; there were at last census, after all, still 300 working blacksmiths in the Australian workforce. There will be demand in the future for skills to build houses to accommodate a bigger population; this demand will result in jobs for plumbers, electricians and carpenters which have been some of the fastest growing jobs in Australia since the 2006 Census.

It’s more the way plumbers, electricians and carpenters work in the future that will change. New tools, new methods of billing, new ways of communicating with clients, new ways of ordering materials will all be part of the tradie toolkit in the 2020s and beyond.

There is also the possibility that the way building work is commissioned might change. In the future work may be allocated via an Uber-like app; billing could be immediate and completed on site with payment required by the end of the day.

But the Doers are far more than builders; the Doer skill set also covers jobs like personal assistant (replaced the secretary), sales representatives (face-to-face selling/pitching will still be required), check-out operators (small retailers being replaced by big-box retailers who will increasingly employ check-out staff) and catchalls like ‘general clerk’ and ‘office manager.’ These jobs are not necessarily disappearing as much as they are morphing into different roles over time.

In addition, time-series occupational data from the censuses show, large-scale job growth in Australia has often occurred in people related activities. More office workers, more management, more houses, more consumption, will drive demand for Doers to deliver and to complete billable and/or receipt based transactions.

5 THE CREATIVES

Not all workers in today’s or tomorrow’s workforce are driven by commercial considerations. Some workers work

Doer job of the future

The Doer job of the future will still involve doing and delivering. A bi-box retail assistant in the future might carry iPads linked to product range and store inventory across the network. Queries, sales orders and item delivery can be tracked and billed in real-time without involvement from a cashier. A Bunnings worker of the future will have more than a red t-shirt and a leather apron; they will be the interface between the customer and the product. Tradies will be able to run more of their businesses from home, giving back time to spend with their families and on their hobbies and/or interests.
Our Working Future

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in jobs for lifestyle and/or creative reasons. There are more workers over the age of 65 in today’s workforce than ever before and there will be even more by 2030.

Some of the fastest growing jobs in the future will be jobs that accommodate the lifestyle aspirations of older baby boomer workers. Lifestyle and creative jobs will blossom as a larger section of the workforce is motivated by what pleases as opposed to what delivers the best return on effort. One of the fastest growing jobs in the first decade of the 21st century is the job of photographer and this was at a time when photography was democratised through the smartphone.

But in fact that same smartphone technology has created new demand for webpage photography and the visualisation of products and services. New technology has in fact delivered job growth in an occupation that was once threatened by technology.

Creative and lifestyle jobs are on the rise and include the likes of dance instructor, life coach, stylist, social media engineer, photographer, sportsperson, yoga instructor and Pilates instructor. All these creative jobs of the future can draw on technology for inspiration as well as client engagement, inspiration and peer communication.

The lifestyle aspect of the Creatives occupation may involve a directional shift but it might also, for example, be expressed in shifting from full time to part time, high-end to local and face-to-face to online. An accountant might pursue a passion for photography later in life but another equally valid pathway is for the corporate accountant to augment their retirement lifestyle by setting up a small business that is operated and marketed entirely online.

KPMG Partner Bernard Salt founded and heads KPMG Demographics, a specialist advisory group that looks at social, cultural and demographic trends over time.

Beauty and the Geek: Jobs of the future unveiled

3 MILLION new jobs by 2030

Population increase means...

- Increase in women workers (55%)
- More part-time work (39%)
- 65+ workers (195%)

It’s not all about robot polishers

Technology is transforming existing jobs

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<th>NEW</th>
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<tr>
<td>-60% Secretaries</td>
<td>34% Personal Assistants</td>
</tr>
<tr>
<td>6% Bank Teller</td>
<td>17% Computer Programmers</td>
</tr>
<tr>
<td>-43% Word Processor/Desktop Publisher</td>
<td>21% Graphic Designer</td>
</tr>
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Job growth vs. job losses since 2000

Job growth has outnumbered job losses 10 to 1

Key growth drivers are knowledge workers in:

- Health Care & Social Assistance: 75% growth
- Education & Training Services: 45% growth
- Professional Scientific & Technical Services: 76% growth

A culture of entrepreneurialism

Small businesses show a 39% growth between 2003-2004 and 2013-2014

Connectivity is the common thread: The five skill sets for future jobs

- Fitness Instructor: 76% growth
- Electrical Engineer: 88% growth
- Primary School Teacher: 22% growth
- Plasterers: 24% growth
- Photographers: 40% growth

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A SMART MOVE: FUTURE-PROOFING AUSTRALIA’S WORKFORCE

This overview from a PricewaterhouseCoopers report endorses future-proofing Australia’s workforce by growing skills in science, technology, engineering and maths.

After a sustained period of economic prosperity, Australia is facing some tough challenges. Slowing growth, declining real wages, falling productivity, and the end of the mining boom, to name a few.

At the same time, businesses are coming to terms with the massive disruptive impact that digital technologies are having on business models, supply chains and customer behaviour. These changes are putting major pressure on the Australian workforce, and the companies that rely on it.

Building on cutting edge work undertaken at Oxford University, businesses competing in a global economy driven by data, digital technologies and innovation will need more employees trained in science, technology, engineering and mathematics (STEM). Research indicates that 75 per cent of the fastest growing occupations now require these skills.

Key findings of the report include:

- 44 per cent or 5.1 million current Australian jobs are at risk from digital disruption in 20 years.
- 75 per cent of the fastest growing occupations require STEM skills.
- Changing 1 per cent of the workforce into STEM roles would add $57.4 billion to GDP.
- Top three occupations least at risk in the workforce of the future are doctors, nurses and teachers.
- The top three occupations at risk are accountants, cashiers and administration workers.

AUSTRALIAN JOBS MOST AT RISK FROM COMPUTERISATION AND TECHNOLOGY IN NEXT 20 YEARS

<table>
<thead>
<tr>
<th>OCCUPATION</th>
<th>PROBABILITY OF BEING AUTOMATED</th>
<th>NUMBER OF WORKERS AFFECTED</th>
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<tr>
<td>Accounting clerks/bookkeepers</td>
<td>97.5%</td>
<td>263,348</td>
</tr>
<tr>
<td>Checkout operators/cashiers</td>
<td>96.9%</td>
<td>128,745</td>
</tr>
<tr>
<td>General office administration workers</td>
<td>96.1%</td>
<td>284,171</td>
</tr>
<tr>
<td>Wood machinists</td>
<td>93.4%</td>
<td>31,081</td>
</tr>
<tr>
<td>Financial and insurance administration workers</td>
<td>93.1%</td>
<td>128,425</td>
</tr>
<tr>
<td>Farm, forestry and garden workers</td>
<td>92.5%</td>
<td>106,017</td>
</tr>
<tr>
<td>Personal assistants and secretaries</td>
<td>92.4%</td>
<td>137,917</td>
</tr>
<tr>
<td>Sales administration workers</td>
<td>91.1%</td>
<td>56,964</td>
</tr>
<tr>
<td>Keyboard operators</td>
<td>87.1%</td>
<td>59,852</td>
</tr>
<tr>
<td>Hospitality administration and support workers</td>
<td>85.5%</td>
<td>248,862</td>
</tr>
<tr>
<td>Sales assistants and salespersons</td>
<td>85.2%</td>
<td>698,780</td>
</tr>
<tr>
<td>Real estate sales agents</td>
<td>85.2%</td>
<td>70,673</td>
</tr>
<tr>
<td>Factory process workers</td>
<td>84.6%</td>
<td>52,631</td>
</tr>
<tr>
<td>Fabrication trades workers</td>
<td>84.3%</td>
<td>90,039</td>
</tr>
<tr>
<td>Receptionists</td>
<td>83.9%</td>
<td>169,371</td>
</tr>
<tr>
<td>Clerical and office support workers</td>
<td>83.8%</td>
<td>114,710</td>
</tr>
<tr>
<td>Printing trades workers</td>
<td>82.9%</td>
<td>23,930</td>
</tr>
<tr>
<td>Mobile plant operators</td>
<td>82.8%</td>
<td>127,298</td>
</tr>
<tr>
<td>Food preparation assistants</td>
<td>82.5%</td>
<td>154,438</td>
</tr>
<tr>
<td>Food process workers</td>
<td>82.2%</td>
<td>63,072</td>
</tr>
<tr>
<td>Glaziers, plasterers and tilers</td>
<td>81.4%</td>
<td>60,977</td>
</tr>
<tr>
<td>Food trades workers</td>
<td>80.7%</td>
<td>173,639</td>
</tr>
<tr>
<td>Automobile, bus and rail drivers</td>
<td>80.5%</td>
<td>94,946</td>
</tr>
<tr>
<td>Machine operators</td>
<td>80.1%</td>
<td>83,757</td>
</tr>
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Derived from Oxford University study, PwC analysis.
new analysis by PwC shows that 44 per cent (5.1 million) of current Australian jobs are at high risk of being affected by computerisation and technology over the next 20 years.

In order to realise our potential for innovation, Australia needs an appropriately skilled workforce; a workforce fit for the future. Businesses competing in a global economy driven by data, digital technologies and innovation will need more employees trained in science, technology, engineering and mathematics (STEM). Research indicates that 75 per cent of the fastest growing occupations now require these skills.

Unfortunately, Australia is lagging on a number of key STEM indicators. STEM university completions are flat, the number of Year 12 students studying STEM subjects is declining and businesses are struggling to find STEM employees.

The benefits of a stronger commitment to STEM are many. It would help meet workforce needs, better equip workers with vital skills for the future and drive innovation and productivity. It would also deliver economic growth.

Modelling by PwC finds that shifting just 1 per cent of the workforce into STEM roles would add $57.4 billion to GDP (net present value over 20 years).

This report argues the case for growing the STEM workforce and outlines some of the benefits and impacts for businesses specifically and the Australian economy broadly. And it calls on business, including PwC, to take a leading role alongside government and the education sector in order to deliver the STEM outcome Australia needs to remain a competitive, innovative and prosperous nation.


### AUSTRALIAN JOBS LEAST AT RISK FROM COMPUTERISATION AND TECHNOLOGY IN NEXT 20 YEARS

<table>
<thead>
<tr>
<th>OCCUPATION</th>
<th>PROBABILITY OF BEING AUTOMATED</th>
<th>NUMBER OF WORKERS AFFECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical practitioners</td>
<td>0.4%</td>
<td>89,754</td>
</tr>
<tr>
<td>Education, health and welfare managers</td>
<td>0.7%</td>
<td>75,082</td>
</tr>
<tr>
<td>Midwives and nurses</td>
<td>0.9%</td>
<td>301,762</td>
</tr>
<tr>
<td>Advertising, public relations and sales managers</td>
<td>1.5%</td>
<td>126,616</td>
</tr>
<tr>
<td>Database and systems administrators, and ICT security specialists</td>
<td>3.0%</td>
<td>34,764</td>
</tr>
<tr>
<td>Education professionals</td>
<td>3.3%</td>
<td>56,264</td>
</tr>
<tr>
<td>ICT managers</td>
<td>3.5%</td>
<td>57,184</td>
</tr>
<tr>
<td>Tertiary-level teachers</td>
<td>3.6%</td>
<td>116,001</td>
</tr>
<tr>
<td>School teachers</td>
<td>4.0%</td>
<td>407,693</td>
</tr>
<tr>
<td>Engineering professionals</td>
<td>4.2%</td>
<td>132,736</td>
</tr>
<tr>
<td>Legal professionals</td>
<td>6.5%</td>
<td>82,552</td>
</tr>
<tr>
<td>Social and welfare workers</td>
<td>6.8%</td>
<td>123,933</td>
</tr>
<tr>
<td>Accommodation and hospitality managers</td>
<td>7.2%</td>
<td>100,765</td>
</tr>
<tr>
<td>Construction, distribution and production managers</td>
<td>8.2%</td>
<td>258,794</td>
</tr>
<tr>
<td>Child carers</td>
<td>8.4%</td>
<td>130,510</td>
</tr>
<tr>
<td>ICT network and support professionals</td>
<td>9.7%</td>
<td>49,688</td>
</tr>
</tbody>
</table>

Derived from Oxford University study, PwC analysis.
MORE STEM EDUCATION WON’T PROTECT OUR JOBS FROM ROBOTS

There are several arguments for why we do need to invest more in STEM education, however, there are also arguments that we need to invest more in the humanities, notes Toby Walsh

Care to guess what is the world’s fastest growing industry? Health care? Biotech? Energy? Nope. According to a recent report, it’s robotics.

And those robots are slowly but surely putting people out of work. Recent research at the University of Oxford suggests that nearly half of all jobs are at risk from automation. Ironically this research used some advanced machine learning techniques to estimate which professions were most at risk of being automated in the next 20 years. Even the task of estimating which jobs are most at risk is being automated!

In the past, new technologies have tended to create more jobs than they have destroyed. As a consequence, despite populations increasing across the world, most of us still manage to find employment. But it’s much less certain that this will be true for the information revolution currently underway.

So what are the jobs most at risk? One was telemarketer. Now this might sound like a great thing. Fewer people will interrupt your dinner trying to sell you cable TV. Unfortunately robotic telemarketers will make it even easier and cheaper for organisations with something to sell to call you.

Another job at risk was tax agent. Again, who will be sad that they no longer have to see their tax agent once a year? Rather, we’ll have our computer file our tax automatically.

A third job at risk was cook. Cook! Sure, robots will make great chefs. Even in a fancy restaurant, the challenge is to turn out the same dish repeatedly. And robots are great at repetition.

A fourth job identified by the report at risk is real estate broker. Again, few of us are probably going to be too sad about this.

The STEM solution

Of course, historically, whenever jobs get destroyed by new technology, other jobs get created. Computer typesetting has put a lot of printers out of work. But we now have loads of new jobs enabled by computer typesetting like web designer and ebook publisher.

In the past, new technologies have tended to create more jobs than they have destroyed. As a consequence, despite populations increasing across the world, most of us still manage to find employment. But it’s much less certain that this will be true for the information revolution currently underway.

In the past, new technologies cost a lot. And it took a lot of effort to put them to use. Steam engines were neither cheap nor easy to put into the factory of old. But computer software can be reproduced at almost no cost.
And computer hardware just gets cheaper and cheaper.

In response to these concerns, a recent report from PwC has recommended we should future proof Australian jobs by growing skills in science, technology, engineering and maths (STEM).

STEM jobs were some of the most future-proof jobs identified by the researchers at the University of Oxford. But they weren’t the most safe jobs. In fact, some of the activities machines are best at are the kinds of tasks done by people in STEM.

One of the safest jobs, on the other hand, was social worker. People skills is one area in which robots are most challenged. Another very safe job was physician.

Sure, we’ll all consult Dr Google (or Dr Watson) more and more often. But we’ll still want to get a ‘proper’ opinion from a real, highly trained doctor.

A third very safe job was teacher. Again, it’s back to people skills.

**Humanities for humans**

There are several arguments for why we do need to invest more in STEM education.

First, it leads to some of the safest jobs. Second, STEM is likely to help grow the economy. Third, STEM will drive innovation and productivity, both of which are desperately needed by Australia to compete in the 21st century. And as a person working in STEM education, I agree with these arguments, and would welcome more focus on STEM.

However, there are also arguments that we need to invest more in the humanities.

First, STEM needs people: interface designers; creative types, etc. It’s not just geeks that are needed in the internet and smartphone enabled future of tomorrow.

Second, STEM isn’t for everyone, and there are many even safer jobs beyond STEM.

Third, if robots are going to reduce how much we work, the humanities will help us fill time that we are not working in constructive ways.

Wouldn’t that be great? If the 21st century became famous for an explosion in great works of art, paintings that changed the way we see the world, symphonies that make us weep, and plays that touch the soul? Robots might one day be able to help make such art, too.

The Oxford report estimated only a 4% chance that fine artists will be automated in the next 20 years, and 2% for a composer. But even then, we can still appreciate such art and everybody wins.

Toby Walsh is Professor, Research Group Leader, in the Optimisation Research Group, Data61.
MACHINES ON THE MARCH THREATEN ALMOST HALF OF MODERN JOBS

Oxford University researchers Carl Frey and Michael Osborne warn of the impending rise of the machines in modern employment.

The likelihood of a job being vulnerable to computerisation is based on the types of tasks workers perform and the engineering obstacles that currently prevent machines from taking over the role.

Computers have been an important part of many industries for decades already and have replaced humans in many jobs. But a new wave of technological development means that even positions that we once saw as immune to computerisation are now under threat.

In 1930, as the Great Depression spread across the Atlantic, John Maynard Keynes famously predicted that the discovery of technological means would outrun the pace at which we can find new uses for labour, resulting in widespread technological unemployment. Keynes, however, was optimistic and predicted that this would only be a temporary phase. In the long-run, he argued, technological progress will solve mankind’s “economic problem”, that is our need to work, and release us from our traditional purpose of subsistence.

Commentators today are less optimistic. ‘How Technology Wrecks the Middle Class’, a recent New York Times column by David Autor and David Dorn, captures an observation made by several commentators: technology has turned on labour.

In the modern world of work, low-income service jobs have expanded sharply at the expense of middle-income manufacturing and production jobs. There are many more security guards and pharmacy aides while the rate of growth has slowed in professions such as chemical plant operators and fabric patternmakers. Meanwhile, computers have increased the productivity of high-income workers, such as professional managers, engineers and consultants. The result has been a polarised labour market with surging wage inequality. Research has shown that this polarisation between ‘lousy’ and ‘lovely’ jobs is happening in Britain as well as the US, implying that there has been a hollowing-out of the middle class.

The threat of computerisation has historically been largely confined to routine manufacturing tasks involving explicit rule-based activities such as part construction and assembly. But a look at 700 occupation types in the US suggests that 47% are at risk from a threat that once only loomed for a small proportion of workers.

The likelihood of a job being vulnerable to computerisation is based on the types of tasks workers perform and the engineering obstacles that currently prevent machines from taking over the role.

These technological breakthroughs are, in large part, due to efforts to turn non-routine tasks into well-defined problems. The automation of these occupations is made possible by big data and advanced sensors, giving robots enhanced senses and dexterity, allowing them to perform a broader scope of non-routine manual tasks. For the first time, jobs in transportation and logistics are at risk. Take the autonomous driverless cars being developed by Google. They are the perfect example of a new way in which a human worker, such as a long-haul truck driver, could be replaced by a machine in the modern age.

Desk dwellers are no longer immune either. Algorithms for big data are now rapidly entering domains reliant upon pattern recognition and can readily substitute for labour in a wide range of non-routine cognitive tasks. Those working in fields such as administration could once feel comfortable that a computer would never be able to do their job but that will no longer be the case for many.

More surprisingly, the bulk of service occupations, from fast food counter attendants to medical transcriptionists, where the most job growth has occurred over the past decades, are also to be found in the high-risk
category. This reflects technological development too. The market for personal and household service robots is already growing by about 20% annually. As the comparative advantage of human labour in tasks involving mobility and dexterity will diminish over time, the pace of labour substitution in service occupations is likely to increase even further.

This first wave of computerisation in the big data era marks a turning point. Nineteenth century manufacturing technologies largely substituted for skilled labour in jobs, such as weaving and the production of tools, by simplifying the tasks involved. Next, the computer revolution of the twentieth century caused a hollowing-out of middle-income jobs. The next generation of computers will mainly substitute low-income, low-skill workers over the next decades.

So, if a computer can drive as well as you, serve customers as well as you and track down information as well as you, just who is safe in their job these days?

Careers at low risk of computerisation are generally those that require knowledge of human heuristics and specialist occupations involving the development of novel ideas and artifacts. Most management, business and finance occupations, which are intensive in generalist tasks requiring social intelligence, are still largely confined to the low-risk category. The same is true of most occupations in education and healthcare, as well as arts and media jobs.

Engineering and science occupations are also less susceptible to the phenomenon, largely due to the high degree of creative intelligence they require. It is, however, possible that computers will fully substitute for workers in these occupations over the long-run.

This means that as technology races ahead, low-skill workers will need to train in tasks that are less susceptible to computerisation – that is, tasks requiring creative and social intelligence. If you want to stop a computer taking your job, you’ll have to hone your creative and social skills. Mercifully, it will be quite a while before the machines outpace us in that respect.

Carl Frey is James Martin Research Fellow, University of Oxford.
Michael Osborne is Lecturer in Machine Learning, University of Oxford.

Jobs most in danger of computerisation

The top 20 jobs that are in danger of computerisation, according to the Oxford University report are:
1. Telemarketers
2. Title examiners, abstractors and searchers
3. Hand sewers
4. Mathematical technicians
5. Insurance underwriters
6. Watch repairers
7. Cargo and freight agents
8. Tax preparers
9. Photographic process workers and processing machine operators
10. New accounts clerks
11. Library technicians
12. Data entry keyers
13. Timing device assemblers and adjusters
14. Insurance claims and policy processing clerks
15. Brokerage clerks
16. Order clerks
17. Loan officers
18. Insurance appraisers (auto damage)
19. Umpires, referees and other sports officials
20. Tellers

Source: Frey, Carl Benedikt and Osborne, Michael A, The future of employment: how susceptible are jobs to computerisation?
Could a robot do your job? Short answer: yes
TOBY WALSH ASKS: COULD THEY BE AFTER YOUR JOB?

Here’s a game to play over dinner. One person names a profession that they believe can’t be taken over by a machine, and another person has to make a case why it’s not so future-proof. We played this game on an upcoming episode of SBS’s Insight on the topic of the future of robots and artificial intelligence.

The first profession suggested was musician. An argument often put forwards against artificial intelligence (AI) is that computers can’t be creative. But there are plenty of examples to counter this argument. For instance, computers can take plain sheet music and turn it into an expressive jazz performance, as my colleague Ramon Lopez de Mantaras has shown.

Economists continue to argue over the net effects of technology. Does technology create more economic activity so we are all better off? Or does it put more people out of work, concentrating wealth in the hands of the few?

So, jazz musicians watch out. Your jobs might not be safe from robot incursion.

The next option was police officer. It’s often said that computers can’t or won’t behave ethically. Unfortunately, Hollywood has already painted a very dystopian picture here in movies like Robocop and Terminator. And, as the current UN campaign to ban autonomous weapons demonstrates, we could easily end up there if we aren’t careful.

The third profession put forward was human resources. Naturally, this came from an HR consultant worried for her future job prospects. However, the bureaucratic side of HR is already easily automated. Indeed, we spend much of our lives on the phone already talking to machines. Can I speak to a real person, please?

On the other hand, the more human-facing side of HR is likely to be harder to automate. But as we argue in the next answer, it’s not clear that this will be impossible.

The fourth challenge was psychiatrist. Again, the human-facing nature of this would seem to offer significant resistance to automation. Nevertheless, there’s an interesting historical precedent.

A well-known computer program called Eliza was the very first chatterbot. It unintentionally passed itself off as a real Rogerian psychotherapist.

Eliza was not very smart. Indeed, the program’s author, Joseph Weizenbaum, meant it more as parody than as therapist. However, his secretary famously asked to be left alone so she could talk in private to the chatterbot.

So, shrinks watch out. Your jobs might not be safe.
The final challenge was Prime Minister.

On the one hand, this is a good answer, as one assumes there’s little routine to being Prime Minister but a lot of tough high-level decision making that would be tough for a machine to handle. On the other hand, it’s a poor winner of our little game. It may be the only job in the whole country that’s safe from robots.

One thing seems sure. [Technology] requires us to adapt. And for this, we need an educated, high-tech workforce.

In one final, beautiful irony, this forthcoming episode of Insight has the robots up on the stage. We, the supposed expert commentators were in the audience. So, even TV pundits should watch out. Your jobs might not be safe too.

**NET EFFECTS**

What this discussion highlights is that the middle classes are likely to be increasingly squeezed by machine labour. Professions that we used to think were quite safe – like doctor, lawyer or accountant – will be increasingly automated.

Whenever technology takes away jobs, it tends to make new jobs and industries elsewhere. For example, printing removed the need for scribes but created the vast publishing industry in its stead. And publishing went on to create many other jobs in the industries that grew out of all the knowledge passed on in printed material.

More recently, computers have taken away many traditional jobs in the printing industry, like typesetters. But we now see many new jobs in areas like self-publishing and web design.

Economists continue to argue over the net effects of technology. Does technology create more economic activity so we are all better off? Or does it put more people out of work, concentrating wealth in the hands of the few?

One thing seems sure. It requires us to adapt. And for this, we need an educated, high-tech workforce. This brings the conversation back to higher education and the stalled reforms that now trouble this sector in Australia.

If there is one policy we need to get right, to future-proof Australia against machines and other disruptions, I would argue, this is it.

Toby Walsh is Professor, Research Group Leader, in the Optimisation Research Group, Data61.
Will automation create as many jobs as it renders obsolete? Either way, the spectre of severe societal consequences looms, and low-skilled workers will end up shouldering the greatest burden, the author of a report into technology in the workplace warns Saturday Extra.

From ordering your food on a tablet today, to one day having your online shopping transported in a self-driving truck – the digital age is transforming the nature of work, but so far it hasn’t translated into many more jobs for humans. That was one theme that emerged from the Technology at Work Report released by the Oxford Martin School and Citi this year.

The accommodation and food services sector is expected to be hardest hit, with as many as 87 per cent of US workers at high risk of being replaced by automation, the report found. Transportation and warehousing, real estate, and retail trade follow close behind, each with at least two-thirds of the workforce at high risk.

These numbers have been reinforced in a recent research paper by the Committee for Economic Development of Australia (CEDA), which warned that in Australia, 40 per cent of jobs could go – a figure that rises to 60 per cent in regional areas.

Michael Osborne, Associate Professor in Machine Learning at Oxford University and an author of the Technology at Work Report, believes the rise in automation presents a real challenge for policy makers after decades of growth in the service sector.

“Low-skilled service sector jobs – I’m thinking about people like waiters and waitresses, whose jobs might be threatened by, for example, the provision of tablets on tables in restaurants, retail assistants whose jobs might be affected by the introduction of online retail – it’s these kind of jobs that have really been part of the central story of jobs growth in the past couple of decades, that begin to be threatened by automation,” he says.

“As those workers in particular may be least well qualified to move into the new jobs that are created, then there really might be some quite severe societal consequences.”

The concern for “technological unemployment” has a long history. John Maynard Keynes used the term in 1930 when he worried that “unemployment due to our discovery of the means of economising the use of labour” could outrun “the pace at which we can find new uses for labour”, at least in a temporary stage before humanity reached an age of leisure. But while many would argue the last 85 years have proven technological unemployment unlikely, automation has economics writers asking whether it may, in fact, be just around the corner.

The latest issue of Foreign Affairs picks up on this theme provocatively wondering whether humans will “go the way of the horse”. The animals were seemingly irreplaceable in the 19th century, with a population of about 21 million across America. But by 1960 that number was down to 3 million as they were replaced by engines. “Is a similar tipping point possible for human labour?” the magazine asks.

Osborne says the effects are likely to be uneven, as it’s still difficult to design a machine to be as creative as a human. That means that jobs that require originality, social intelligence, and manipulation are less vulnerable – but those that involve performing “routine cognitive labour” might be next in line to be replaced by machines. And that goes beyond fast food workers and truck drivers.

“Accountants, paralegals, could be said to some extent to basically perform just the storage and access and processing of data ... there’s no reason that couldn’t be better performed by a machine,” he says.

He says it may be difficult for those rendered jobless by machines to easily slip into the jobs of tomorrow.

“We find very clearly that the burden of computerisation will rest most heavily on the shoulders of the least skilled,” he says.

“The kind of new jobs that we see emerge are likely to be quite high-skilled, for example, data scientists or Android developers or iOS developers. These are not necessarily jobs that an unemployed truck driver put out of work by self-driving cars is going to be able to move into naturally.”

(As for how vulnerable your own job is, an interactive calculator produced by NPR based on Osborne’s research may have the answer.)

The debate has divided experts in the fields of automation, robotics and economics, according to the Pew Research Centre, who canvassed almost 2,000 researchers last year. The centre found 48 per cent believed automation would displace...
more jobs than it created by 2025, compared to 52 per cent who had faith it will create enough new jobs.

Michael Rosemann, a professor of information systems at Queensland University of Technology, is one of those who believes the fear of ‘technological unemployment’ is misplaced.

“When people moved from agriculture to factories, from farms into factories, we feared unemployment. Then we moved ... into firms and to offices and feared unemployment,” he says.

“I think generation by generation we’re used to this threat and generation by generation we’re able to generate typically more complex solutions. I believe we will unlock an entire new generation of jobs.

“Take the driverless car as an example. You might argue the driverless car will eliminate taxi drivers; you might also argue the driverless car will unlock the biggest amount of human time we’ve ever seen. These will be people who will want to be entertained, educated, they want to communicate, and this will create additional new opportunities. I think it’s easier to predict what can be eliminated than to predict what will be designed.”

According to CEDA, local business and policymakers need to rethink how they deal with reskilling workers as particular fields of employment disappear. The group highlights the approach taken in Denmark, where the focus is on reskilling workers while they are in the workforce, rather than waiting for people to become retrenched.

While more expensive initially, CEDA argues, the Danish approach makes long-term economic sense, ensuring people return to the workforce more quickly, with the skills the economy needs, and are more adaptable.

Rosemann says the changing environment will increase the pressure on every breadwinner to upskill and to “learn how to learn” in order to continue to earn a living.

“We all need to be proactive. We need government that understands, appreciates, and incentivises this ... but we also need industry building up a higher awareness for what does it mean to invest in conceptual deep thinking capacity. In Europe you will see how a Master’s, even a PhD, in some cases is a prerequisite for certain roles. We’re not even close to that sort of conversation here in Australia,” he says.

“That will require everyone on this planet to invest more in his or her educational wellbeing. The notion of lifelong, ongoing proactive learning is something that is here to stay.”

He says it’s also necessary to differentiate between jobs being eliminated and jobs being redefined.

“You might argue that an accountant could be replaced, but you might also argue that an accountant in the future might provide much more personalised services,” he says.

“I have to complement this story around the negative impact of automation on human labour with a much more positive story in the opportunities for digital, highly personalised healthcare services, highly personalised educational services, entertainment for people who have more time.”

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Job automation: speed of innovation could send economies towards stagnation

A new report from the Oxford Martin School and Citi calls for long-term thinking to mitigate the negative effects of an ever more automated and digital economy

The latest Citi GPS Report, Technology at Work: The Future of Innovation and Employment, explores trends in automation and points to sluggish job creation caused partly by increasing automation.

The report highlights the key challenges, explores some of the new technology brought on by the digital age and sets out an agenda for change, arguing that secular stagnation in the digital age can only be avoided by a shift towards inclusive growth.

The digital age brings with it innovation and technological change that is affecting both the way we live and work. Citi Research analysts explore how this change is affecting different sectors. Big data and the digitisation of industries are driving disruptive change in banks, advertising, software and IT services. The introduction of the Internet of Things and the advancement of sensors are helping progress intelligent robots with implications for the defence, manufacturing, healthcare, and consumer industries, while the advent of autonomous robots is drastically changing the auto, mining and printing sectors.

Dr Carl Benedikt Frey and Associate Professor Michael Osborne, the report’s Oxford Martin School authors, have collaborated with Citi analysts to investigate the extent of automation, its effects on the labour market, and the potential risk of long-term stagnation. Technology at Work marks the start of a new programme of research supported by Citi, the Oxford...
Martin Programme on Technology and Employment. New analysis by Frey and Osborne in the report highlights how the digital age will transform the nature of work across industries. For example, up to 87% of jobs in Accommodation and Food Services are at risk of automation. Even in some relatively skilled industries, such as Finance and Insurance, up to 54% of jobs could be displaced over the next decade or two.

Carl Frey, Co-Director of the Oxford Martin Programme on Technology and Employment, and co-author of the report, explains a key trend: “So far the digital age has not created very many new jobs. According to our estimates, only 0.5% of the US workforce is employed in industries that did not exist at the turn of the century.

“Digital companies need very little capital to get started and not much labour to grow their financial value. For example, WhatsApp had just 55 employees when it was acquired for $19bn. While new technologies create new occupations, they are higher skilled jobs and are not created at scale.”

Michael Osborne, Co-Director of the Oxford Martin Programme on Technology Employment, and co-author of Technology at Work, spells out just how quickly change is happening: “The successes of autonomous driving, speech recognition and machine translation have, in the space of little more than a decade, disproved long-held ideas about the distinction between human and machine. Many of these advances, that enable better data and networking, are improving our ability to innovate. This is likely to lead to further acceleration in the rate of technological change.”

Kathleen Boyle, Citi GPS Managing Editor, acknowledges that mindsets need to change, saying: “A key challenge of the 21st century will be to make growth inclusive again. This is in everyone’s interest, as rising inequality not only divides society but also threatens macroeconomic stability. Reduced investment and consumption increase the risks of a period of stagnation.”

Technology at Work outlines the options available, including access to education and training, examining the potential for MOOCs (Massive Open Online Courses) to allow people to study at their own rate and without the huge costs attached to traditional education.

As to where the new jobs might come from, the authors are hopeful and positive.

Carl Frey concludes: “Predicting the type of new jobs that will emerge is difficult. Nobody in the early 20th century would have predicted many of the jobs and industries we have today, such as software engineer or tourism.

“Public investment in promising technologies could help drive job creation. Solar energy systems engineers, wind energy engineers, informatics nurse specialists, and biomass plant technicians are new and emerging occupational titles, where public spending could help facilitate new job creation. These are all very different jobs, but they share one characteristic: they are significantly more skilled than most jobs of the past. Although education alone is unlikely to solve the problem of surging inequality, it remains the most important factor.”

Carl Frey, Co-Director, Oxford Martin Programme on Technology and Employment

JOB SURVIVAL IN THE AGE OF ROBOTS AND INTELLIGENT MACHINES

David Tuffley offers some advice on how to protect your employment prospects as robots take over more jobs

Almost any job that can be described as a ‘process’ could be done by a computer, whether that computer is housed in a robot or embedded somewhere out of sight.

In Australia, there are reports that up to half a million of existing jobs could be taken over by robotics or machines run by artificial intelligence. So with smarter computers taking on more of the work that people currently do, we are left to wonder what jobs there might be left for us humans.

Could a robot do your job?
Almost any job that can be described as a ‘process’ could be done by a computer, whether that computer is housed in a robot or embedded somewhere out of sight.

Some jobs will always be done by people. The reasons can vary greatly: economic, social, nostalgic or simply not practical for robots to do.

If we consider that many of the jobs of the future have not been invented yet, we cannot be sure what those future jobs will actually look like, though futurists are not shy of making predictions.

While we may not know what outward form these jobs will take, we can still make a catalogue of the generic skills that will be valued highly.

Thinking skills for future workers
In his book *Five Minds for the Future*, the Harvard professor Howard Gardner makes the case for cultivating a disciplined mind, being someone who can bring their attention to a laser-like focus and drill down to the essence of a subject, perceiving the simple truth of it.

Then to take this clarity to the next level by combining multiple ideas in new ways to create something interesting and perhaps useful. This done by the synthesising mind and the creative mind.

Gardner describes the respectful mind that values diversity in people and looks for positive ways to interact, thus overcoming the ‘us and them’ instinct that still creates so much conflict in human affairs.

Building on this is the ethical mind, of one who thinks about the big picture and how their personal needs can be brought into alignment with the greater good of the community. Skills for a globally connected world.

Mastering the new media
The future will see a host of new technology for creating and communicating content. In-demand workers will be able to critically assess this content and find ways to communicate it to good effect.

Communication skills have always been important and will remain so.

Knowing how to deal with large data sets will be a handy skill; finding ways to make sense of the data and turn it into useful information.

This could involve devising new, multi-disciplinary and perhaps unconventional approaches to the challenges.

Managing the information
We already filter a deluge of information every day. Our grandparents were lucky, they had to deal with a lot less.

People will need to be even better at managing the cognitive load, they will have the thinking skills to filter the deluge and find optimum solutions to problems.

When good collaboration tools exist for virtual project teams, there are few limits to what can be achieved. More projects will be done by such teams because the technology that supports them is getting better every year.

It allows the right people, with the right skills at the right price to be employed, regardless of where they live.

So it will be that people with the right virtual team skills will be in high demand.
Virtual environments

Speaking of the virtual, Procedural Architects will be at a premium. These are people who can design virtual environments and experiences that allow people to get things done and perhaps have some fun.

This is what the minds behind Google, YouTube, Facebook, Amazon, Wikipedia, Twitter, eBay, LinkedIn, Pinterest, WordPress and MSN have done.

All of this leads us to the question; what actual jobs are likely to be in demand?

Employment specialists compile lists of what they think will be in demand, based on trends. These are some of the jobs that appear on multiple lists.

The IT sector is likely to need:
Information security analysts, big data analysts, artificial intelligence and robotics specialists, applications developers for mobile devices, web developers, database administrators, business intelligence analysts, gamification designers, business/systems analysts and ethicists.

In other disciplines, there will be a need for:
Engineers of all kinds, accountants, lawyers, financial advisers, project managers, specialist doctors, nurses, pharmacists, physical therapists, veterinarians, psychologists, health services managers, school teachers, market research analysts, sales reps and construction workers (particularly bricklayers and carpenters).

Both lists are not exhaustive.

On the downside, occupations likely to shrink in demand include:
Agricultural workers, postal service workers, sewing machine operators, switchboard operators, data entry clerks and word processor typists.

Some jobs will always be done by people. The reasons can vary greatly: economic, social, nostalgic or simply not practical for robots to do.

The bottom line

To position yourself favourably for the jobs of the future, become someone who can look at problems in unorthodox ways, seeing different angles and finding workable solutions.

Be a multi-disciplinary, insatiably curious person who knows how to use the tools to model ideas and create prototypes. Possessed of an open mind and few fixed ideas about how things should be done, you nonetheless have a strong conscience and can operate outside of your comfort zone to achieve win-win outcomes. You are known for your integrity and resilience.

All of these qualities can be cultivated or perhaps rediscovered, since children often exhibit them in abundance. They have always been the way for creative, high-achieving people and they are still the way today and into the future.

In the brave new world of the coming age of intelligent machines, it is these essentially human qualities that will be more important than ever. Some things will never change because human nature is what it is.

David Tuffley is Lecturer in Applied Ethics and Socio-Technical Studies, Griffith University.

CHAPTER 2
Career trends in the future

Australia’s employment outlook

The following information has been extracted from a report based on the latest employment projections from the Department of Employment.

Employment growth in Australia has remained relatively subdued compared with the robust labour market conditions leading up to the onset of the Global Financial Crisis. Employment has increased by 780,500 (or 7.1 per cent) over the five years to June 2015, well below the growth of 1,098,900 (or 11.1 per cent) recorded over the five years to June 2010. However, more recently, employment growth has improved, rising by a solid 214,900 (or 1.9 per cent) over the year to June 2015.

Over the past five years, employment growth in the Australian economy has been spread across a number of industries and occupational groups, with a handful of services (particularly Health Care and Social Assistance and Professional Scientific and Technical Services) making particularly substantial contributions to employment growth. That said, employment growth has been offset by falls in employment in Manufacturing (down by 58,500 or 6.0 per cent) and Agriculture, Forestry and Fishing (53,900 or 15.1 per cent), while the previous strong employment growth in Mining has ended with employment in the industry declining in recent years.

Looking ahead, based on the employment forecasts and projections published in the December 2014 Mid-Year Economic and Fiscal Outlook (MYEFO), total employment is projected to increase by 1,166,400 (or 10.0 per cent) over the five years to November 2019 to reach 12,776,500. However, the distribution of this growth is projected to vary across industries, occupations, skill...
levels, states and territories, and regions. This report outlines the employment outlook across these categories, based on employment projections produced by the Department of Employment for the period November 2014 to November 2019.

Projected employment growth by industry

Over the five years to November 2019, employment is projected to increase in 17 of the 19 broad industry groups, with declines in employment only projected for Mining and Manufacturing. Health Care and Social Assistance is expected to have the largest employment growth, at 258.0 thousand (‘000) employees, followed by Construction with 137.9 thousand. Mining is expected to have the largest decline, at -40.7 thousand employees.
Assistance is projected to make the largest contribution to employment growth (up by 258,000 or 18.7 per cent), followed by Education and Training (142,700 or 15.6 per cent), Construction (137,900 or 13.0 per cent), and Professional, Scientific and Technical Services (136,600 or 14.4 per cent). Together, these four industries are projected to provide more than half of the employment growth to November 2019.

By contrast, against the backdrop of an expected peak in capital expenditure and the transition of new mines from a construction phase to a less labour-intensive operational phase, employment in Mining is projected to decline by 40,700 (or 17.8 per cent) over the five years to November 2019.

In line with the long term structural change in the labour market and the announced plant closures by major car manufacturers, employment in Manufacturing is projected to decline by 26,200 (or 2.9 per cent) over this period.

At the more detailed sector level, Australia’s largest employing industry sector – Cafés, Restaurants and Takeaway Food Services – is projected to make the largest contribution to growth over the five years to November 2019 (up by 93,600 or 16.9 per cent). The top 20 projected growth sectors generally reflect the projections at the broader industry level, with sectors in Health Care and Social Assistance and Education and Training particularly prevalent.

Against the backdrop of the implementation of the National Disability Insurance Scheme, Australia’s ageing population and increased demand for childcare and home-based care services, large increases in employment are projected for Hospitals (up by 53,900 or 15.2 per cent), Residential Care Services (46,700 or 21.6 per cent) and Child Care Services (37.7 per cent or 27.7 per cent).

Supported by above average growth in the school aged population and continuing growth in part-time workers in the sector and non-teaching staff, strong growth is projected in School Education (up by 55,600 or 12.3 per cent), Adult, Community and Other Education (40,600 or 25.8 per cent) and Tertiary Education (36,500 or 15.6 per cent).

Reflecting the large contribution to employment growth projected for the Construction industry, strong growth in employment is projected for Building Installation Services (50,400 or 20.7 per cent) and Building Completion Services (24,800 or 13.0 per cent).

A number of industry sectors are projected to record a decline in employment over the five years to November 2019. The largest fall across all sectors is projected for Motor Vehicle and Motor Vehicle Part

![FIGURE 3: TOP 20 INDUSTRY SECTORS – RANKED BY PROJECTED GROWTH TO NOVEMBER 2019 (’000)](image)

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Projected Growth ('000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cafés, Restaurants and Takeaway Food Services</td>
<td>93.6</td>
</tr>
<tr>
<td>School Education</td>
<td>55.6</td>
</tr>
<tr>
<td>Hospitals</td>
<td>53.9</td>
</tr>
<tr>
<td>Building Installation Services</td>
<td>50.4</td>
</tr>
<tr>
<td>Residential Care Services</td>
<td>46.7</td>
</tr>
<tr>
<td>Architectural, Engineering and Technical Services</td>
<td>42.9</td>
</tr>
<tr>
<td>Adult, Community and Other Education</td>
<td>40.6</td>
</tr>
<tr>
<td>Legal and Accounting Services</td>
<td>39.5</td>
</tr>
<tr>
<td>Child Care Services</td>
<td>37.7</td>
</tr>
<tr>
<td>Tertiary Education</td>
<td>36.5</td>
</tr>
<tr>
<td>Allied Health Services^</td>
<td>36.1</td>
</tr>
<tr>
<td>State Government Administration</td>
<td>30.9</td>
</tr>
<tr>
<td>Road Freight Transport</td>
<td>29.0</td>
</tr>
<tr>
<td>Computer System Design and Related Services</td>
<td>27.1</td>
</tr>
<tr>
<td>Supermarket and Grocery Stores</td>
<td>26.6</td>
</tr>
<tr>
<td>Medical Services</td>
<td>25.9</td>
</tr>
<tr>
<td>Building Cleaning, Pest Control and Gardening Services</td>
<td>25.9</td>
</tr>
<tr>
<td>Building Completion Services</td>
<td>24.8</td>
</tr>
<tr>
<td>Other Social Assistance Services*</td>
<td>24.0</td>
</tr>
<tr>
<td>Public Order and Safety Services</td>
<td>20.8</td>
</tr>
</tbody>
</table>

^Allied Health Services includes Dental Services, Optometry and Optical Dispensing, Physiotherapy Services and Chiropractic and Osteopathic Services.
*Other Social Assistance Services includes Aged Care Assistance Services, Disabilities Assistance Services, Youth Welfare Services and Welfare Counselling Services.
Manufacturing\(^1\) (down by 23,800 or 47.5 per cent), following the announced plant closures by major car manufacturers. Employment is projected to decline for a number of Mining related sectors, with the largest declines projected for Metal Ore Mining (7,600 or 13.4 per cent), Coal Mining (7,300 or 17.1 per cent), Heavy and Civil Engineering Construction (6,500 or 8.3 per cent), Other Mining Support Services\(^4\) (6,400 or 25.2 per cent) and Exploration (5,500 or 22.0 per cent). Employment in Central Government Administration is also projected to record one of the largest falls over the period (4,900 or 4.6 per cent).

**Projected employment growth by skill level**

The Australian Bureau of Statistics (ABS) classifies occupations according to five skill levels commensurate with the following qualification(s)\(^5\):

- **Skill level 1**: Bachelor degree or higher qualification
- **Skill level 2**: Advanced Diploma or Diploma
- **Skill level 3**: Certificate IV or III* (including at least two years on-the-job training)
- **Skill level 4**: Certificate II or III
- **Skill level 5**: Certificate I or secondary education.

The attainment of educational qualifications remains important given the strong past and projected growth of higher skilled occupations, as well as the lower unemployment rates recorded for people with higher qualifications.

Over the past few decades, the Australian economy has continued to shift away from lower-skilled jobs towards a higher-skilled, service-based economy. Looking ahead, the evolution of the labour market towards higher skilled occupations looks set to continue over the five years to November 2019, with employment growth projected to be strongest, in percentage terms, among the two highest skill levels.

This highlights the importance of educational attainment not only for those in the workforce looking for career advancement, but also for potential first time labour market entrants looking to improve their employment prospects.

Employment for skill level 1 occupations is projected to increase strongly by 466,700 (or 13.1 per cent) over the five years to November 2019, while skill level 2 is also projected to grow by 136,400 (or 10.4 per cent). More subdued growth is projected for skill level 3 (147,100 or just 8.3 per cent), with weak or negative growth projected for some Automotive and Engineering Trades, and Printing, Clothing and Wood Trades, as well as for Secretaries and Personal Assistants. Employment for skill level 4 is projected to

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*FIGURE 4: PROJECTED EMPLOYMENT GROWTH TO NOVEMBER 2019 (’000), BY SKILL LEVEL*

*Includes at least two years on-the-job training.*

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*FIGURE 5: PROJECTED EMPLOYMENT GROWTH BY OCCUPATIONAL GROUP – FIVE YEARS TO NOVEMBER 2019 (’000)*
increase by 299,000 (or 9.9 per cent), providing lower skilled opportunities for job seekers, while weaker growth is projected for skill level 5 (up by 117,200 or 6.0 per cent).

Projected employment growth by occupation

Employment is projected to increase in all eight of the occupational groups over the five years to November 2019. In particular, recent strong employment growth is projected to continue for Professionals (up by 376,300 or 14.2 per cent) and Community and Personal Service Workers (205,500 or 17.9 per cent). Together, these two occupational groups are expected to account for half of the total growth in employment over the next five years. Strong growth is also projected for Technicians and Trades Workers (159,800 or 9.3 per cent), Managers (146,200 or 9.5 per cent), and Sales Workers (110,400 or 10.0 per cent). Employment of Clerical and Administrative Support Workers is projected to grow by 121,400 or 7.4 per cent, below the all occupations average of 10.0 per cent. Employment growth is projected to be subdued for Machinery Operators and Drivers (25,500 or 3.4 per cent) and Labourers (21,300 or 1.9 per cent).

Figure 6 shows the 20 detailed occupations that are projected to contribute the most to employment growth over the five years to November 2019. General Clerks is projected to record the largest increase in employment over the five years of any occupation (up by 75,600 or 30.0 per cent), followed by Sales Assistants (General) (58,300 or 11.5 per cent) and Registered Nurses (41,400 or 17.9 per cent). Carers and Aides are well represented amongst the top 20 occupations, with strong growth projected for Aged and Disabled Carers (26,100 or 18.5 per cent), Child Carers (22,800 or 17.5 per cent) and Education Aides (20,900 or 29.1 per cent). Secretaries is projected to record the largest decline in employment (11,400 or 22.3 per cent). Overall, the majority of the occupations projected to decline fall within the lowest skill levels, with eight of the bottom 10 occupations either skill level 4 or 5 (for example Drillers, Miners and Shot Firers, Product Assemblers, Packers and Crop Farm Workers), and just one occupation from the bottom 10 being skill level 1 (Engineering Managers).

NOTES

1. All employment figures used in this analysis are trend series from ABS Labour Force Survey, Australia (Catalogue No. 6202.0 and 6291.0) unless otherwise stated. Latest available data on employment by industry and occupation are for May 2015.
2. All employment projections used in this analysis are Department of Employment Projections to November 2019.
3. Motor Vehicle and Motor Vehicle Part Manufacturing includes the manufacture of cars, vans, buses, trucks, trailers and caravans, as well as motor vehicle engines, bodies, electrical components and motor vehicle parts not elsewhere classified.
4. Other Mining Support Services includes directional drilling and redrilling; mining draining and pumping services; and oil and gas field support services.
5. Please note, in some cases relevant work experience may be a substitute for formal qualifications, or relevant work experience and/or on-the-job training may be required in addition to formal qualifications and training.

FUTURE PROOFING CAREERS: embracing the ever-changing job market

According to this social analysis from McCrindle Research, technology is changing faster than ever, and with that, the job market

With Australians changing jobs more frequently than ever (averaging 3 jobs per decade), and with new industries and careers emerging faster than ever (social media, digital advertising, and the apps industry’s emergence in the last decade), it is an interesting challenge to future-proof careers.

As this ever-changing career market responds to emerging technologies and demographic shifts, some jobs become obsolete as others emerge. Employees today need to be innovative and observe the trends, collaborate and learn from others, and be proactive in upskilling and retraining to remain relevant.

CAREERS OF THE PAST

On 30 June, 2013, we saw Sydney’s last ever cash payment being taken from a toll booth cash collector, when the M5 Southwest Motorway’s cash booths closed. While this career has been relevant for centuries, it is now on the brink of extinction.

A number of other careers have become obsolete over the last century:

1. SWITCHBOARD OPERATOR

While today’s phones are connected through satellite connections and tower signals, calls until the 1960s were manually connected by switchboard operators who connected each call by inserting a pair of phone plugs into the appropriate jacks.

2. BOWLING ALLEY PINSETTER

Pinsetters were most often teenage boys who would work for low pay to clear fallen pins, reset them into correct position and return the bowling balls to the players. In 1936 the mechanic pinsetter was invented, negating the need for this job.

3. ELEVATOR OPERATOR

This role involved manually operating an elevator by controlling a level that stopped and started the machine on the correct floors and regulated its speed. Lift operators were trained in operation and safety and were also utilised as greeters and tour guides, but they vanished as electric elevators became more widespread in the 1950s.

4. RADIO ACTORS

Before television became a household commodity, families would huddle around radios, entertained by light-hearted skits put on by comedians and voice actors. While radio shows still exist, they are no longer as elaborate as those of the 1800s and early 1900s.
5. LAMPLIGHTERS

Before street lamps were automated, lamplighters would climb ladders to manually light the gas lamps that lit the streets of towns and cities. This was phased out in the middle of the 20th century through electric lighting.

EMERGING CAREERS

While a number of jobs are no longer needed, here are several which have come into existence over the last decade:

1. SUSTAINABILITY OFFICER

This is a person put in charge of an organisation’s environmental programmes, formalising that organisation’s commitment to the environment by developing sustainability initiatives that build community resilience and reduce environmental impact.

2. TELEWORKING COORDINATOR

This person is an advisor to teleworking personnel, ensuring telework policy and procedures are correctly applied and that employees are adequately trained in their organisation’s teleworking implementations.

3. MEDICAL NANOTECHNOLOGIST

With nanotechnology advances and greater testing in the field of medicine, particularly with the intention to manipulate properties and structures at the nanoscale such as in the treatment of cancer cells, the demand for experienced scientists in the development and application of such technology will increase.

4. APP DEVELOPER

Smartphones have only been around for 5 years, and tablet computing took off with the first iPad in 2010, yet there are already over 1 million apps developed for these devices.

5. CYBER SECURITY PROFESSIONAL

An individual who protects computer-based equipment, information, services and communications systems from damage, unauthorised use and modification, or exploitation.

DRIVERS OF EMERGING JOB MARKETS

What factors lead to the decline of some industries and jobs and create new sectors, giving rise to new careers?

There are five factors that are redefining the world of work, and an understanding of these drivers will assist in future-proofing careers:

1. TECHNOLOGICAL INFLUENCES

From manufacturing becoming automated, robotic processes replacing jobs, driverless vehicles and the emergence of unmanned aerial vehicles (UAVs) replacing human navigation, and automated pickers reducing the demand for some plant operators, new technologies are replacing old roles. However, technology also creates new careers and opportunities. For example, in less than a decade, cloud computing, social media, and wireless devices have created some of the roles outlined above such as teleworking coordinators, app developers, social media managers, and digital analysts.

2. DEMOGRAPHIC CHANGES

The ageing population is creating new demand and opportunities, not just in the aged care sector but also for retirement services agents. Australia’s record birth rates and more affluent parents are creating new childcare services and carer roles. From cultural diversity to changing family structures, population shifts create new demands and industries.

3. REGULATORY OPPORTUNITIES

From the new Workplace Health and Safety (WHS) regime to the Working with Children Check and environmental sustainability legislation, new legislative frameworks create whole new industries. Examples of this include appliance test and tag assessors, workplace noise, air quality and safety assessors, carbon compliance auditors, and product and procurement assessors who can check on fair trade and environmental claims.

4. GLOBAL OPPORTUNITIES

Globalisation, and particularly the growth of emerging economies, creates great opportunities for Australians who are located close to the fastest growing part of the world, Asia, which is also home to 60% of the global population. Education is already Australia’s third biggest export earner (after iron ore and coal), but Australia is increasingly a provider, not only of raw materials but also of expertise as booming economies grow their cities, upgrade their infrastructure, and implement systems and procedures to develop to world standards.

5. LIFESTYLE CHANGES

Two decades ago, outsourcing of home services took off in Australia, from paying people to mow lawns or clean houses to more recently mobile dog-washers, wheelie bin sanitisers, and even oven cleaners. However, the opportunities will grow as the lifestyle expectations of 21st century families change – from meal preparation services to the evolution of childcare services, from professional organisers to personal concierge services, and from professional party organisers to styling and image consultants.

Society is rapidly changing. Our population is increasing and people are living longer. Technology is also evolving at a fast rate. Factors such as these will shape the kind of jobs that will be available in the future and the ways in which we work. Here are some projections about the top jobs leading up to 2025.

**Top three growth industries**
1. Health care and social assistance – projected to increase by up to 798,000 jobs
2. Professional, scientific and technical services – projected to increase by up to 583,000 jobs
3. Education and training – projected to increase by up to 503,700 jobs

**Top tertiary qualified jobs**
1. Registered nurses
2. Advertising and sales managers
3. Software and applications programmers
4. Accountants
5. CEO and managing directors
6. Secondary school teachers
7. Primary school teachers
8. Private tutors and teachers
9. Contract program and project administrators
10. General managers

**Top vocational and trade jobs**
1. Aged and disabled carers
2. Child carers
3. Electricians
4. Nursing support and personal care workers
5. Construction managers
6. Real estate sales agents
7. Welfare support workers
8. Metal fitters and machinists
9. Plumbers
10. Education aides

The ways in which we work are also changing. Here are some predictions for the future. How do you think the workplace will change?

**The rise of freelance workers:** More and more people are choosing to work for themselves than for a boss. People choose this for the independence, freedom and opportunity that it offers. There is, however, the risk of not finding enough work or the work itself taking over one’s personal commitments. Freelancers need to make voluntary personal contributions to their super, and do not get entitlements such as paid leave.

**Home sweet office:** Email, teleconferencing, and almost universal internet access has made it easier than ever to work from home. Many employers already offer this option to employees if, for example: the employee has commitments such as a sick child at home, or even as a benefit of being part of the company.

**Growth of casual work:** Casual work is suitable in instances where the employee needs flexible work hours that fit with study and other commitments. Industries that require shift workers are especially likely to look for casuals. Casually employed workers receive a higher wage than full- or part-time employees, but do not receive entitlements such as paid and sick leave, and secure hours.

**Slaves to the machine?** Workers in the future will need to be more wary of setting boundaries when it comes to work hours. The advent of smartphones can be an intrusion on personal time, as emails can be sent and accessed 24/7 from anywhere.

**‘Fly-in-fly-out’ work:** FIFO work is especially prevalent in industries such as mining, where workers are flown to remote areas of Australia to work over a few days before being flown back home for rest. Employers have actually discovered that this is cheaper than providing long-term housing and community facilities; however there are concerns that this type of work is having a negative impact on the health of the workers.
Young people hardest hit by new work order

A report from the Foundation for Young Australians has revealed young people will be the hardest hit under a new future of work, as the economy and labour market undergo significant changes over the coming decades.

The report *The New Work Order: Ensuring young Australians have skills and experience for jobs of the future, not the past*, highlights the way we work will be increasingly affected by three key economic drivers:

- **Automation**, with smarter machines performing a growing number of traditionally human tasks
- **Globalisation**, where technology platforms are making it possible for workers around the world to do jobs from remote locations
- **Collaboration**, through which we will see an increasing number of people engaged in flexible work with a range of employers to generate an income.

While these changes present some positive opportunities for young people – such as lower barriers to entrepreneurship; more flexibility in ways to source income and wider markets to access employment – the report also found significant risks, including rising inequality, unemployment and insecurity which young people are likely to bear the brunt of.

FYA CEO Jan Owen AM said the findings confirm the urgent need for a comprehensive national investment in young Australians, to ensure the next generation is prepared for the economy of the future and equipped with the tools to drive it.

“Australia is already facing the challenge of an ageing population and the subsequent shrinking workforce and if our nation is going to overcome these challenges, young people must be given the opportunity to drive the economy forward,” Ms Owen said.

“The future of work is going to be very different. Many of the changes could be great for our nation, but they could also be devastating – for young people in particular – if we don’t take the right actions to prepare for this vastly different world.

“This report shows that right now, around 70% of young Australians are getting their first job in roles that will either look very different or be completely lost in the next 10-15 years due to automation. Today’s 12 year old won’t have the same opportunities to get a start in the workforce.

“Around one in three young people are currently unemployed or underemployed in Australia. As more entry level jobs go in the coming decades, the chances for young people to get a foothold in the labour market will continue to shrink.

**YOUNG PEOPLE NEED SKILLS AND EXPERIENCE FOR JOBS OF THE FUTURE, NOT THE PAST**

70% of young people currently enter the workforce in jobs that will be radically affected by AUTOMATION

**OCCUPATIONS:**

ENTRY LEVEL roles for young people are DISAPPEARING

**TRAINING:**

60% of students are being trained in jobs that will be radically CHANGED BY AUTOMATION

**DIGITAL LITERACY:**

MORE THAN HALF of Australian workers will need to be able to use, configure or build digital systems in the next 2-3 years

Source: FYA, *The New Work Order: Ensuring young Australians have skills and experience for the jobs of the future, not the past.*
“Yet young Australians are not being geared for this change. Our report found nearly 60% of Australian students (71% in VET) are currently studying or training for occupations where at least two thirds of jobs will be automated over the coming decades. Many of the jobs they are studying could vanish in 10-15 years’ time.

“We need to provide our young people with a different set of skills – to allow them to navigate their way through a diverse employment journey that will include around five career changes and an average of 17 different jobs. We must start thinking differently about how we back young people for the jobs and careers of the future, so they don’t get stuck in the past.”

Ms Owen said there is a growing awareness about the need to boost digital literacy, but Australia is not acting fast enough.

“Technology and globalisation are making it easier and cheaper for people to start their own business; and new technologies and ways of working are making how and where people work more flexible. If we are to make this work in our favour, we need to position our young people for success.

“Our report found more than 90% of Australia’s current workforce will need digital skills to communicate and find information in order to perform their roles in the next 2-5 years. At least 50% will need advanced skills to configure and build systems.

“To manage this demand and ensure Australia’s young people can thrive in this environment, the next generation need to not only know how to operate technology, but how to create and manipulate it as well. Our children may be able to operate a smartphone with ease, but what they need is to learn how to build it.

“Unfortunately, our national curriculum is stuck in the past – with the current recommendation that teaching in digital skills not commence until Year 9. This is despite the international evidence that says we must go early.

“If we don’t start early to equip our young people to be digitally-literate, financially-savvy, innovative, adaptable workers they will not be able to keep up in the global market place, and the gap between high-income earners and low-income earners will get even wider for the next generation.”

Ms Owen said Australia desperately needs a national enterprise learning strategy to provide young people...
with the skills, knowledge and ideas required for a 21st century economy. Enterprise learning involves a focus on core skills including: Communication; Financial literacy; Digital literacy; Project management; Creativity; and Innovation.

“Since 2012, the OECD has reported that the development of enterprise skills is a more powerful predictor of long-term job success and performance than technical ‘subject-specific’ knowledge. This will become even more important in the future.

“If we equip our young people with the right set of skills, a thirst for innovation, and the ability to collaborate, we can ensure they take our nation’s economy in a positive direction and build the kind of lives and society for themselves we would all hope for our children.”

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An enterprising skills education would:

- Begin early in primary school and build consistently, year on year, throughout high school
- Be provided in ways that young people want to learn: through experience, immersion and with peers
- Provide accurate information and exposure about where future jobs will exist and the skills to craft and navigate multiple careers
- Engage students, schools, industry and parents in co-designing opportunities in and outside the classroom.

Three Global Forces, Automation, Globalisation and Collaboration, Are Revolutionising the Way We Work

**Automation:**

- 40% of Australian jobs are at high risk of automation in the next 10-15 years

**Gained in the Past 25 Years:**

- 700,000 professionals
- 400,000 health & security workers

**Lost in the Past 25 Years:**

- 500,000 secretaries
- 400,000 labourers
- 250,000 tradies
- 100,000 machinery workers

**Globalisation:**

- 33%+ manufacturing exports down in past 20 years

**Lost in the Past 25 Years:**

- 11% of our service jobs could be provided remotely from abroad

**Gained in the Past 25 Years:**

- Services from abroad

**Collaboration:**

- 30% of Australians workers are already participating in flexible working arrangements, involving multiple jobs / employers

*Source: FYA, The New Work Order: Ensuring young Australians have skills and experience for the jobs of the future, not the past.*

THE ROBOTS ARE COMING FOR YOUR JOB!
WHY DIGITAL LITERACY IS SO IMPORTANT FOR THE JOBS OF THE FUTURE

With automation a real threat to future jobs, school curricula have to keep up with the times, warns Stewart Riddle

In a report released this week, the Foundation for Young Australians (FYA) claims that up to 70% of young people are preparing for jobs that will no longer exist in the future. The report also raises concerns about decreasing entry-level occupations for school leavers and the impacts of automation.

In another recent report, the Committee for Economic Development of Australia predicts that:

Almost five million Australian jobs – around 40% of the workforce – face the high probability of being replaced by computers in the next 10 to 15 years.

Some of the jobs most at risk of being automated include office administration staff, sales assistants, checkout operators, accounting clerks, personal assistants and secretaries.

The collapse of Australia’s manufacturing industries, the end of the mining boom and the impact of disruptive technologies is having a significant impact on the employment prospects, not only for workers being laid off from car factories and mine sites, but also for the students who are in our schools, TAFE colleges and universities.

In response to the changing work demands, a report by PricewaterhouseCoopers argues for a focus on developing Science, Technology, Engineering and Maths (STEM) as three-quarters of the fastest-growing jobs require these skills. The FYA report also makes the case for increased emphasis on developing digital literacy and the implementation of a digital technologies curriculum in primary school.

At the heart of addressing the demands of the new work order is literacy, which is becoming more high-stakes than ever before.

Why literacy is high-stakes

Literacy is often thought of as something that happens in school, yet low levels of functional literacy of adults are also a major concern.

Low literacy levels have a significant impact on the health, education and employment opportunities of workers and are connected to lower salaries, lower employment rates, poor health and housing, crime and poverty.

The question of how workers will be able to navigate the changing employment landscape with low literacy levels is an important one. We also need to strengthen our training opportunities through TAFE and the Vocational Education and Training (VET) system for workers seeking to transition from manufacturing and unskilled labour to the new working economy.

At the same time, the question of how we are preparing students in our schools for the new work order also bears serious consideration.

Is digital literacy the answer?

The increasing importance of digital literacy can no longer be overlooked, with the FYA report claiming that over 50% of Australian workers will need to:

... be able to use, configure or build digital systems in the next 2-3 years.

Digital literacy includes skills such as coding, data synthesis and manipulation, as well as the design, use and management of computerised, digital and automated systems. Success in the new work order requires these skills alongside lateral thinking, innovation, problem-solving, collaboration and entrepreneurship. Add these to the traditional literacy skills of reading and writing and you have a very complex picture of what literacy is.

As such, our understanding of what literacy is and how it should be measured needs to be expanded from a simple view of reading and writing to one that encompasses a...
Digital literacy includes skills such as coding, data synthesis and manipulation, as well as the design, use and management of computerised, digital and automated systems. Success in the new work order requires these skills alongside lateral thinking, innovation, problem-solving, collaboration and entrepreneurship.

We are in a transition phase from old manufacturing industries, mining and the service sector economy to one that is about digital disruption, renewables and socially driven enterprise. As such, we need an education system that is responsive to the major shifts in Australia’s social, cultural and economic fabric.

Teaching computer coding in schools is a good start, but is it enough to address the significant challenges of preparing young Australians for an uncertain world of work?

Perhaps a more thoughtful review of the curriculum is needed than the one recently conducted by Kevin Donnelly, who argues that:

*Computers should not be used in the early years of primary school where more traditional teaching methods need to prevail.*

The current review of the curriculum has a backward-looking approach, with its recommendations to delay computing until Year 9 and to focus on basic literacy and numeracy in primary school. We need a school curriculum that has a clear focus on the future, not a ‘back-to-the-basics’ 1950s approach to literacy learning.

A recent report from the UK House of Lords provides some useful clues for what they call “future-proofing” young people:

1. **Digital literacy fosters creativity and innovation, underpinning job creation**
2. **Digital literacy complements traditional literacy and more effort is needed to lift outcomes across all domains**
3. **Digital literacy is important not only in schools but also in further education**
4. **Stronger links need to be made between industry and education providers**
5. **There needs to be universal access to digital technologies and for all people to have access to digital literacy learning opportunities.**

We need to do all of these things, and the sooner the better, before the robots come for all our jobs.

**Stewart Riddle is a Senior Lecturer, the University of Southern Queensland.**

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Riddle, S (27 August 2015). *The robots are coming for your job! Why digital literacy is so important for the jobs of the future.* Retrieved from [http://theconversation.com](http://theconversation.com) on 16 November 2015.
Paying a price: young men and women experiencing joblessness in Australia

Amid the changing nature of the job market, youth unemployment remains more than double the rate of overall unemployment in Australia, according to this report from the Brotherhood of St Laurence.

The tremors of the global financial crisis, and its enduring impact on youth unemployment rates in Australia, have been felt differently by the nation’s young men and young women.

Both groups have been under intense pressure in their job search: the unemployment rate for youth aged 15 to 24 years hovers above 13 per cent – a level not experienced in this country since the early 2000s. However, analysing Australian Bureau of Statistics trend data shows that there has been a marked difference in the effects on young males and females.

Today, teenage boys and young men who are in the labour market (which comprises people in work or looking for work) are more likely than young women to be unemployed – that is, looking for work.

Meanwhile, young women are more likely to be underemployed – having some work but wanting more hours, and so not counted in the official unemployment rates published each month.

This highlights the different challenges the two sexes face in a complex job market. Young people lacking experience must negotiate a globalised modern economy that is rapidly shifting to a knowledge and service base, and demanding more than ever of all its employees – including its new entrants.

The gender scenario outlined by the data is nuanced. Males aged 15 to 24 today are at higher risk of unemployment in Australia but once they have secured a job they are less likely than young females to be underemployed.

In contrast, girls and young women in the labour force are more likely to be employed than the young males, but also more likely to be working fewer hours than they would like to. Overall, as at August 2015, there were nearly 290,000 young people out of work nationwide – 55 per cent more, or 100,000 more people than at the start of the GFC in 2008.

Youth unemployment remains stubbornly, and troublingly, more than double the rate of overall unemployment in Australia.

TREND ANALYSIS: YOUNG ARE BURDENED IN DIFFERENT WAYS

The unemployment rate for young males aged 15 to 24 as at August 2015 was 14.6 per cent, more than two percentage points higher than that for young women.

The decline in the traditional sectors of young male employment, such as trades, is likely to have contributed to higher unemployment among young men ...


Source: ABS Labour force, Australia, August 2015, cat. no. 6202.0, Table 13, trend estimates.
Indeed, in most months since 2000, males in this age group have been more likely to be unemployed than the females.

Within the teenage cohort – people aged 15 to 19 in the labour force – the rate was also higher for males, at 21.9 per cent compared with 16.7 per cent for the females.

The decline in employment since the GFC has been steeper for young men than for women, especially among...
the 15-19 year olds. Male employment decreased by 8 percentage points – more than double the decrease for women – in the 15-24 years age group overall.

Yet the gender picture is reversed when looking through the prism of underemployment.

As far back as the year 2000, young women were more likely to be underemployed than their male counterparts. In August this year, 19.9 per cent of young women in the labour force – one in five – wanted more work than they had, compared with 15.4 per cent of men.

These trends are likely to be linked to the changing nature of the job market.

The decline in the traditional sectors of young male employment, such as trades, is likely to have contributed to higher unemployment among young men.

At the same time, women have historically been more likely to be in part-time work and many of these jobs today are located in lower-paid sectors such as retail and...
child care. This may explain why young women are more likely than young men to say they want more hours.

In addition, the data shows that for both sexes the percentage of young people who are entirely out of the labour force – neither doing paid work nor looking for work – has increased since the GFC. The increase has been bigger for young men. Many of these young people who are not in the labour force at all are in full-time education.

YOUTH UNEMPLOYMENT HIGHEST IN MORE THAN A DECADE, AND HIGHER FOR YOUNG MEN

Figure 1 shows that from 2000 youth unemployment trended downwards from a peak in 2001 until the GFC in 2008. Since then it has risen, to levels close to that previous unemployment high in 2001. By August 2015 the unemployment rate among those aged between 15 and 24 years stood at 13.6 per cent, or nearly 290,000 young people looking for a job.

For young men the unemployment rate in August was 14.6 per cent and for women 12.5 per cent. In most months since 2000 men have been more likely to be unemployed than women.

Since 2008 and the GFC the number of young people who are unemployed has increased by more than 55 per cent. The Labour force August 2015 figure of nearly 290,000 unemployed is an increase of more than 100,000 compared with August 2008.

Figure 2 shows the trend in the level of youth employment and of unemployment since January 2000. These are expressed as changes in the levels since 2000, with the baseline set at 100 for that year.

The decline in employment since the GFC has been steeper for young men than women. By August 2015 male employment was more than 8 percentage points below the level in August 2008, whereas for young women the fall was under 3 percentage points.

TEENAGE UNEMPLOYMENT RATE CLOSE TO 20 PER CENT

If we separate the 15-24 year olds in the labour force into two groups, the percentage of unemployed in the younger group, aged 15 to 19, is almost twice that of their older counterparts, as Figure 3 shows: 19.3 per cent compared to 10.2 per cent for August 2015.

Male unemployment was higher in both age groups, and the difference was more marked for the 15-19 year olds: 21.9 per cent for male teenagers compared with 16.7 per cent for female teenagers. For 20-24 year olds the male unemployment rate was 10.4 per cent and the female rate 9.8 per cent.

ONE IN FIVE YOUNG WOMEN IN THE LABOUR FORCE IS UNDEREMPLOYED

The unemployment rate does not fully capture the extent to which young people are missing out on the opportunity to earn and contribute to the economy. A fuller picture is achieved by also looking at the rate of underemployment – the percentage of people in the labour force who have some work and want more.

Figure 4 shows the underemployment rates of young men and women from August 2000 to August 2015. The rate has been increasing since the GFC.

Interestingly, young women have been more likely to be underemployed than young men throughout the period since 2000. In August some 19.9 per cent of young
women in the labour force – one in five – wanted more work then they had; the rate for men was 15.4 per cent.

Yet over the same period unemployment among young women has tended to be lower than among men (see Figure 1).

FEWER YOUNG PEOPLE ARE IN THE LABOUR MARKET

The fall in employment among young men (Figure 2) did not lead to a matching increase in unemployment. This is because some left the labour market altogether – they were not working at all or looking for work. As Figure 5 shows, the ‘participation rate’ for young men – the percentage that are either working or looking for work – has declined four percentage points since February 2008. The rate for women also declined, but by less. The overall participation rate in the labour force for young people in 2015 is three percentage points lower than in 2008, despite an upturn since early 2014.

As there has been a decline in employment for young people since the global financial crisis, it’s not surprising that some have left the labour market. With the job market tight overall, it seems that if it’s hard for other age groups to get a job, it will be even harder for young people, who are therefore likely to spend more time in study.

Research in Australia shows that the poorer labour market conditions since the GFC coincided with increased enrolments in tertiary education. This signals that more young people are deciding to go into further study in an attempt to improve their prospects of finding jobs when more work becomes available. Indeed the proportion of full-time students among those out of the labour force aged 15-24 rose from 76.5 per cent in August 2009 to 79.1 per cent in August 2015.

This trend of increased study also appears to be influenced by government policy, such as the removal of caps on the number of government-subsidised HECS university places in 2012.

HOW TO GUARD YOUR CAREER AGAINST RAPID TECHNOLOGICAL CHANGE

There are a lot fewer workers on the assembly line today. And it’s not just car manufacturing that has seen jobs lost to automation, cautions Rob Livingstone.

Disruptive technologies are nothing new. From the development of steam power in the early 1800s to today’s digitally-enriched world, the impact of technology on the employment landscape has been substantial.

What is new is the speed, extent and unpredictability of modern digital technology-induced disruption, and that this rate of change is dramatically increasing.

More importantly, these changes are impacting the employment landscape at all levels. Having a university degree or entering a profession is no longer a guarantee of a rich and productive working career.

So the question is: if you were about to leave school and begin a university degree or embark on your career, what should you study or do in order to give you the best chances of weathering future technology-induced disruption?

Disruptive change

Technology is changing the employment landscape in a number of ways that are affecting many careers.

Robotics and smart technologies are increasingly able to perform high level, cognitively complex tasks, which impacts a lot of skilled jobs. For example, IBM is working with the Cleveland Clinic in the US to train Watson (IBM’s ‘thinking’ computer) to become board-certified in medicine.

Similar technologies are also encroaching on other white-collar and professional jobs. Oxford University researchers have recently suggested that, in certain instances, the computerised results of complex non-routine cognitive tasks are superior to human ‘experts’ because they do not have our biases.

So the challenge facing anyone at the start of their working life lies in finding a career that will be rewarding, fulfilling and, more importantly, resilient, not just resistant to change. Individuals wishing to be successful in their careers should expect to take a more deliberate and planned approach, and regard their career as their own business.

Their research on the likelihood of technology disrupting more than 700 occupation categories makes for gripping reading for those who take their future career prospects seriously. The researchers suggest that sophisticated digital technologies could substitute for approximately 140 million full-time knowledge workers worldwide in the near future.

Anyone whose work can be outsourced to low-cost countries could also be at risk, such as we’ve already seen in manufacturing, medical radiology and even legal services. Accounting, engineering or architectural design services are also increasingly being offered from low cost countries at a fraction of the cost.

With the global market size of outsourced services standing at more than US$100 billion, the outsourcing industry is already big business.

Career planning

Earning a university degree is increasingly becoming the default position of many school leavers, thus eliminating the point of difference a degree once offered. So holding a degree is no longer enough to guarantee a job.

While the personal benefits of acquiring knowledge are indisputable, the hypothesis that attending a university will result in a net positive return in the investment in time and money is less so.

So the challenge facing anyone at the start of their working life lies in finding a career that will be rewarding, fulfilling and, more importantly, resilient, not just resistant to change. Individuals wishing to be
successful in their careers should expect to take a more deliberate and planned approach, and regard their career as their own business.

Being employed is no different to running your own business, in that you are deriving an income from your one client – that being your current employer. Most importantly, while your current employer may dictate the terms of your employment, you should be the one in charge of your career. Employees need to think of themselves and their careers as if it were a business enterprise – that must be evolved, grown, sometimes re-directed and above all – protected.

So what to study or train in? There are a number of trades and professions that are likely to be more resilient to automation and/or outsourcing and can enable you to run your career like a business.

The question is: can you recognise these career-shaping changes before your employer notices them? If so, you’re well down the path of building career resilience.

Choosing a career

So what to study or train in? There are a number of trades and professions that are likely to be more resilient to automation and/or outsourcing and can enable you to run your career like a business.

A useful guide is to consider work that fulfils a number of criteria. These include:

• The delivery of a service in real-time
• Being physically present at the point of service delivery
• The need for a high degree of skill, training and experience, and
• There is likely to be a sustained need for your service.

For example, as an electrician, you have to be trained and certified to handle live electrical services as well as be on-site to do the job. It is also an excellent foundation for the subsequent acquisition of complementary or supplementary skills and experience that reinforce your future employability prospects.

You could expand into fields such as electronics, control systems, high voltage and industrial systems, communications or electrical engineering – any one could open up rewarding career options as well as protecting your future earning potential.

Other examples of careers that meet these criteria include nurse, physiotherapist, plumber, special needs teacher, surveyor, veterinarian, air traffic controller, surgeon or firefighter. All are highly skilled and hands-on, and are unlikely to be replaced by machines any time soon.

Even though many of these careers exist in constantly evolving environments that are themselves rapidly changing, the fundamentals remain: none are at high risk of being outsourced overseas or completely automated. The same can’t be said of programmer, legal aid or accountant.

Rob Livingstone is Fellow of the Faculty of Engineering and Information Technology, University of Technology Sydney.

A 21ST-CENTURY HIGHER EDUCATION: TRAINING FOR JOBS OF THE FUTURE

What should higher education look like given we don’t know what the jobs of the future will be? Belinda Probert and Shirley Alexander explore the issue

Only the brave or foolhardy would claim knowledge about the shape of jobs for the next decade, let alone the rest of the 21st century. We know that the end of local car manufacturing alone will involve the loss of up to 200,000 jobs directly or indirectly, and there will be no large-scale manufacturing to replace them.

We also cannot assume that employment in health and human services will continue to expand in their place. Globally, millions of dollars are being invested in robotic monitors, nurses and companions for the elderly. The driverless car is almost with us, meaning that even Uber’s moment in the sun may be brief.

So if we’re not sure what the jobs of the future will look like, what kind of tertiary education can prepare students for the world of work? Various forces will be at play including economic (such as continued globalisation and intensification of competition), social (such as the ageing of Australia’s population), and technological (automation, digitalisation). There are also powerful environmental constraints.

Only the brave or foolhardy would claim knowledge about the shape of jobs for the next decade, let alone the rest of the 21st century.

What kind of education can prepare us for the future?

If we accept that tertiary education (from diplomas to doctorates) will be the key to career opportunities, ensuring everyone has equal access will be a priority. Higher levels of education must also be available in more flexible and innovative forms to enable lifelong learning. This will be essential both for deepening skills and re-skilling as old occupations disappear and new ones evolve.

Future education should not just prepare students for jobs that might be on offer, but stimulate them to see the possibilities for innovation and even – for some – the creation of their own jobs.

There will be plenty of teachers and chefs, hairdressers and scientists, but even familiar occupations will require new capabilities. Whether working in Shepparton or Shanghai, graduates will need cultural competencies to be effective practitioners of their trade in a
Multicultural world. Most will also need to have skills in analysing and interpreting a world flooded with data, and dominated by digital forms of communication.

There are key generic skills that need to be developed. Communication skills – including writing skills – are essential to support both effective teamwork and creative linkages across disciplines and specialisations. Higher levels of numeracy are also needed across many more occupations.

Generic skills need to be developed in specific disciplinary and professional contexts. The uncertainty of the future should not be used to reduce the importance of disciplinary depth in either vocational or higher tertiary education. We need graduates who have disciplinary depth as well as a broad range of generic capabilities. A focus on narrow occupational competencies won’t serve students well. Critical thinking is essential.

Learning of the future will be about solving problems

Arizona State University is attracting attention worldwide for its focus on solving big social, economic and environmental problems. To do this the university has to break down disciplinary silos, and stop focusing on questions that academics know how to answer.

There is no reason, they argue, to assume that what we can know is what we most need to know.

So if we’re not sure what the jobs of the future will look like, what kind of tertiary education can prepare students for the world of work?

Closer to home, the University of Technology Sydney has introduced a Bachelor in Creative Intelligence and Innovation (BCII) that can be taken as part of a double degree with everything from midwifery to accounting. The BCII allows students to develop a capacity for approaching messy, complex problems and issues of contemporary society with unique capabilities.

Students don’t learn by sitting passively in lectures, but by engaging in activities that help them understand which technologies, methods and creative practices can provoke innovation. They have to be able to critique proposals by developing skills in team collaboration, visualisation, modelling, and communication of complex ideas.

The challenges for tertiary education are significant. To meet them universities will need to give teaching and curriculum design a greater priority. This will require greater incentives for collaboration between teachers, and across disciplinary boundaries. Students will need opportunities to experience work environments as part of their learning.

Boundaries between educational institutions and the outside world need to be far more porous, not to ‘train’ students for existing jobs, but so they can understand the new forces at work. They will have to adapt to these forces, but they can also be helped to respond with creativity and intelligence.

Belinda Probert is Adjunct Professor, La Trobe University.

Shirley Alexander is Deputy Vice-Chancellor and Vice-President (Education and Students), University of Technology Sydney.

The Conversation

Graduating into a weak job market: why so many grads can’t find work

Joshua Healy explains how many young Australians are currently going from the graduation ceremony and straight to the unemployment line

Times are tough for young Australians. The costs of education and housing are rising. The youth unemployment rate is double the national average and competition for good jobs is intense.

Many young people are taking longer to reach the conventional milestones of adulthood: independent housing, career stability, a partner and children. This is not because young people no longer want these things, but because they have become harder to attain.

Degrees of importance

A university education is often seen as a reliable pathway to a good career and a comfortable life, but this pathway also seems to be crumbling with ongoing weakness in the job market.

Graduate Careers Australia runs a large, annual survey of new graduates to track what happens to them after university. Over 100,000 graduates took part in the 2014 survey and the results were released last week.

The headline-grabbing figure was that only 68% of bachelor graduates from the class of 2014 had a full-time job four months after graduating. That is the lowest full-time employment rate for new graduates since Graduate Careers Australia began measuring in 1982. The long-term average for the past three decades is 80.6%. The previous low (70.6%) was in 1992, after Paul Keating’s “recession we had to have”.

The 68% is also only for Australian citizens and permanent residents. Overseas students, who represent a large share of Australian university enrolments but whose full-time employment rates within Australia are lower, are also excluded.

After graduation, unemployment?

The Australian graduate labour market is in a serious slump. In some ways, the news is actually worse than the 68% figure lets on. First, more graduates are continuing into further study.

This is what we would expect with high unemployment: graduates stay out of the bad market and add to their qualifications, hoping to find work later when conditions have improved. The proportion of bachelor graduates staying on in full-time study has increased for the past six years; the trend is the exact opposite of the declining full-time employment rate.

Second, the chance of finding a full-time job straight after graduation is even lower (65%) for those aged less than 25 years. These younger graduates are the majority of all bachelor degree graduates, but their older counterparts seem to do better in finding full-time work. There may be an employer preference here against hiring younger applicants who have less general or specific work experience.

Finally, average starting salaries have declined for younger graduates who do find full-time jobs. In 2014, the median salary of graduates in their first full-time job was worth 74% of male average weekly earnings. Like the graduate full-time employment rate, this ratio has been declining for the past six years and is at the lowest level yet recorded by Graduate Careers Australia.
Employment and salary outcomes of recent higher education graduates

Survey highlights from the latest annual Australian Graduate Survey by Graduate Careers Australia

The 2014 AGS saw deterioration in the short-term employment prospects of new graduates compared with 2013. In terms of bachelor degree graduates either in or seeking full-time employment:

- 68.1 per cent were in full-time employment within four months of completing their degrees (down from 71.3 per cent in 2013 and 76.1 per cent in 2012).
- 20.3 per cent had secured a part-time or casual position while continuing to seek full-time employment (up from 18.1 per cent in 2013 and 15.3 per cent in 2012, and
- 11.6 per cent were not working and still looking for full-time employment at the time of the survey (up from 10.6 per cent in 2013 and 8.6 per cent in 2012.
- However, GCA’s Beyond Graduation Survey (BGS) indicates that the middle- and longer-term outlook is very positive, with the employment figures for 2010 graduates growing by 14 percentage points three years later.
- Bachelor degree graduates in the wider Australian workforce (aged 15-74) had (at the time of the survey) an unemployment rate of just 3.2 per cent compared with an overall rate of 5.8 per cent and 8.2 per cent for those with no post-school qualifications.
- The median annual starting salary for new Australian resident bachelor degree graduates aged less than 25 and in their first full-time employment in Australia was $52,500 in 2014, essentially unchanged from $52,450 in 2013 and $52,000 in 2012. This was 74.0 per cent of the annual rate of male average weekly earnings ($70,959 at the time of the AGS), unchanged from 74.3 per cent in 2013 and down from 77.8 per cent in 2012 and GradStats 2013.
- One-fifth of respondents (20.8 per cent, essentially unchanged from 20.7 per cent in 2013), were undertaking further full-time study.
- Overall satisfaction with courses as measured by the Course Experience Questionnaire (CEQ) remains at a high level, with 93.9 per cent of graduates expressing broad satisfaction with their courses.
- Just over half of the graduates who found full-time employment in 2013 or 2014 learned of the job first through one of three strategies: searching advertisements on the internet (25.7 per cent), talking to family or friends (13.9 per cent) and visiting university or college careers services (12.4 per cent).
- GCA’s Beyond Graduation Survey (BGS), which follows up AGS respondents three years after their original survey response, shows that by 2013, the full-time employment figure for 2010 graduates was 90.2 per cent, an increase of almost 14 percentage points from 76.3 per cent.


There is now a real risk that, in attempting to expand access to higher education, governments and universities have effectively flooded the job market with new graduates, at a time when employer demand for them was slipping. The research indicates that those who are unlucky enough to graduate in a recession suffer long-term ‘scarring’ effects in terms of their employment and earnings prospects.

Get better grades, or better contacts?

So what can be done to help new graduates in a weak job market? One clue comes from the Graduate Careers Australia findings for graduates who did and did not work during their final year of study. Those who did any work in that year, and especially if it was full-time, were more likely to be employed full-time after graduation than those who did not work while finishing their degree.

This strongly suggests that employers prefer to hire graduates with recent work experience, even if it is outside their field of study. Deepening students’ engagement with the job market just as they are about to graduate seems to boost their employment prospects. Students who spend all their time studying may not actually be maximising their appeal to future recruiters.

Many universities already offer placement services to their students. This sort of assistance helps graduates to link up with prospective employers. It also allows universities to tailor their courses somewhat to the skills that employers demand.

Such programs are undoubtedly easier to administer where there are clearly-defined occupations for graduates to enter (like dentistry) than when the destinations and employers are varied (like humanities). Yet graduates in the second group are the ones who appear to be most in need of assistance.

Providing more targeted support to graduates facing a difficult job market is inexpensive when compared with the high personal and economic costs of graduate underemployment.

Joshua Healy is Senior Research Fellow, at the Centre for Workplace Leadership, University of Melbourne.

Future leaders – attitudes toward career and employment

Following is the executive summary from the 2015 Future Leaders Index, the latest survey of 18-29 year-olds about their study and work attitudes, compiled by university campus retailer The Co-op and accountancy firm BDO

The survey examined the attitudes of more than 5,000 young Australians to study and work. Two in three respondents were concerned about getting a career-related job. More than half felt job prospects in their field weren’t strong. Among tertiary students, one in two said they felt so pessimistic about their prospects that they were considering further study so they could avoid making career decisions. Today’s graduates are facing the worst job prospects in a quarter of a century – and perhaps even longer, the latest research shows.

Against a backdrop of relative economic volatility and a highly competitive labour market, the 2015 Future Leaders Index reveals young Australians’ career concerns, and gives insight into our Future Leaders’ fear, desire and consequential actions.

INSIGHT 01
Career Fear: Future Leaders are concerned* (67%) about their career prospects in the current economic climate. Only a third (29%) of Future Leaders feel sure about the career path they will take, suggesting an opportunity for greater career guidance services aimed specifically at 18-29 year-olds.

INSIGHT 02
Career Desire: Most Future Leaders (65%) are driven to obtain a career rather than “just a job”. But when faced with important career decisions, some Future Leaders who are currently students are opting to defer making any decision given poor current job prospects, instead opting to further their study.

INSIGHT 03
Mind The Skills Gap: There is a lack of alignment between Australia’s forecasted growth industries and career paths that either have been chosen or are being contemplated by 18-29 year-olds. These findings highlight the potential skills shortage Australia could face within these key economic and employment sectors unless Government, the education sector and industry address this skills gap. Conversely, it also highlights possible oversupply in some sectors that Future Leaders intend to pursue.

INSIGHT 04
The Training Deficit: Future Leaders are keen to learn more on-the-job skills during their studies – 84% believe there needs to be much more workplace training for students, and 64% believe universities don’t equip students sufficiently with the practical skills they will need when they start work.

INSIGHT 05
Career Competition: In order to get ahead of the competition, students are taking vocational training into their own hands, with 43% of current students completing career-related work placements. Future Leaders will also look abroad to fulfil their career goals if local opportunities are scarce.

NOTES
*Q We’d like you to think about trying to get a full- or part-time career-related role in the current economic environment. Given the current economic environment, are you ...
[Sum of extremely, very, quite concerned].

© The Co-op

Two in three respondents were concerned about getting a career-related job. More than half felt job prospects in their field weren’t strong. Among tertiary students, one in two said they felt so pessimistic about their prospects that they were considering further study so they could avoid making career decisions.
WORKSHEETS AND ACTIVITIES

The Exploring Issues section comprises a range of ready-to-use worksheets featuring activities which relate to facts and views raised in this book.

The exercises presented in these worksheets are suitable for use by students at middle secondary school level and beyond. Some of the activities may be explored either individually or as a group.

As the information in this book is compiled from a number of different sources, readers are prompted to consider the origin of the text and to critically evaluate the questions presented.

Is the information cited from a primary or secondary source? Are you being presented with facts or opinions?

Is there any evidence of a particular bias or agenda? What are your own views after having explored the issues?

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Brainstorm, individually or as a group, to find out what you know about projected future work trends.

1. What does the term ‘casualisation of the workforce’ mean? (include examples)

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

2. What do the letters ‘STEM’ refer to in relation to future employment prospects?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

3. What is automation, and how could it affect future job opportunities?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

4. Whom does the term ‘technocrat’ refer to, and what kind of jobs do they perform?

   ____________________________________________________________
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Complete the following activity on a separate sheet of paper if more space is required.

“Disruptive technologies are nothing new. From the development of steam power in the early 1800s to today's digitally-enriched world, the impact of technology on the employment landscape has been substantial.”

Livingstone, R, How to guard your career against rapid technological change.

Consider the above statement, and in the space below explain the meaning of the term ‘disruptive technologies’. Provide examples of these types of technologies and how they may affect the job market in the present and in the future.
Complete the following activity on a separate sheet of paper if more space is required.

In groups of two or more, write a design brief for a flyer or poster to promote study and training ideas for future job prospects.

In the brief, offer ideas for education and training, explain why it is important to focus on these areas for the future work environment, and list the relevant types of jobs that could be available in the future (include suggestions for text and images). Share your ideas with other groups in the class.
Complete the following activity on a separate sheet of paper if more space is required.

“A university education is often seen as a reliable pathway to a good career and a comfortable life, but this pathway also seems to be crumbling with ongoing weakness in the job market.”

Healy, J, Graduating into a weak job market: why so many grads can’t find work.

Use the internet to research university courses offered in Australia which you believe could provide the basis for a career which is future-proofed. Write a few paragraphs identifying at least three (3) courses, the university where the courses are offered, and how you feel those courses could help you to attain secure employment in the job market of the future.
Complete the following activity on a separate sheet of paper if more space is required.

“Almost five million Australian jobs – around 40% of the workforce – face the high probability of being replaced by computers in the next 10 to 15 years.”

Riddle, S, The robots are coming for your job! Why digital literacy is so important for the jobs of the future.

Consider the above statement. Form into two or more groups in your class to discuss the probability of jobs being replaced by computerisation.

Compile a list of three (3) jobs you believe would, and three (3) jobs you believe wouldn’t, be replaced by computers. Include reasons to back up your choices. Discuss the results with other groups in the class.

**JOBS THAT WILL BE REPLACED BY COMPUTERS**

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

**JOBS THAT WON’T BE REPLACED BY COMPUTERS**

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
MULTIPLE CHOICE

Complete the following multiple choice questionnaire by circling or matching your preferred responses. The answers are at the end of the next page.

1. What do the letters ‘AI’ refer to in relation to computer technology?
   a. Assisted interface
   b. Artificial interface
   c. Assisted intelligence
   d. Automated interface
   e. Automated intelligence
   f. Artificial intelligence

2. In 2014, the median starting salary for Australian resident bachelor degree graduates aged less than 25 in their first full-time job was:
   a. $22,500
   b. $32,500
   c. $42,500
   d. $52,500
   e. $62,500
   f. $72,500

3. A recent headline-grabbing figure stated that only 68% of bachelor graduates from the class of 2014 had a full-time job four months after graduating. However, over the past three decades, the long-term average has been:
   a. 16.8%
   b. 18.6%
   c. 30.6%
   d. 68.0%
   e. 80.6%
   f. 98.0%

4. Which of the following are considered main drivers of future job markets? (select all that apply)
   a. Technological influences
   b. Extinction rates
   c. Regulatory factors
   d. Global opportunities
   e. Fashion changes
   f. Lifestyle changes
   g. Demographic changes

5. In what year was the first iPad introduced?
   a. 1970
   b. 1980
   c. 1990
   d. 2000
   e. 2010
   f. 2015
6. Respond to the following statements by circling either 'True' or 'False':

a. The computer revolution of the twentieth century created an increase in middle-income jobs.  
   True / False

b. Creative and lifestyle jobs are on the decline.  
   True / False

c. The threat of computerisation has historically been largely confined to routine manufacturing tasks, such as part construction and assembly.  
   True / False

d. A well-known computer program called Eliza once passed itself off as a real psychotherapist.  
   True / False

e. The introduction of computer typesetting put a lot of printers out of work.  
   True / False

f. There are less workers over the age of 65 in today's workforce than ever before.  
   True / False

g. One of the fastest growing jobs in the first decade of the 21st century is the job of photographer.  
   True / False

MULTIPLE CHOICE ANSWERS
1 = f; 2 = d; 3 = e; 4 = a, c, d, f, g; 5 = e; 6 – a = F (the computer revolution of the twentieth century created a hollowing out of middle-income jobs), b = F (creative and lifestyle jobs are on the increase), c = T, d = T, e = T, f = F (there are more workers over the age of 65 in today's workforce than ever before), g = T.
Research shows that in some parts of rural and regional Australia in particular there is a high likelihood of job losses being over 60% (Committee for Economic Development of Australia, *More than five million Aussie jobs gone in 10 to 15 years*). (p.1)

Australia has the lowest levels of unemployment benefits of the OECD for a single person recently unemployed (ibid). (p.2)

With three million new jobs since 2000, it is likely the Australian workforce will increase by another three million more workers in the next 15 years to 2030. There will be a growing emphasis on part-time working women as well as longer careers for older workers (nbn co ltd, *Beauty and the geek: jobs of the future unveiled*). (p.3)

The Australian population is ageing giving rise to demand for more care givers (Salt, B, *Super Connected Jobs: Understanding Australia's future workforce*). (pp. 5-6)

The composition of the workforce is changing. More and more women are working which means there is a rising market for household services. The care giver jobs of the future include social worker, aged-care worker, childcare worker and youth worker (ibid). (p.6)

The Australian population will increase by close to six million by 2030; this will create demand for jobs that are a function of increased population levels including health, teaching, accounting and public administration professionals (ibid). (p.7)

There are more workers over the age of 65 in today’s workforce than ever before and there will be even more by 2030 (ibid). (pp. 7-8)

One of the fastest growing jobs in the first decade of the 21st century is the job of photographer at a time when photography was democratised through the smartphone. That same smartphone technology created new demand for webpage photography and the visualisation of products and services (ibid). (p.8)

The top 3 occupations least at risk in the future workforce are doctors, nurses and teachers. The top 3 occupations at risk are accountants, cashiers and administration workers (PricewaterhouseCoopers, *A smart move*). (p.10)

44% (5.1 million) of current Australian jobs are at high risk of being affected by computerisation and technology over the next 20 years (ibid). (p.11)

The computer revolution of the 20th century caused a hollowing-out of middle-income jobs. The next generation of computers will mainly substitute low-income, low-skill workers (Frey, C and Osborne, M, *Machines on the march threaten almost half of modern jobs*). (p.15)

A survey of almost 2,000 researchers in 2014 found 48% believed automation would displace more jobs than it created by 2025, compared to 52% who had faith it will create enough new jobs (Ryan, R, *Will new jobs emerge as automation takes over*?). (p.19)

Up to 87% of jobs in accommodation and food services are at risk of automation. Even in some relatively skilled industries, such as finance and insurance, up to 54% of jobs could be displaced over the next decade or two (Oxford Martin School, *Job automation: speed of innovation could send economies towards stagnation*). (pp. 20-21)

Employment has increased by 780,500 (7.1%) over the 5 years to June 2015, well below the growth of 1,098,900 (11.1%) recorded over the 5 years to June 2010 (Department of Employment, *Employment Outlook to November 2019*). (p.24)

Smartphones have only been around for 5 years, and tablet computing took off with the first iPad in 2010, yet there are already over 1 million apps developed for these devices (McCrindle Research, *Future proofing careers: Embracing the ever-changing job market*). (p.30)

The ageing population is creating new demand and opportunities, not just in the aged care sector but also for retirement services agents (ibid). (p.30)

Two decades ago, outsourcing of home services took off in Australia, from paying people to mow lawns or clean houses to more recently mobile dog-washers, wheelie bin sanitisers, and even oven cleaners (ibid). (p.30)

Leading up to 2025, healthcare and social assistance jobs are projected to increase by up to 798,000 (ACTU Worksite for Schools, *Job trends and growth industries*). (p.31)

Around 70% of young Australians are getting their first job in roles that will either look very different or be completely lost in the next 10-15 years due to automation (FYA, *Young people hardest hit by new work order*). (p.32)

A report has found more than 90% of Australia’s current workforce will need digital skills to communicate and find information in order to perform their roles in the next 2-5 years. At least 50% will need advanced skills to configure and build systems (ibid). (p.33)

Since 2012, the OECD has reported that the development of enterprise skills is a more powerful predictor of long-term job success and performance than technical ‘subject-specific’ knowledge (ibid). (p.34)

In 2015, the unemployment rate for youth aged 15-24 years hovers above 13% – a level not experienced in this country since the early 2000s (Brotherhood of St Laurence, *Paying a price young men and women experiencing joblessness in Australia*). (p.37)

Overall, as at August 2015, there were nearly 290,000 young people out of work nationwide – 55% more, or 100,000 more people than at the start of the GFC in 2008 (ibid). (p.37)

Research in Australia shows that the poorer labour market conditions since the GFC coincided with increased enrolments in tertiary education (ibid). (p.41)

Researchers suggest that sophisticated digital technologies could substitute for approximately 140 million full-time knowledge workers worldwide in the near future (Livingstone, R, *How to guard your career against rapid technological change*). (p.42)

Today’s graduates are facing the worst job prospects in a quarter of a century – and perhaps even longer (The Co-op and BDO, *2015 Future Leaders Index*). (p.48)
GLOSSARY

Artificial intelligence
AI is the intelligence exhibited by machines or software.

Automation
The use of machines in a manufacturing or other process or facility to perform traditional human tasks.

Casual work
Includes temporary work or work with changeable hours, which does not offer the protection of a permanent job. Casual employees are usually not entitled to the benefits associated with continuous employment although they are often entitled to a casual loading in lieu of these other benefits, such as sick leave.

Casualisation
The process where an increasing number of the workforce becomes employed in 'casual' jobs.

Digital disruption
When new digital technologies and business models affect an existing market. Robotics and smart technologies are increasingly able to perform high-level, cognitively-complex tasks, which impacts a lot of skilled jobs.

Digital literacy
Includes skills such as coding, data synthesis and manipulation, as well as the design, use and management of computerised, digital and automated systems.

Employment
A contract between an employer and employee in which the employee agrees to provide services under the direction and control of the employer in return for a salary or wage.

Family-friendly workplaces
Workplaces with policies designed to support staff to balance work and family responsibilities, e.g. looking after dependent children, and family members who have disabilities, or are aged and infirm.

Flexitime
Flexible working hours which allow employees to start and finish work between a flexible range of agreed hours, providing they work a set number of hours each day or week.

'Fly-in-fly-out'
FIFO work is especially prevalent in industries such as mining, where workers are flown to remote areas of Australia to work over a few days before being flown back home for rest.

Freelance work
When a person who is self-employed and is not necessarily committed to a particular employer long-term. Freelancers need to make voluntary personal contributions to their super, and do not get entitlements such as paid leave.

Globalisation
Where technology platforms are making it possible for workers around the world to do jobs from remote locations.

Job
The set of tasks that is allocated to an employee and that they are expected to carry out during their work day. The term is often extended to include the immediate physical or social work environment in which the tasks are performed.

Job sharing
When two or more people share a single full-time job. Job sharing is particularly useful for people who have commitments.

Outsourcing
When an employer or business 'contracts out' work that would normally be done by employees. Many self-employed workers and fixed-term workers receive work that has been outsourced. Outsourcing can reduce an employer’s costs and can also reduce the workload of full-time employees. Information technology (IT) jobs are commonly outsourced.

Part-time employees
Employees who are engaged for a number of hours that are less than those for full-time employees in an award. Part-time workers generally receive the same entitlements and benefits of a full-time worker on a proportional basis.

Part-time work
Permanent employees who have a set number of weekly working hours. Many part-time workers receive benefits like those of full-time workers on a proportional or pro rata basis.

STEM
The abbreviation for science, technology, engineering and mathematics.

STEM solution
The recommendation to future-proof Australian jobs by growing skills in science, technology, engineering and maths (STEM).

Technocrats
Highly-skilled, highly-trained and well-remunerated people who control the know-how that drives the methods of production. Without the technocrats the robots and the automatons subside and business ceases to evolve. Technocrats have highly-developed skill sets in science, technology, engineering and mathematics (STEM).

Working from home
Work performed in the homes of employees which is often a way for parents to strike a balance between family and work. Home-based work arrangements can contribute to improved productivity, reduced absenteeism and improved morale and employee commitment.

Work-life balance
Refers to achieving a balance between all of the aspects in an individual’s life including work, family, friends, health, relaxation, community activities and socialisation.
WEB LINKS

Websites with further information on the topic

ACTU Worksite  http://worksite.actu.org.au
Career Industry Council of Australia  https://cica.org.au
Committee for Economic Development of Australia (CEDA)  www.ceda.com.au
Department of Employment  www.employment.gov.au
Department of Industry, Innovation and Science  www.industry.gov.au
Digital Disruption for Government  www.digitaldisruptiongov.com.au
Foundation for Young Australians (FYA)  www.fya.org.au
Job Outlook  http://joboutlook.gov.au
myfuture  http://myfuture.edu.au
The Conversation  http://theconversation.com

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