QUT Real World Futures report

FUTURE OF WORK – THE STATE OF THE DEBATE

March 2018

www.real-world-futures.qut.edu.au

INTRODUCTION

It seems only yesterday we were talking about how to use the extra leisure time we would have from the reduced working week that technology would deliver.

Then we discovered that technology was more likely to add work to our leisure time and we started to talk about work-life balance.

And it was only a few years ago that the Australian Government's Intergenerational Report flagged another issue: that our ageing population meant more of us would have to stay at work for longer to provide basic services and to fund the longer retirement that went with a longer life.

Ticking in the background has been another issue and it's this: will there be enough income-generating work to keep enough of us in the workforce as technology offers new, cheaper ways to perform functions once exclusively the function of human workers?

That issue has now moved front and centre.

It's been at the heart of the *QUT Real World Futures* program since launch in early 2015 and more and more focus is turning to the "future of work".

Surprisingly, there has been no official government position on this. The government's scientific research agency, the CSIRO, has published a document on the digitally enabled workforce of the future and a number of private organisations (the Committee for the Economic Development of Australia, Deloitte's and AlphaBeta) have produced reports but none have fed into government policy.

This might be about to change. A Senate Select Committee on the Future of Work and Workers has begun its own investigation, an act that has produced more than 50 submissions from across industry, academia and government.

Printed double-sided and stacked, they are about 35cm high.

This *Real World Futures* report summarises a selection with a focus on those that represent the views of big organisations or with something unique to say.

Not surprisingly, the views vary. The major business organisations use their submissions to echo their calls for industrial relations reforms but one of them, the Australian Chamber of Commerce and Industry, cites figures which show how quickly things will change.

It relies on projections from the computer chip manufacturer, Intel, which points out that the world had 2 billion smart devices (i.e. connected to the internet) in 2006, 15 billion in 2015 and will likely have 200 billion by 2020. Many of them will be gathering data and performing functions that impact on human work.

The mining industry reports that 29% of its businesses are working on how to bring robots into their operations and 27% are looking at drones. Seventy percent are exploring how they operate mines remotely from their often unattractive locations.

The manufacturing industry sees benefits for Australia – in that technology takes away the competitive disadvantage it suffers in labour costs, a view that doesn't help direct employment in manufacturing but creates other opportunities.

The pressing issue in this is how we prepare for these changes – what skills will matter.

There is a consistent view across the groups the Senate committee is hearing from that the worker of the future will need technical skills but will be most likely succeed if they are complemented by creative problem solving ability, strong communication and flexibility for fresh learning.

This is coming through in other recent studies on the Future of Work.

A UK study which includes Associate Professor Michael Osborne, an Oxford mathematician well known to Real World Futures followers takes a similar view.

That study late last year concluded that about 20% of current jobs were at risk from technology between now and 2030 and it forecast many new jobs that technology could not match – particularly in the caring industries or in intricate construction and agricultural jobs.

And the World Economic Forum which meets in Davos each January turned its attention to how workers in vulnerable occupations could be trained to transition to new in-demand occupations.

The threat isn't just new technology but the business models it creates. In many industries, the efficiency of those models is already damaging old businesses and the employment within them – newspapers, photography and retailing are the standout examples.

The so-called platform businesses – Uber and Airbnb are the standout examples – which provide a marketplace for anyone to sell their idle assets are the ones most people look at.

They use the forum of the Senate inquiry to paint themselves as a solution to the problem, pointing out that they are an immediate alternative for those who lose their work from other disruptive technologies.

But back to skills: One worrying sign is research by the Australian jobs aggregator Seek.com.au which asked people how they would prepare for the future. On-the-job training was the most popular answer but one-in-five people didn't know.

This might not be an issue if we value the view of the human resources professionals who are tasked with planning the workforces of big businesses. While many understand the implications of the technological shift, almost 9 in 10 of Australian Human Resources Institute members – those who are paid to plan future workforce needs - think the risk is more than a decade away.

QUT is among the submitters to the inquiry. It takes the view that technological change is happening and sets out the changes it is making to prepare its students for robust careers in a challenging work environment.

And they include making sure there is stronger understanding of what is ahead. This summary of what Australia's principal participants in business and workforce planning are thinking is part of it.

The debate is live and taking place in living rooms, workplaces, through the *Real World Futures* program and in Senate committee rooms around the country. This document is live and will be updated as more information and views come to light. In the meantime you can stay directly in touch with the Senate submissions at **https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Future_of_Work_and_Workers/FutureofWork/Submissions.**

David Fagan,

Director Corporate Transition and the Real World Futures program

UNIVERSITIES

QUT

QUT outlines the multi-pronged approach it is taking to future workforce challenges. They include curriculum changes to help equip students with digital economy skills – both in technology and in high-level problem solving.

It details research efforts in the digital economy, entrepreneurship and workplace changes which will inform both the university and the broader community.

And it cites the *Real World Futures* program as an exemplar of surfacing the issues that are central to understanding the coming challenge to skills.

"Every career we educate for is changing. Every discipline we research is changing. This has its sharpest impact in workplaces where owners, managers and employees are managing change like never before," QUT says in its submission.

"The University has paid close attention to the emerging analysis of future workplaces and its effect on the skills we educate for and the careers we help launch and has played some role in both surfacing the issues this raises and trying to more deeply understand the macro impact.

"In short, some jobs will be lost to technology and new business models. Some jobs will change through augmentation by technology. And new technology, in combination with other economic and social factors will create many new jobs. This represents an evolution of the workforce and the need to both plan for structural and individual change.

"This accords with the view of QUT and matches the direction we have taken as we prepare for a rapidly changing environment.

"Almost every university activity is influenced by the need and desire to develop new skills that will equip our graduates well into the mid-century.

The continued advance of technology through the marriage of robotics, artificial intelligence, big data is inevitable and largely welcome. The issue we all face (whether as a university or a business or a community or a government) is how this complements, rather than supersedes, human activity in the workplace.

"These are complex issues that require consideration at both national and international level. The impacts of technology on work will take many years, perhaps decades, to become apparent. We understand this deeply as a home for leading researchers on many of these technologies. The university welcomes more public focus on the issues you raise which are vital to the development of graduates with knowledge to function through coming decades. This is the university's mission.

 "QUT puts great value on this role and the accompanying role of being an agent for economic development of the nation. Central to the university's ability to achieve this is the need for ongoing funding certainty and policy settings that encourage economic development at all levels. The University urges the committee to consider this as an important part of the context in reaching a view on the future of work and the positive role education at all levels can play in securing a future for workers of all categories."

# Melbourne Institute of Applied Economic and Social Research

The Melbourne Institute of Applied Economic and Social Research, based at the University of Melbourne, is sceptical about the claimed scale of impact from disruptive technologies.

It takes a long view of the labour force, pointing out that technology has always changed the way work is done and the makeup of employment.

"The experience of history to date is that waves of new technology have been accompanied by net increases in employment," the institute (one of the nation's leading economic research bodies) says.

It is also sceptical about how advanced machines will be in replacing human work. "There is a set of skills that humans have a comparative advantage over machines; those that require interpersonal interactions, flexibility, adaptability and situation-specific problem solving.

Figure 1: The Changing Industrial Composition of Employment in Australia
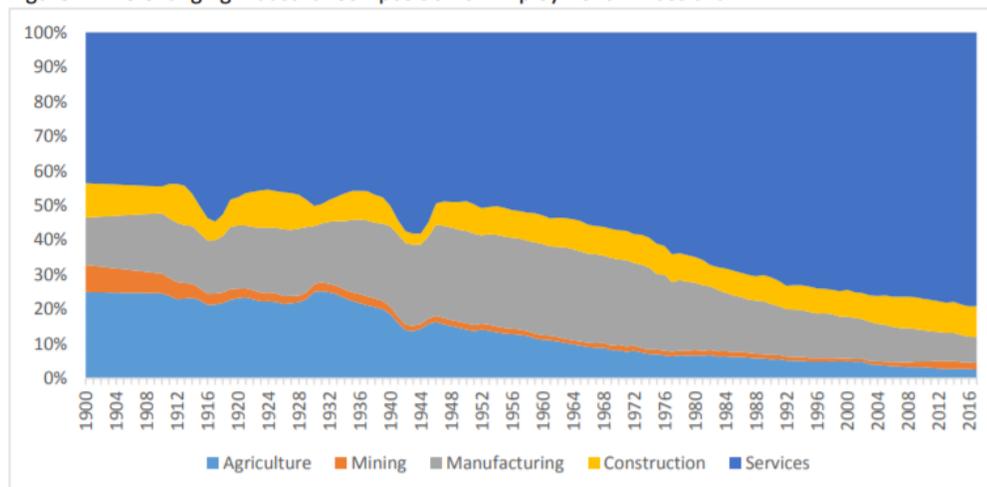
Source: Heath (2016), who in turn drew on data from ABS, RBA and Withers et al. (1985).

"….Is more university education the answer? Traditional training and learning systems may not be well placed to meet future skills needs and so just turning out more university graduates may not be the best solution.

"The skills that will be most valued are hard to teach _ emotional intelligence, creativity, critical thinking, and adaptability. Further, these "soft skills" are not neatly aligned with traditional vocational career paths."

It highlights one other issue beyond what to do about displaced workers. "The bigger question is how can we take advantage of the changes to the labour market to ensure workers are best placed to benefit? Australia's digital infrastructure needs to be world class to ensure the benefits from technological developments are maximised. The problems with the rollout of the NBN suggest we have not made a good start here."

Australian Council of Learned Academies

The council draws from the work of four academies for its recent series of publications on the impact of new technology.

The academies are the Australian Academy of the Humanities, Australian Academy of Science, Academy of the Social Sciences in Australia and Australian Academy of Technology and Engineering.

Their recent reports have looked at our relative performance in STEM education, the role of science in increasing productivity, innovation and the impact of technology on democracy and culture.

"Technology is constantly changing the nature of our work and an innovative workforce requires a strong education system that fosters academic skills across all disciplines," ACOLA says.

"Australia will need to train a future workforce to be equipped with skills to work with and maintain complex equipment and new technology in many sectors.

"As technologies advance, old jobs will disappear and new ones will arise. Australia's workforce will therefore need to thrive with tomorrow's technologies and be adaptable.

"Australia faces shortfalls in skilled workers due to an ageing population and the aforementioned advancements in technology. Maintaining a skilled, productive and innovative workforce that can keep pace with technological advancement will be essential for our continued growth and prosperity.

INDUSTRY

Australian Chamber of Commerce and Industry

Australia's peak employer body, the Australian Chamber of Commerce and Industry (ACCI), framed the future of work issues around the broader economic challenges for business.

Noting that the private sector accounted for 80% of employment, it says: "Our working future and the jobs we can generate for today's young people and generations to come will be a function of the foundations we provide for business."

It also underlines how disruption will impact work and life, using Intel data which shows the number of smart devices increasing from 2 billion in 2006 to 15 billion in 2015 and a forecast 200 billion by 2020.

It describes the value of a shared approach to business success between employers and employees – whether they be baristas, CFOs, cleaners or web developers.

"… to approach the future of work as a divisive, political, industrial relations debate anchored around a 100-year-old system, the perceived opportunities of the current political cycle or the short term statutory agenda of some stakeholders would do all Australians, current and future, a significant and lasting disservice."

ACCI draws extensively on the work of the CSIRO's Data61's *Tomorrow's Digitally Enabled Workforce* in describing how work will change. It also used ABS data to show that health care and social assistance is now the largest employing industry, accounting for 13.32% of the workforce. Employment in the creative economy is also growing.

It gives examples where technology change has created more jobs than it has displaced – for instance 50,000 bank teller jobs were lost to ATMs

between 1995 and 2005 while a similar number of roles for more highly skilled financial professionals were created; the number of traditional printing jobs over the past two decades declined by 17,000 but 35,000 new graphic jobs were created.

The broader economic issues ACCI aligned to the future of work included the ageing workforce and the growth of independent workers. It also warned about Australia's loss of competitiveness, citing risks to power supply, second-rate telecommunications, onerous regulations and inflexible industrial relations as serious matters.

"We also need to better support Australian businesses in navigating the inherent uncertainty that is set to characterise the ever globalising, intensifying and accelerating markets of the future," ACCI says.

"Australian businesses will not be able to ignore disruptive business models which increase the risk environment for doing business and for investment. They will need to adapt to compete effectively.

"The extent to which government helps or hinders this adaptation will be more important than any single factor in how Australia experiences the future of work."

Australian Human Resources Institute

Only one in eight human resources professionals surveyed by their member organisation sees threats to the future workplace in the next decade.

And almost half of them are apprehensive or unsure about the future challenges in their own work when the future arrives.

The surprising result is contained in the AHRI submission to the Senate's Future of Work inquiry. It flies in the face of most research which predicts significant changes to the workplace by 2030.

Despite the scepticism of its members, the institute says there are many signs that the "future" has arrived.

"There are signs that the future is already upon us and is disturbing the sense of order we have become used to," its submission says.

"Robotics has already changed the face of sectors such as manufacturing, but we don't have to look far to see other examples of business models thrown into disarray, the relatively sudden emergence of brands such as Amazon and Uber being two potent examples."

The full survey of members included these findings:

- 96% see emerging technologies as an opportunity rather than a threat;
- 79% believe emerging technologies will improve processes and contribute to productivity;
- 59% believe fewer than 10% of human jobs in their organisation will be replaced by emerging technologies;

On the workforce in general, 51% do not expect emerging technologies to replace many jobs in the future;

Of the jobs that are replaced by technology, 78% expect the technology will be augmented with a human presence (through job re-design);

- 62% believe today's workforce planners are capable of planning for a future workforce;
- 87% are confident they personally will be able to acquire skills and knowledge to meet future work challenges (via further study);
- 70% disagree that the role of HR will diminish with the impact of new technology;

- 63% say they are preparing to focus on the parts of their job that rely on human skills (because other parts of their job can be replaced by new technologies).

But 34% believe robotics and AI will create more jobs than they replace and 43% believe the gig economy will be an offshoot of emerging technologies with a negative impact on performance, customer service, culture and ethical behaviour.

"Since the pathological corporate behaviours that revealed themselves leading up to and contributing to the global financial crisis of 2008, these four attributes when measuring organisational value are regarded as critical to both profitability and sustainability.

"With that in mind, policy makers in business and law makers in government may well be advised to turn their minds to the potential impacts of a gig economy on the nature of work and workplaces, and the potential impacts on service expectations of consumers.

"In addition, those drafting policy might be mindful of the wider social consequences of a growing workforce in a gig economy that may not enjoy the benefits that employees have come to expect with regard to relative security of employment, access to benefits such as paid leave, and the potential to qualify for loans and mortgages."

Financial Planning Association

The Financial Planning Association which claims a close connection to the financial wellbeing of Australians calls for actions from all sectors to pave the way for change.

"Wages will be affected for both low and high-skill workers. Job responsibilities will shift as automation and robotics integrate into the workforce.

"Digital platforms will present more jobs for employees and working patterns will adapt. For the best outcomes, education models will need to complement the new workforce as they prove to be the fundamental platform for future change to be built upon."

The association sees increased roles for financial planners in helping workers achieve their goals navigating less certain workplaces and income streams.

"Employment safeguards such as superannuation and insurance will have to evolve as both eligibility and portability of insurance will need to adapt to the spasmodic nature of the gig economy.

"The necessity for higher education attainment will undoubtedly procure new costs and expenses, requiring better debt management. Furthermore, inconsistent income from episodic work will become critical to manage in terms of cash flow and debt management."

The range of measures proposed by the FPA includes reinvention of the HR function to better spot trends and manage talent, modernising education systems, incentives for lifelong learning and transition support for workers.

"The expansion of the gig economy and displaced jobs in the automation and digital work will put pressure on the government's capabilities to assist the vulnerable workers transitioning into new careers or employees' in-between jobs," the submission says.

The planners say government labour agencies have a focus on fraud control and payment of unemployment benefits and do not pay attention to how workers can develop the skills they need to transition through careers.

Australian Retailers Association

The Australian Retailers Association tells the inquiry that its industry has the lowest confidence levels as measured by the Sensis Business Index.

Retail sales through traditional outlets grew 3.3% last year while online sales grew 10.2%.

The association represents 7500 retailers selling through 50,000 shopfronts where 1.23 million Australians are employed.

It again calls for a modernisation of the industrial relations system to allow more flexible employment practices.

It sees benefits in technology, particularly for food retailers accessing new markets.

But it is dubious about the rise of "platform work" in retailing because of the continued importance of customer service which relies on a traditional, stable, yet adaptable workforce.

"As with all disruptive forces, questions arise around the effects of platforms and new technologies on workers and the workforce more generally. While historically, technological revolutions have created shifts in employment patterns, this has largely been driven by slow institutional and political responses.

"Disruption of the workforce by technological change should, rather, be considered in the context of contemplating existing jobs and job tasks and providing opportunities for businesses to grow.

"There is no future of work without the future of business."

Minerals Council of Australia

The Minerals Council of Australia spells out the scale of technological innovation proposed in the mining industry which employs 218,000 people in Australia.

It cites research by Deloitte that shows 69% of mining companies globally are looking at introducing remote operations and monitoring centres. Some 29 percent of companies are looking at their use of robotics and 27% unmanned drones.

"Deloitte further explains that shared services centres and centres of expertise will employ a mix of onshore, offshore and robotic workforce with increased human-machine interaction and new and different skills with both work and equipment being redesigned."

The Australian mining workforce is highly paid and highly skilled and has been concentrated in regional areas but technological innovation has moved more jobs from mining sites to remote operational centres.

The Minerals Council says it is looking closely at what these developments mean for its industry but relies heavily on work done by Rio Tinto which was considered an industry leader when it began to remotely operate many aspects of its Hope Downs 4 mine in Western Australia.

"As we move forwards with automation systems, we will need specialists in computing, systems and diagnosis and the upskilling of maintenance people to service and maintain the technology," Rio says in a case study on automation.

"These "employees of the future" will have good operational knowledge and detailed systems knowledge of the automated system. This will enable them to troubleshoot, conduct investigations, generate

meaningful corrective actions, manage continuous improvement and contribute to operational procedures and training materials."

The Minerals Council calls for industrial relations reforms to allow it more flexibility and also challenges educational institutions to produce graduates with the skills needed for the resources sector.

It also identifies a looming skills gap with exceptionally low demand for entry into mining engineering courses.

"Technologies such as automation and big data are presently being used across the value chain to increase productivity and reduce risk," the Minerals Council says in its submission.

"These technologies are changing how companies mine and the skills needed to work in this new environment. The industry also recognises that the pace of innovation within the industry is changing workforce needs at speed and this presents opportunities and challenges for the minerals sector."

Australian Road Transport Industrial Organisation

The Australian Road Transport Industrial Organisation calls on the government to reform workplace legislation to recognise the potential rise of the "gig economy" through unregulated platforms such as Uber, Deliveroo and Foodora.

"These commercial relationships sit outside traditional employer/employee and principal contractor/subcontractor relationships in the industry and, arguably, threaten standards of remuneration and working conditions even though the ad hoc nature of the work involved may of itself be attractive to contractors engaged through platform owners," the ARTIO tells the Senate inquiry.

"...Legislation has not kept pace with changes in work arrangements in the gig economy which means a detailed review of current employment legislation with a particular focus on its adequacy and efficacy is justified.

"...There is also a very important issue around workplace health and safety - if the employees of traditional transport operators with OH&S systems and regimes in place are being replaced by "gig" workers receiving jobs from a particular platform then the question of driving hours, fatigue management and related OH&S training becomes a bigger concern for society."

The organisation agrees adoption of new technologies will create more benefits than costs but calls for them to be spread more widely and "not confined to the innovator such as the platform developer".

"They should be rewarded for their risk and enterprise but not necessarily at the expense of workers who gain work through such businesses. Legislative and institutional change usually occurs after the event. The starting point is to review its adequacy and efficacy."

Australian Information Industries Association

The AIIA, an industry body representing Australia's tech industry seeks a reset on the discussion about technology and innovation.
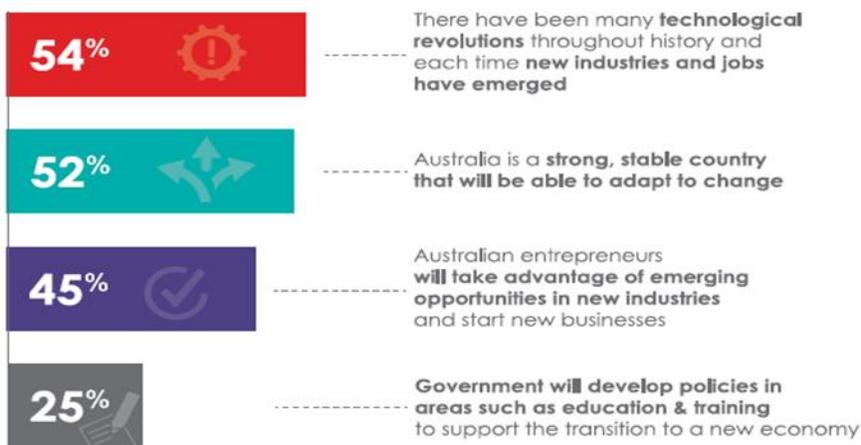
"An important learning from the last federal election is the importance of getting the narrative right. Despite both parties supporting messaging about innovation being key to Australia's competitiveness and growth, in the end what the electorate heard was _ innovation means using more technology, technology means disruption, digital disruption means jobs are disappearing _ 'I'm going to lose my job'."

Newer technology developments (artificial intelligence, robotics and machine learning) were fuelling fresh anxiety only justified by the lack of an urgent response to the pace of change.

"Australians need a narrative about how the impact of technology on how we work and the types of jobs we do will be managed. This includes a clear strategy for preparing for this future and specific policy responses to issues such as the adjustment and re-employment of workers who are displaced; concerns about digital exclusion and more broadly an understanding of what skills will be required and how they will be developed."

The AIIA cites its own public opinion polling to claim strong public support for innovation and technology in the nation's future prosperity. But Australians' confidence in the nation's performance is lukewarm with 44% believing government, business and consumers are lagging the rest of the world while only 7% believe it is moving faster.

The reasons why Australians feel positive about future work and job opportunities:

54% There have been many **technological revolutions** throughout history and each time **new industries and jobs have emerged**

52% Australia is a **strong, stable country that will be able to adapt to change**

45% Australian entrepreneurs **will take advantage of emerging opportunities in new industries** and start new businesses

25% Government will develop policies in areas such as education & training to support the transition to a new economy

SOURCE: *Australian Information Industry Association / Galaxy Poll, 2017*

The association breaks the economy into 10 industries and analyses the impact of emerging technologies on each of them, attempting to define future roles that might emerge.

They include remote drill operators (guiding robots) in the mining industry, sensor installers in agriculture, smart home advisers in construction, virtual teachers in education, robotic engineers in health, social media monitors in professional services, crypto-currency investment bankers in financial services, drone drivers in transport and behavioral specialists in retailing.

The submission includes a call for the development of STEM skills to create, not just use, technology but recognises that technical proficiency alone won't be enough.

"The notion that there's only a finite amount of work and that advances in technology reduces that notional limit have clearly proved to be unfounded," the information industries say.

"Changes in demographics and in our socio-economic and socio-political environment, coupled with the need for growth, the phenomenon that is competition and man's ingenuity have combined over centuries to constantly evolve jobs and the nature of work and the labour market – mostly for the better."

GOVERNMENT

Department of Industry, Innovation and Science

The department's submission spells out the range of digital infrastructure and platforms needed to support jobs growth in a modern digital economy.

They include:

. CSIRO research in robotics, space technology, natural resource management and 5G networks;

. Geoscience Australia's second generation Satellite-Based Augmentation System which offers centimetre-level positioning accuracy anywhere, anytime. And its Digital Earth Australia technology providing access to satellite data for commercial purposes;

Its own Digital Economy Strategy will be released in the first half of this year.

Like other agencies, it comments on the upside and downside for employment of digital uptake.

"Emerging digital technologies such as artificial intelligence, robotics and the Internet of Things provide significant opportunities for economic growth. Embracing these new technologies can boost national productivity and enhance the competitiveness of Australian industries. This in turn will increase investment, exports, wages and living standards.

"While technological advances can have benefits, there may also be costs and uneven impacts on individuals, industries and regions, particularly where the technology is rapid or unexpected."

It describes its key areas of focus for the future of work and workers as: technological change; education and skills challenges and their impacts on employment; changing industrial composition and the growth of non-market services and digital industries; and the impact on regional Australia.

Figure 3: Employment growth by skill level, 1986 to 2017
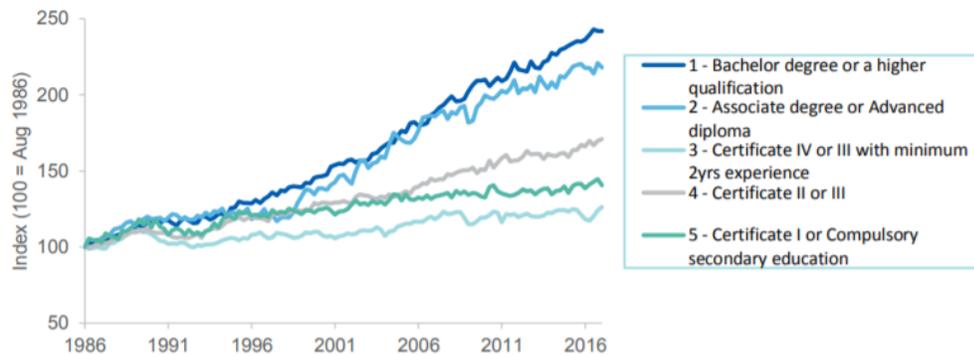
Source: ABS cat. no. 6291.0.55.003

It reaffirms the concern of others that Australian industry is underprepared, referring to the World Economic Forum's Digital Readiness Index which ranks Australian business's use of information and communication technologies at 24th in the world and trending downwards since 2000.

And it raises the question about our ability to respond: "Emerging technologies are challenging the adequacy of skills and raising the importance of interdisciplinary education and research and clearly outlining the need for workers to be more open to the need to upskill and engage in lifelong learning. Digital skills and skills that complement machines are increasingly important for workers."

The greater change in the workforce would be in changing the way existing jobs are performed. "For instance, accountants increasingly need strong analytical skills as more routine tasks are performed by

computers; teachers will have more time to interact with students due to new learning programs and platforms and increasingly automated grading." (See graphic on p10 employment growth by industry)

Productivity Commission

The agency which helps guide a lot of government economic policy reminds the committee that "flux in the Australian economy" has been the norm. Drawing on thousands of pages of reviews over the past two years it recaps six key observations. They are:

- The labour market is and has been resilient;
- Change through technology is still slow and slow to produce productivity gains;
- The "gigi economy" is still in its infancy in Australia;
- Forecasting the impact of technology is risky and often overstated in the short term;
- Data will become more important as a commodity;
- Vocational training and university education are not delivering the skills needed in the digital economy but business is also not employing graduates with STEM skills at entry levels.

THE DISRUPTORS

GOOGLE

Google Australia provided its own research to show the average Australian worker experienced two hours of automation in their working week between 2000 and 2015 and on current trends will experience another two hours between 2015 and 2030.

"Australian work is now composed of proportionately more tasks involving interpersonal communication, creativity, decision-making and synthesising information," Google says.

"Most Australians have experienced automation as change in the way they do their jobs, not as a change in the job they do, however, because automation affects some tasks more than others, and, because some jobs are composed of more of those automatable tasks, workers in those jobs are disproportionately affected.
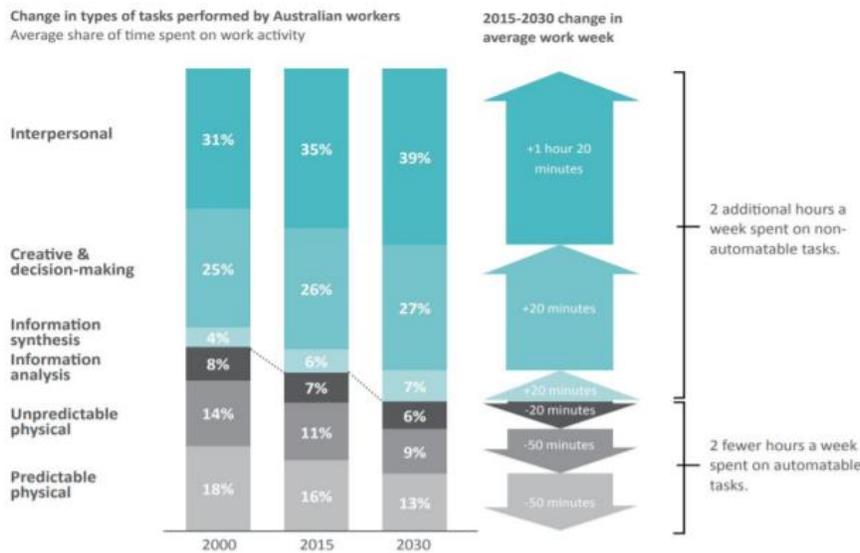
Google calls for a framework to build a Future of Work policy with three pillars – investment for job creation, reskilling for jobs composed of different tasks and social support for displaced workers. And it sets out the challenge for developing the future workforce.

"Australians yet to enter the workforce will need to be prepared for work involving more interpersonal and creative tasks; workers in the early-middle stage of their careers, particularly those whose jobs have traditionally involved more routine or repetitive work, will need avenues to gain new skills; and workers near the end of their careers whose jobs are comprised of a high proportion of automatable tasks will need policies that support them if they are unable to find work."

The shift to more automation shifts investment decisions in important ways, according to Google. "Where previously the cost of labour was a critical imperative for offshoring in manufacturing, as it has been for

labour-intensive call centre tasks in the service sector in recent years, 21st Century advanced manufacturing will be led by countries with regulatory certainty, adaptable workforces with problem solving and interpersonal skills, reliable and cost effective energy and efficient cyber-physical networks."

Automation is changing the way we work, reducing the amount of time a worker will spend on routine tasks by up to 2 hours a week

Change in types of tasks performed by Australian workers
Average share of time spent on work activity

2015-2030 change in average work week

SOURCE: O*NET, AlphaBeta analysis

Google contends that the right policy settings can boost Australia's economy by $1.2 trillion in value between 2015 and 2030 - $400 billion from highly skilled workers using more automation, $400 billion form upskilling the 3.5 million workers at high risk of displacement from automation and $600 billion from the right education policies to skill those entering the workforce over the next 12 years.

Other benefits from automation include less injury times, higher job satisfaction and higher wages from increased productivity.

"Research shows that embracing digital technology brings benefits across the economy. In Australia, small and medium businesses that are advanced in their use of digital technology compared to those at a basic level are eight-times more likely to be creating jobs, seven-times more likely to be exporting, earning 1.4-times more revenue and 14-times more likely to be innovating.

"Some are calling the process of implementing digital tool and business models the fourth industrial revolution. What is clear is that the consumer productivity benefits that technology has delivered are now being sought by business and governments."

But Google sounds a warning bell about our preparedness.

"Although Australia's consumers are generally sophisticated users of technology, Australia's publicly listed businesses lag global leaders in automation. Only 9% of Australia's publicly listed companies are engaging in automation, compared to 14% on average against peer countries and more than 20% in leading nations like the United States. And Australia's 9% figure is substantially bolstered by mining industry investment."

AIRBNB

The digital business which lays claim to being the world's largest accommodation provider without owning a bed also lays claim to lofty motives in the debate.

"Airbnb's community is democratising capitalism and creating economic opportunities for everyday Australians, using technology to help connect and empower people – rather than replacing them," it declares in its submission.

It wants to ensure the growth of the sharing economy has people – not robots and algorithms – at its heart.

In 2017, Airbnb, hosted 5 million guests in Australia, it housed 137,700 property listings and its hosts earned on average $5200 for the year.

It links its activity to the future of work by outlining how its users generate income from underused assets (spare rooms). This, it says, helps housing affordability and helps spread economic activity to regional areas which otherwise miss out on the economic benefits of tourism.

"We are true believers in the enduring, irreplaceable ingenuity and dynamism of humanity. To that end, while some businesses search to replace or minimise the human element, we instead want to liberate and maximise it.

"Rather than displacing workers, we want to empower millions of people and strengthen local communities through technology. We want to harness the transformative power of technology to improve livelihoods, reimagine what it means to travel and make communities more open and resilient."

It cites digital literacy as important to achieving this and encourages the federal government to run workshops in targeted parts of Australia to provide resources and content to train hospitality entrepreneurs "so that citizens can participate confidently in the sharing economy.

 A similar program is already in place in India where Airbnb is training 50,000 would be hospitality entrepreneurs.

UBER

The ride-sharing disruptor, Uber, portrays itself similarly as a liberating force creating work opportunities for those otherwise displaced, relieving congestion in cities and delivering nutrition to homes.

"Uber's technology has enormous potential to improve how people access economic opportunities, giving power and control to individuals to access earning opportunities, facilitating work-life balance and creating new opportunities for people traditionally marginalised from the labour market.

"We believe that digital apps should improve the way people earn and create better opportunities, consistent with the social contract, and that everyone should be able to find good earning opportunities that they can access in the way they choose and to have access to social protections."

Anticipating reaction to its relations with drivers, it cites a survey of 1500 drivers conducted in October 2017: 94% liked flexibility and 80% believed that flexibility to drive when they liked was more important than being paid a flat hourly rate for driving.

Uber also highlighted its ability as a path back to paid work for either the injured or disabled but also as means of creating independent income for any worker.

"We support a focus on skills development and lifelong learning. For example, opportunities like driving Uber can help people learn to become micro-entrepreneurs – skills that are useful in starting other small businesses. We believe there is a role for digital intermediaries in providing tools and partnerships for their customers (for example drivers in Uber's case).

"Independent work can also be an important tool to support people during transitions including those arising from job displacement. Being able to quickly start earning a living and fit that work flexibly around retraining will help people adapt to the future."

SEEK.COM.AU

Australia's original disruptor, the jobs advertiser Seek.com.au, want to collaborate with governments to combine its market insights with public data to better skill future workers.

It explains that it is investing heavily in a career services division which will allow people to "match their skills and passion with education and career opportunities based on real-world data". It is soon to release a product that provides live information on supply, demand and career paths for over 200 roles.

"Data sharing arrangements between SEEK and the public sector can help this product and other initiatives to deliver superior information to Australians on career pathways," it says.

This development has been influenced by SEEK's own research on how Australians intend to remain relevant in the workforce. The results were:

- On job training 47%
- Staying on top of current information and trends 56%
- Further formal education 30%
- Changing industry or looking at where current skills might be used 24%

"Soberingly, 22% of people, nearly one in four Australians, stated they did not know how they could stay relevant," SEEK has told the committee.

SEEK identified three key trends through its own data and additional research. They were:

- Hollowing out of the middle: Middle skill roles are in decline while low-skill and high-skill roles are on the rise;
- War for Talent: There is not a large enough pool of highly skilled technical people to support businesses as they transform to leverage digital technology;
- Flexible work: Full-time roles are not growing at the same rate as non-full-time roles.

As well as co-operating on date, SEEK also called for the release of more educational data, the creation of incentives to make digital economy skills more desirable and embracing online delivery of education.

THE UNIONS

Finance Sector Union

The FSU represents 450,000 workers in the finance sector which is at the forefront of technological change.

"The pace and scale of change in financial services is unprecedented," it says.

"The rapid deployment of artificial intelligence, more refined algorithms and technological advances mean massive disruption for the financial sector. Recent large job losses in major banks is a pointer to this disruption.

"The traditional provision of banking, through face to face interaction in bricks and mortar branches is being steadily replaced by online and app-based financial engagement. … This landscape presents significant challenges for banks, their workforces and the broader community."

It cites recent job shedding by the ANZ, Commonwealth and Westpac banks as evidence of its concern for employment.

And it calls for an industry plan to stabilise the changes.

It would include some constraints on artificial intelligence to "put people and planet first". "This is why ethical AI discussions on national and global scale are essential.

"…Artificial intelligence and the data that it builds on must combat, not accelerate, inequality. This requires new public policies and monitoring mechanisms, including the establishment of a new ombudsman function."

CFMEU

Australia's strongest union, the Construction Forestry and Mine Employees Union (CFMEU) warns that technology is among the factors creating an underclass through "the proliferation of insecure work, record low wages and increased inequality."

"Technology is a prime contributor to rising unemployment and underemployment as tasks usually done by workers become automated, outsourced overseas or made obsolete," the CFMEU says.

"…Without intervention, increased technology change will continue to erode job security, increase underemployment and push down wages for working people in Australia.

"Technology change presents numerous benefits to the country but, as things are, without adequate control of examination of the social, economic and policy structure in which change occurs, it will likely only lead to further insecure work, underemployment, stagnating wages and inequality."

The CFMEU says it has three choices:

1. To fight and prevent technological change;
2. To let change occur freely;
3. Take advantage of the opportunities of innovation but ensure the benefits are widely shared.

It expands its concerns about inequality to the impact on corporations.

"Innovation has allowed individuals and companies to access markets they have never been able to in the past. This has allowed individual companies to capture entire markets, particularly for new technological products where the cost of selling to each additional person is low.

"These winner-take-all markets are resulting in a small number of 'superstar' businesses and individuals making ridiculously large amounts of money while other competitors make very little."

Specific technologies the CFMEU sees affecting its members include autonomous robots and drones in mining and building sites, the rise of online news damaging newspaper jobs and 3D printing in the manufacturing and textile industries.

Its submission includes case studies of automated mines by two of Australia's biggest resource companies, BHP and Rio but says there is not yet an "Armageddon" in mining.

"As automation becomes routinized, clearly mining employment levels will fall. There will be some new jobs created, maintenance and one-off work will still require humans and the higher productivity of the production task will increase the ratio of white collar/professional work relative to production jobs."

On construction, the union foresees new jobs which require greater digital literacy and entrepreneurship.

"The precise nature of the jobs that will emerge in the next 20 years is difficult to predict but what is known is that the skills required will be largely based on operating new technology and computer programs and using new materials and production methods.

"This will have a massive impact on the way in which the industry has traditionally trained workers. …Apprentices will still need to know the theory of building techniques and their limitations but this will likely be more focused on ensuring that the computers and technology they are using are working properly."

Queensland Nurses and Midwives Union

Nurses forecast that there will be three categories of jobs by 2030 – Future jobs focused on digital skills; Changing jobs similar to current jobs but with more focus on caring, and; Fading jobs which will be replaced by automation.

Demand for nursing skills is predicted to increase over the next decade due to an ageing population and the increased funding to the disabilities sector.

But the nursing union sees a dramatic change in the professional role of nurses in that time.

"In response to new clinical technologies, nurses and midwives' clinical skills and sense of autonomy are complex," the union says in its submission.

"Their clinical judgment remains the interface between existing and developing clinical knowledge and skills and the information and support provided by new technologies.

"While simple technologies may be 'set and forget', more sophisticated technologies require recalibration and/or trouble shooting. With limited resources and a large number of older nurses and midwives, there is considerable pressure to provide adequate training for new staff and to plan for the upcoming workforce."

The union calls for co-ordinated long-term reforms by governments, the profession and education and training sectors to develop a sustainable health workforce which may "negate the need" for nurses to provide as much direct patient care.

"Digital hospitals, electronic records and robotic technology will all impact on the training and skills required by nurses and midwives," the union says in its submission.

"For example, robotic-assisted surgery reduces the amount of time patients spend in hospital after surgery so the majority of patient education must be conducted beforehand.

"Perioperative nurses who are involved in the intraoperative phase of patient care need to be aware of the basic procedural requirements and know how to properly connect, calibrate, set up and dismantle the components of the surgical system.

"They must also be familiar with specific robotic instrumentation and surgeon preferences for each procedure, including how to load, unload, handle and clean the equipment correctly.

"An overarching requirement is for nurses and midwives to be trained in health informatics so they are equipped to use and master digital technology."

A NOTE ON SOURCES

This report is based on analysis of the range of submissions to the Senate Inquiry of the Future of Work and Workers. It is informed by the many discussions that have been part of the Real World Futures program at QUT since 2015 and draws from other analyses conducted both in Australia and overseas.

While it is written to summarise the positions of the various participants in the debate, it does not purport to represent their views nor the entire range of views.