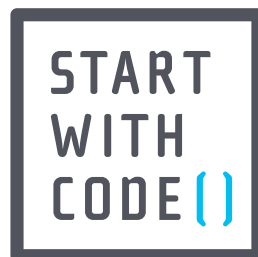




Australia's Innovation Generation

Australia's
Innovation
Generation



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FOREWORD

MALCOLM TURNBULL MP, MINISTER FOR COMMUNICATIONS

The Internet and the technologies that enable it have profoundly transformed us and the world we live in. Most people in developed countries, and before long most people globally, are connected to the Internet, and thus to each other, 24 hours a day.

So much of our lives are lived in the digital plane that fundamental paradigms are being shattered. For all of human history the default was to forget – we had to make an effort to remember, whether it was painting on a cave wall or writing a history. Now the default is perpetual digital memory.

But at the core of all this revolution are two essential human drives. We are social animals and we yearn to communicate, to engage, to connect. And we now have the universal hyper platform of the Internet accessible to all of us. And we are also each of us unique, or think we are, and place immense value on being free and able to make our own choices. The Internet has enabled more choice and freedom than ever before.

And at the core of this revolution is technological innovation. Australia is not without achievements in the digital world, with an impressive track record for innovation and high-tech manufacturing. Freelancer, Cochlear and WiFi, developed by the CSIRO, are all well known.

But a country of our size and sophistication should be able to do more to innovate and commercialise that innovation.

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“Australia’s entrepreneurs and businesses are increasingly making their fortune from technology and digital services. This is a significant change from the growth centred on resources, finance and property.”

The Internet has made the world much more competitive. Retailers whose competition was across the other side of the street now face competitors from around the globe – the trade exposed proportion of our economy gets bigger every day. And while the competition is greater so too are the opportunities and to succeed Australian companies, young and old, must increasingly act like tech startups – staying flexible, open-minded and prepared for disruptive change.

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“We need to improve the way we teach our kids; we need to inspire a generation of digital natives who are already avid consumers of technology to embark on careers as entrepreneurs and coders, in e-commerce and as engineers.”

This book addresses important issues for the future of Australian innovation. The recent struggles in Australia's traditional manufacturing sector, while lamentable, reflect a trend across the developed world. In some Australian industries – such as building cars or canning fruit – we have seen a long decline of our relative competitiveness, with production shifting to lower wage and larger scale economies of the developing world.

However, as Alan Noble explains, there is cause for optimism. Australia's entrepreneurs and businesses are increasingly making their fortune from technology and digital services. This is a significant change from the growth centred on resources, finance and property.

The risks and opportunities created by digital platforms are clear. Last year Facebook, a company less than ten years old, was valued at \$104 billion.

The market value of US new media companies like Apple, Google, Amazon and Facebook is more than three times that of the old media companies like Disney, News Corp, Comcast, Time Warner and CBS. By 2012, the market capitalisation of the three leading listed Australian online advertising companies – Seek, Carsales and Realestate.com.au – was more than twice (at approximately \$6 billion) the combined market capitalisation of Fairfax, Seven West Media, Ten Network Holdings and Southern Cross Media.

High entry barriers in many industries have eroded, leading profitable incumbents to be shown up by nimble upstarts. Companies that were traditionally in the non-tradable sector are now heavily trade-exposed, meaning that they have a much bigger customer footprint but have much more intensive competition.

Australia's Innovation Generation not only sets out these significant opportunities that the digital economy presents Australia, but provides a roadmap as to how we might get there. We need to improve the way we teach our kids; we need to inspire a generation of digital natives who are already avid consumers of technology to embark on careers as entrepreneurs and coders, in e-commerce and as engineers. It is also important we embrace an 'innovation mindset' encouraging companies to embrace new and inventive solutions in the face of disruptive change.

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“But beyond that they want Government to provide leadership and inspiration and to ensure that Government embraces the digital economy in the way that most of business has done.”

The role of Government in supporting the 'innovation generation' need not always be complex. People want dumb or cumbersome laws, like those relating to employee shares, reformed and made consistent with global best practice. They want smart laws, like those allowing crowdfunding and easier access to venture capital, introduced. But beyond that they want Government to provide leadership and inspiration and to ensure that Government embraces the digital economy in the way that most of business has done.

MANUFACTURING AUSTRALIA'S TECH FUTURE

ALAN NOBLE, GOOGLE

During the 18th and 19th centuries, machines, steam power and steel came together to create a huge outpouring of economic activity and business creativity, which started in Europe and spread across the world. This combination of different interchangeable pieces of 'technology' – wheels, pulleys, belts, and gears – transformed lives more dramatically than at any other time in human history.

The manufacturing industry that sprang from the industrial revolution became the bedrock of Western economies right through the 20th century. Australia enjoyed its own manufacturing boom in the 1960s, with manufacturing peaking at 25% of Australian GDP as we produced steel, cars and textiles.

Manufacturing became firmly entrenched in our economy, our communities, and our national psyche. As I was growing up, it felt like there was an Aussie manufacturer in practically every suburb.

But it's a different story today. Open any newspaper and you'll read about factory closures, from cars to tinned fruit. Low cost overseas markets, the high Aussie dollar, and the small domestic market are bringing substantial pressure to bear on our manufacturers.

Despite this, when I look around Australia today I see a lot of reasons for optimism. That's because I believe that we can still be a manufacturing nation... we just need to manufacture 21st century things. Look under the hood of the Australian economy today and you'll see pockets of manufacturing brilliance, just by another name. That's because the standardised components of 21st century manufacturing are digital. They are software, protocols, computing languages and capabilities, not wheels, pulleys, belts or gears. Just as with the combinatorial innovation of the 19th and 20th centuries, these components can be combined in ways that create totally new innovations and technologies that build on each other at low cost.

Australia is leading the world in a number of niche, high tech-manufacturing sectors, such as biotechnology, medical devices, and mining. This builds on our proud history of new-to-the world inventions. The Cochlear bionic ear gives thousands of people around the world the gift of hearing, and provides more than 2,000 Australian jobs and \$783 million in revenue. CSIRO invented the industry standard WiFi technology that connects over five billion devices every day, earning Australia \$430 million in licensing fees. However, beyond breakout successes like Cochlear, Australia lacks innovative, global, mid-size companies. Our high-tech exports are only 2% of our total, which is tiny compared to 20% in the US.

The historic twin tyrannies of scale and geographic isolation certainly helped put us in a situation in which it was very difficult for these kind of businesses to gain a foothold – but the good news is that the web is changing all that.

Just as the advent of the telegram allowed Britain and Australia to communicate much more quickly so our wool trade could flourish, today's communications technologies allow Australian businesses to innovate and connect with regional supply chains and export products to the world.

The web is also allowing Australian companies to access the scale of markets they need to grow and operate globally, regardless of size or location. There's no reason for today's Australian businesses not to supervise, communicate and coordinate at a distance when this makes sense for their business model. If the late 20th century was the age of the multinational company, the 21st century is shaping up as the age of the "micro-multinational" – small businesses with international footprints.

But these two factors alone are not enough. We need to fundamentally change our attitudes to skills and to innovation in order to manufacture for the future.

Today, our young people are consumers of technology – not creators of it. computer science graduates make up a dismal 2% of the domestic total each year and the number of graduates in the broader fields of science, technology, engineering and maths is 30% lower than our international counterparts. Meanwhile, countries like Vietnam are positioning to pull ahead.

In 2012 Neil Fraser, a software engineer at Google, visited a number of schools in Vietnam (where computer science is part of the school curriculum) to see how computer science was taught. He observed that in grade five, students were already programming at a level on par with their grade 11 peers in the US.

But skills alone won't be enough. An innovation mindset is required to manufacture 21st century things. Staying relevant requires constant innovation for both countries as well as companies.

Today, the digital economy is growing twice as fast as the rest of the economy, and is estimated to contribute \$70 billion by 2015. But BCG warns that Australia will slip in the global rankings – from 7th place in 2011 to 10th by 2016 – in terms of the internet's contribution to GDP if nothing changes. We need to bake technology into everything we do – every business that we run, every startup that we launch – to take advantage of the technology dividend.

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“We need to fundamentally change our attitudes to skills and to innovation in order to manufacture for the future.”

There's every indicator that the kind of 21st century manufacturing we're talking about is absolutely possible in Australia. Take Atlassian. It's a 750-person Australian-based multinational heading towards a billion dollar public listing. Atlassian develops enterprise software to help developers and project managers. NASA uses Atlassian's software to help crunch data from the Curiosity Mars rover. They're the 21st century equivalent of the companies who manufactured shovels for coal miners – playing their part in a booming ecosystem.

Technology can also transform traditional manufacturing processes for 21st century needs. Shoes of Prey, headquartered in Sydney's Surry Hills, is a rapidly-growing small business with a regional supply chain, and 60% of their business comes from overseas. This online women's shoe retailer allows customers to design bespoke shoes via a web application, with the shoes then manufactured on-demand in China and shipped anywhere in the world.

Whether following the Atlassian model of building 21st century 'bits' to capture a piece of the value chain, or Shoes of Prey using technology to up-end a traditional model, Australian businesses must transform to unlock this potential. We can build on our proud history to transform into an economy of new, high-value jobs, and in doing so, manufacture ourselves a new future.

THE STARTUP ECONOMY

supporting tech startups
and accelerating Australian
innovation

JEREMY THORPE & TRENT LUND, PWC

As technology continues to become a central driver in our personal and professional lives, it is not surprising that our report 'The startup economy' (commissioned by Google Australia) uncovered that the tech startup industry has potential to drive much of this innovation and could deliver an additional \$109 billion to the economy and create 540,000 jobs by 2033.

We believe that accelerating the use of technology in industry is vital to maintaining Australia's global economic position, productivity and prosperity. The Internet and computing power are allowing technology companies to disrupt the global economy, leading to a redistribution of industry revenues (and wealth) across geographic borders towards regions which can address large global markets. Australians are great users of technology. Evolving from a nation of tech consumers to a nation of tech innovators will enable Australia to solidify its place in the global economy.

There are around 1,500 tech startups in Australia, and the sector is evolving rapidly. The majority of startups were founded less than five years ago and a vibrant ecosystem of incubators, co-working spaces, angel investors and venture capitalists has emerged in the past few years.

Australia's economic composition is changing. Industries such as Mining and Finance and Insurance which upheld growth in Australia in the past are losing their economic prowess.

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"We all recognise that we need to innovate faster and more effectively to meet the challenges of digital disruption."

Meanwhile industries such as Health Care and Social Assistance and Information Media and Telecommunications are rising in importance. There are lucrative opportunities for both tech startups and enterprise organisations already in these industries to work together, leveraging talent, innovation and market access to harness these prospects.

There is no better time to be an entrepreneur in Australia, but achieving the projected economic contribution will require a significant and persistent effort to grow the startup community. Five key areas for growth are:

First, enhancing culture and community engagement. Culture is a key differentiator of startup ecosystems that thrive and startup ecosystems that fail. To make a significant impact on the Australian economy, Australia's tech startup community needs to continue to build a culture of openness and inclusion to increase participation in the sector. This includes: celebrating entrepreneurship and encouraging the broader community to participate; encouraging entrepreneurs to try again and again... and again; and recycling knowledge and capital back into the community.

Second, attracting more entrepreneurs with the right skills. Growing the pool of potential entrepreneurs with the right skills needs to be driven through both education and engaging the existing workforce. The latter is something that has been done incredibly well by local tech companies, where employees are actively encouraged to take time out to develop innovations and think entrepreneurially. Driving this approach through enterprise in organisations could not only facilitate the growth of the tech startup ecosystem, but benefit organisations on many different fronts.

Third, opening up markets to Australian tech startups. Governments, large companies and tech startups are incredibly different by nature. Yet they can work well together, leveraging each other's strengths to achieve amazing outcomes. For example in 2012, procurement contracts from all levels of Australian government totalled \$41 billion. The opportunity is there, but the challenge for startups is in accessing this important market. Simplifying procurement processes and increasing the use of open-innovation could have mutually beneficial outcomes.

Fourth, encouraging more early stage funding. Funding for the Australian tech startup sector exists, but it is in short supply. Australia invests approximately US\$7.50 per capita in venture capital (VC) per annum, compared to \$75 in the US and \$170 in Israel.

Yet this is somewhat expected given the lack of demonstrated returns to VCs. Unless VCs invest because they believe in the vision or until more successes are recorded, funding will remain scarce for the time being.

Fifth, improving the regulatory environment. Australia has one of the best regulatory environments for entrepreneurship. However, there is potential for government to further support innovation and entrepreneurship, for example by making its programs more accessible and bringing Employee Share Option Plans in line with the rest of the world.

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“By 2033, tech startups could contribute \$109 billion to the economy and create 540,000 new jobs.”

From an enterprise perspective, a thriving tech startup sector will generate flow-on benefits to the broader business community. We all recognise that we all need to innovate faster and more effectively to meet the challenges of digital disruption.

We believe that tech startups' entrepreneurial approach to the development of new products and services has proven capacity to help us all accelerate to greater growth.

Corporate Australia needs to do more to capitalise on the opportunities presented by startups - procuring from them, investing in them and enabling entrepreneurs. There are huge opportunities for business to unearth 'problems worth solving' that were previously too-hard and engage with tech startups through open innovation processes to co-creating solutions, and then use the startups' product to better meet their needs.

Although full of promise, the Australian tech startup sector remains in a fragile state. For Australia to realise the benefits we need to take shared responsibility.

OPPORTUNITY

#2

Computer science graduates have the **second highest starting salaries** in the US (*Forbes*)



29%

START
UPS

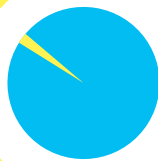
29% of Aussie startup founders **studied computer science** at university (*PwC*)

Australian Graduation rates in **STEM** are almost 30% lower than the global average (*Office of the Chief Scientist*)

-30%

CHALLENGE

2%



Computer science graduates make up just 2% of the domestic total each year, and those numbers are falling (*Department of Industry*)

“The sexy job in the next 10 years will be **statisticians**. I’m not kidding.”

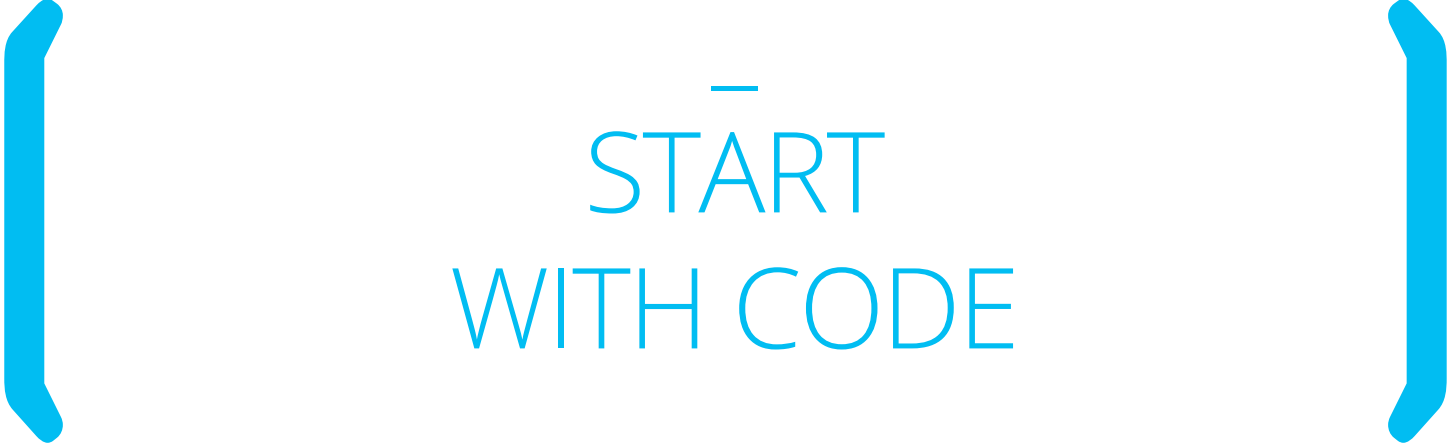
- Hal Varian, Chief Economist, Google

1 SKILLS

“Once I started computational thinking, I could transfer a real world problem into a smaller computerised problem that I could solve.”

Viney Kumar, Google Science Fair winner





START WITH CODE

FRAN MOLLOY

The upcoming generation of young Australians, born around the same time as Yahoo and OzEmail, are soon to graduate from high school, with nearly 60 per cent of them enrolling in tertiary education¹ – and almost all of them deeply immersed in technology, glued to smartphone, tablet and computer screens for hours each day.

Our newest adults are truly digital natives, yet less than two per cent of our graduates will hold computer science degrees; our digital natives are mainly consumers, not creators.

Currently only a tiny portion of them will go on to be the engineers and builders of the infrastructure, systems and products we must produce and adopt if Australia is to play a key role in tomorrow's global digital economy.

Despite the pervasiveness of technology in their lives, today's school leavers don't consider computing to be something they can create or contribute to, rather something that they use or consume.

Yet technology drives the economy, and goes far beyond the ICT industry itself; in fact, it is an important part of nearly every industry in the economy that uses ICT to create value, from healthcare and education to agriculture, transport and manufacturing.

Australians are avid users of technology and voracious digital content consumers; by June 2013, 11.9 million Australians had a smartphone, 14.2 million Australians had access to the internet in their home and nearly eight million Australians downloaded video or audio in the six months to May 2013.²

While consuming technology costs money, creating and applying technology generates money and builds a stronger economy. Australia's geographic isolation, a disadvantage in the pre-web world, is no longer a barrier. The opportunities for our children to join the global economy are enormous.

The young people who grow up today can be our first 'Innovation Generation' with some of the world's most sought-after and highly-valued skills as world demand for computer science and computational thinking skills continues to accelerate.

Decline in enrolments

Global demand for skilled technology workers is reflected in the local economy, with an estimated 100,000 new jobs created in Australia's technology sector in the past decade - resulting in a skills shortage, with only around 49,500 students graduating from technology degrees over the same period.

There has been a significant decline in enrolments in university computing degrees in the last decade, particularly among women.

Most school leavers enter university without a grounding in core concepts like computational thinking, algorithms and the way that computers work, so the discipline struggles to recruit students because syllabus topics aren't immediately understood. Enrolments in computer science degrees hit their zenith in the heady days of the dot-com boom at the turn of this century - but despite the strong demand for graduates now, many parents of school-leavers still recall the ensuing dot-com crash that led to widespread industry lay-offs and business failures and aren't encouraging students to enter the industry.

The Australian Financial Review reported in February 2014 that there was a 36 per cent decline in students starting computer science degrees at Australian universities since 2001 - and a 41 per cent decline in students graduating from those degrees. This at a time when most other professional fields had increased significantly.

Professor Ian Chubb, Australia's Chief Scientist, told the Australian Financial Review: "The real issue is how are we teaching what we're teaching and why aren't we making it so compellingly interesting so people want to do it first, and second; that they want to finish?"

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"The young people who grow up today can be our first 'Innovation Generation' with some of the world's most sought-after and highly-valued skills as world demand for computer science and computational thinking skills continues to accelerate."

Early inspiration

In this digital age, our models for success are increasingly the pioneers of the digital economy, who believe we need to educate our children in technology, one of our most significant skills.

Steve Jobs, the late founder of Apple, said: "I think everybody in [America] should learn how to program a computer because it teaches you how to think."

Professor Jeanette Wing at Carnegie Mellon University has led a global drive to introduce computational thinking in early school years. "To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability," she writes.³

While these skills are universal, they also provide the strongest possible pathway for students to engage with and excel in computer science, and benefit from the careers it enables. However, some of Australia's most successful digital entrepreneurs report poor experiences in the classroom.

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“When students begin to realise that it's this same “science” that builds Google products and other great things they use every day, these subjects seem a lot less remote.”

BigCommerce co-founder Mitchell Harper recalls that his senior high school IT teacher was under-resourced and out of his depth. “He was a good teacher, but his knowledge of computer science just wasn't there.” Mitchell had been programming for over five years by this stage and says that he learned only because he helped other students understand computer science, which improved his own knowledge.

Fortunately, some ten years later, Viney Kumar has had a very different experience in school education. At just 14 years old, he won the 13-14 year old international Google Science Fair category for developing a smartphone app that alerts drivers when an emergency vehicle approaches.

He has had the opportunity to learn programming at school and participate in cross-school programs such as the National Computer Science Challenge and a creativity conference held at his school, Knox Grammar in Sydney.

Atlassian co-founder Mike Cannon-Brookes points out that Australian teachers aren't getting enough support to teach computer science at an acceptable level in schools.

Teachers who attend Google's education conferences report that it's hard enough to keep up with the latest advances in technology, let alone develop compelling classroom content for it.

Google's Computer Science for High School (CS4HS) program helps bridge this gap by showing teachers how they can develop classes that have students building and programming robots, or showing them how they can create their own mobile app. In 2013, CS4HS partnered with 13 universities in Australia and three in New Zealand to fund training for more than 1,000 high school computer science teachers.

When students begin to realise that it's this same “science” that builds Google products and other great things they use every day, these subjects seem a lot less remote.

National Digital Curriculum in Schools

Australia's National Curriculum for Technologies has gone through an extensive draft process and awaits final endorsement before being published and ready for teaching in the states and territories.

This curriculum, if successfully implemented in schools across the nation and taught by passionate teachers, will be an important first step in preparing young Australians to become the creators and innovators of the future.

The proposed new digital technology curriculum introduces computational thinking, logic and problem-solving capability earlier in schools, with simple visual programming taught in primary schools and a general purpose programming language in early high school.

Introducing a new subject area will bring many implementation challenges, in particular developing classroom resources and providing professional development for teachers. Google has teamed up with the University of Adelaide to develop a free, open online course to help primary school teachers across Australia bring computer science and computational thinking (a set of problem-solving skills and techniques that software engineers use) into their classrooms. The course will run for 8-10 weeks and will be open for access at any time once released online.

There are already many amazing teachers and shining a spotlight to recognise and celebrate successful and passionate teachers from around the country is important - such as Dr Linda McIver, whose hard work has inspired many young students to join the ranks of Australia's Innovation Generation.

Dr McIver, who teaches Information Technology to senior high school students at the John Monash Science School in Melbourne, uses real-world projects to bring computing to life; her senior class has partnered with an eco-group to digitise and analyse almost a decade of handwritten data about dolphins in Port Phillip Bay, while a previous class helped develop tools for a cancer researcher.

Changing computer science in universities

The key to improving computer science education at universities is introducing better linkages with industry to demonstrate the world class jobs on offer.

It is no surprise that tech companies, from Google to Salesforce.com to Australia's own Atlassian, are constantly nominated the top places to work. The career options – and the perks like three free meals a day and massages – are spectacular.

Google's Chief Economist, Hal Varian, once quipped in the New York Times that "the sexy job in the next 10 years will be statisticians. And I'm not kidding."

While no one knows what future jobs will be, they will increasingly rely on tech. Computer science will enhance career potential in any students' area of interest. Inspiring students to follow this path will generate high quality Australian jobs and innovation in every sector from health to agriculture.

1. *Australian Bureau of Statistics 6227.0 - Education and Work, Australia, May 2013 - Transition From Education to Work*

2. *Australian Communications and Media Authority (ACMA) Communications Report 2013*

3. *Wing, Jeanette (2006) "Computational Thinking" in Communications of the ACM, March 2006 Vol. 49, No. 3 pp 33-35*

PROGRAMMING HIS FUTURE

PROFILE: VINEY KUMAR

A foundation in computational thinking led to this young computer scientist's global award-winning app.



Last year, 14-year old Viney Kumar beat 7,500 other students to become Australia's only finalist in the international Google Science Fair, after developing a smartphone app that alerts nearby drivers when an emergency vehicle approaches.

Viney came up with the concept when travelling in India, where he noticed an ambulance stuck in traffic and realised there could be a technology-driven solution.

Viney says that he became interested in science when his grandfather showed him the night sky through a telescope. By the age of seven, he had become fascinated by browsing the Internet, and before long, had focused his curiosity on computers. "I started asking about why computers work, how they could provide all this information and process it, how did people develop it?"

“Programming seemed very unfamiliar and way out of my league when I heard my uncles and cousins talk, but as I started to do it I realised that it wasn’t as hard as it seemed. It was logical and creative at the same time, and I started to really like it.”

By Year 7, Viney had the opportunity to learn programming at school. “I got really fascinated about this area when I realised how much opportunity there is with computer science and programming and how empowering it can actually be, because it’s very hard to develop revolutionary physics or chemistry projects, but with computer science, fundamental breakthroughs are being made every day.”

Viney says that he taught himself to program using online sites, but became fascinated with the idea of computational thinking. “It was a new kind of logic that I’ve never seen before,” he says.

“Programming seemed very unfamiliar and way out of my league when I heard my uncles and cousins talk, but as I started to do it I realised that it wasn’t as hard as it seemed, it was logical and creative at the same time, and I started to really like it.”

He says that his training in computational thinking meant that seeing an ambulance stuck in traffic in India gave him the idea to develop a mobile app.

“Once I started thinking that way I could transfer a real world problem into a smaller computerised problem that I could solve.”

As with most teenagers, getting his first smartphone was a thrill for Viney and he couldn’t wait to try out mobile apps – and soon realised that he could expand his talents to the mobile world. “I had seen so many apps and then I realised, hang on a minute, these apps are based on programs, the same things I am doing, so then I thought, if I go into app programming, I can get the stuff I make out to the wider world.”

Viney says that apart from his self-taught skills, studying maths and science at school taught him how to use a step by step method to solve problems. “I’m applying knowledge from maths and science class, from computer clubs, languages and music,” he says.

He adds that creativity is an important component of problem-solving and should be encouraged in schools. “Our school is implementing a Creativity Conference to encourage the idea of being creative in the way you learn and also applying this creativity in order to solve problems.”

“Once I started thinking that way I could transfer a real world problem into a smaller computerised problem that I could solve.”

— OUTREACH TO THE COMPUTER SCIENCE STARS OF TOMORROW

PROFILE: MARITA CHENG



Robogals founder and tech entrepreneur Marita Cheng says there's a real need to invest in getting more women into computer science training from a young age.

2012 Young Australian of the Year, Marita Cheng, believes that inspiring female role models are the best way to get girls interested in careers in technology and science.

Marita was an engineering student at the University of Melbourne when she founded Robogals in 2008, aiming to get girls interested in tertiary studies and careers in engineering and technology. "We go out to schools with robots and teach girls how to build and program them," she says.

The student-run group is primarily funded by industry partners, and has expanded to more than 20 campuses worldwide.

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“I like maths and science, but I saw engineering as a way to help people in a way that was efficient.”

Marita stepped down as CEO of Robogals last year to start 2Mar Robotics, making robotic arms for people with disabilities, and says the lack of women in technology was brought home to her immediately.

“I advertised for an internship position with funding from the Victorian government and received 60 applications, less than ten percent women. We short listed eight candidates and only one of the eight was a woman. We made decisions based on skills, coding ability, and how they answered various technical questions.”

The best candidate was a male, Marita says – though had she not been a startup with very limited resources, she would have loved to hire the female applicant also. “I think having a gender mix makes a difference to the dynamics of your organisation, the ideas, the diversity, which adds to the creativity and the ideas.”

Marita became interested in engineering after attending a four-day science camp as a school student. She says that, like a lot of women who enter science and engineering field, she was attracted to the idea that she could help people through her work.

“I like maths and science, but I saw engineering as a way to help people in a way that was efficient.

The most efficient way is to do something and scale it, and in engineering and computing you do that through creating devices or really small IT systems that are helpful to people.”

Marita thinks that girls often start with a disadvantage when they begin computer science. “A lot of guys start coding at ten or 12 – starting with simple grab-and-drop programming, then they program games, then more and more complex systems. Not so for girls who are interested in maths or science – I wasn’t encouraged to play with computers very much when I was a young girl.”

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“If we introduce girls to that, so it’s not scary, in ten years, we’ll have amazing female programmers who are on par with the guys.”

Some girls start their first day of a computer science class at university to discover that most of their class have already been programming for years, Marita says. “That’s why I think it’s so important that we have girls go through the baby steps of computer science or programming when they’re really young.

“Structuring code efficiently - that’s grammar and English, it’s all about putting it all together and following through logically.”

“If we introduce girls to that, so it’s not scary, in ten years, we’ll have amazing female programmers who are on par with the guys.”

OVER THE MOON

PROFILE: ANDREW OVER

Google software engineer Andrew Over says that computer science in Australian universities needs to encourage flexibility and fundamentals to ensure graduates get a shot at the top jobs.



Andrew Over is a senior software engineer for Google, heading up mobile development for Google+ in San Francisco.

"Google is actually one of the largest iOS developers in the world, so I'm working on some pretty exciting projects across a range of platforms," he says.

As a young kid in suburban Brisbane, Andrew had taught himself programming, starting with a Commodore 64 computer.

He studied computer systems engineering at the University of Queensland, then worked in the US for a few years, returning to Australia in 2003 to do a PhD in computer science at the Australian National University.

His PhD investigated how to evaluate the performance of computer architecture; while it's a niche field, he says that his computer science education at university gave him skills that went beyond code-hacking.

"University was much more about the more formal side of things, the theoretical background underpinning everything else, which is material that still serves me very well even now."

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 "As a young kid in suburban Brisbane, Andrew had taught himself programming, starting with a Commodore 64 computer. "

He says that this core understanding of computer science fundamentals gives students skills that are relevant in the longer term. "Universities are under a lot of pressure to teach people things that will be immediately applicable on the job and this often translates to the hottest new programming language, instead of spending the time to teach people the actual fundamentals of computer science.

"Without the right fundamentals, you quickly come to a point where you can't go any further. When I'm hiring and I ask people to write code on a whiteboard, it's in whatever language they feel comfortable writing," he adds.

What Google looks for is smart people who can learn quickly, who understand the fundamentals and can quickly adapt to new problems. Andrew says "The people who do well in this industry are those who are flexible and who aren't intimidated by a 'random problem' but will dive in and learn as they go."

Andrew joined Google in Sydney in 2008 after working for about six years at several small Australian technology firms. He ran a team of 15 or so engineers, initially spread across the US, Korea and Japan but eventually the whole team transitioned to Sydney. They worked on Google's blogging site, Blogger, at that time sixth-largest site on the internet.

Andrew says that while working on such a big website was fascinating and entertaining, the job also came complete with perks like a fun office culture with three free gourmet meals a day, snacks, games rooms and even massages.

It's no surprise that tech companies, renowned for their great perks and progressive cultures, receive millions of applications each year and hire just a few for highly competitive roles. Although he has moved into a management role, he says at Google, very technical people will manage - but also maintain their own input into coding, design and guidance. "We have parallel technical and management tracks, so you can stay purely technical if you choose while maintaining perceived rank, salary and benefits all the way up the ladder."

He chose to move to the US to join his current project team and today, he's living the dream - buying a condo in San Francisco and mixing with some of the world's brightest tech minds in Silicon Valley.

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 "It's no surprise that tech companies, renowned for their great perks and progressive cultures, receive millions of applications each year and hire just a few for highly competitive roles."

THE ACCIDENTAL TEACHER

PROFILE: LINDA MCIVER

Linda McIver's high school students work on real-life cancer research and dolphin conservation projects – and they're developing a real passion for computer science.



Linda McIver never planned to study computer science, nor did she plan to be a teacher – but now, she now holds a PhD in computer science and teaches Information Technology to senior high school students in a specialty science school in Melbourne.

Linda picked up computer science as a fourth subject when enrolling in a science degree majoring in biology at Monash University.

“Over half of the students who completed her Information Technology class two years ago are studying computer science at university. ”

“It was a fill-in, really – but by third year I found myself doing exclusively computer science because I picked all the subjects that I was interested in. I fell into it by accident,” she admits. Her accidental journey has led her to her current job – something she loves even more than the university lecturer role in computer science that she held previously.

Linda is passionate about teaching computational thinking in schools and says that if she hadn't accidentally found out what computer science was all about, she may never have found her 'thing'. That's unlikely to happen to her own students;

Over half of the students who completed her Information Technology class two years ago are studying computer science at university.

Last year, her Year 11 students worked with an eco-tour group that had collected ten years of hand-written data on the numbers, locations and behaviors of the bottlenose dolphin population in Port Phillip Bay.

The project is continuing, with volunteers transcribing the data and Linda's students using programming, data analysis and data mining techniques to uncover changes over the last decade. That information will help develop dolphin sanctuaries and discover the impact of human activity such as dredging on dolphin populations.

“There's still a lot more data to digitise and some of my students have gone off and written an app so that the crew of the [eco-tour group] ship can actually be entering the data digitally to start with,” Linda says.

“All schools could be doing this sort of stuff - there are endless community organisations out there that would love somebody to build them a website or write them a bit of software to do something that they need to do all the time.”

This isn't the first real-world project for Linda's students – her 2011 class worked with a cancer researcher at the Monash Medical Research Institute and wrote software that the scientist is still using and which has made a material impact on his research.

“Even if you're not into computer science, it can be really thrilling when presented the right way, once you get past that initial fear of 'I hate computers and computers hate me'.”

Linda says that even at John Monash Science school, with a cohort of bright, motivated students, many students are reluctant to study computer science.

“These are amazing kids who can do anything but they have this ingrained belief, this learned helplessness in the face of computers,” she says.

Linda believes that it's essential to change the way that the subject is introduced in schools.

“Even if you're not into computer science, it can be really thrilling when presented the right way, once you get past that initial fear of 'I hate computers and computers hate me'.”

SOLVING PROBLEMS EARLY

PROFILE: KATRINA FALKNER

Katrina Falkner is excited about Australia's proposed Digital Technologies curriculum which will change the way students view computer science.



Computer science in Australia is struggling, says Associate Professor Katrina Falkner – but she's optimistic that the proposed Australian Digital Technologies curriculum will see a huge change in our national focus.

"Although technology is so much more pervasive in people's lives, today young people don't see it as something that they can actually contribute to, something that they can create themselves," she says. That change has to start in schools, she says, because the typical university syllabus for computer science only makes sense to someone who understands the field. "Our kids aren't growing up being aware of computational thinking and algorithms and the way that computers work, so the subjects are completely foreign, unlike physics or maths or science, which they study at high school and primary school."

Parents still don't see the technology industry as viable, she adds, with the fallout from the dot-com crash over a decade ago still resonating with many.

"People aren't aware that the [technology] industry is tied into almost everything around them."

Katrina developed an interest in computer science as a child because her older sister, now a biochemist, would write mathematics programs for her to solve. "I didn't realise until much later that I was doing some very simple programming." She later enrolled in a science degree, chose computer science subjects, and after working on a vacation project using artificial intelligence with the Defence Science and Technology Organisation realised that she wanted to stay in the field.

"It was so interesting after just doing exercises and assignments. For the first time I had really seen how computer science could be used and it made me interested in improving the way that we educate our students."

Katrina will run a free ten-week, open online course in 2014 through the University of Adelaide's partnership with Google. These resources and sample learning activities will help Australian primary school teachers introduce computer science and computational thinking into classrooms.

"People aren't aware that the [technology] industry is tied into almost everything around them."

"The new technologies curriculum moves away from the digital literacy that's taught in schools, to the idea that students will start to identify what technology is and start to think about how it actually works, right from five or six years of age." The proposed curriculum has huge support from universities, she adds.

"It's very much about problem solving, which is a fantastic skill for our young people to grow up with."

"This will potentially introduce computational thinking from the very first year of school, so five and six year olds will start thinking about how to make choices, how to use the language of computers and identifying where technology is in their life – even what an algorithm is and how it works," she says – similarly to the way students engage with maths and science.

"The Australian curriculum includes a lot of what we call computational thinking, which is about how to approach a problem in a systematic way and understanding how a computer might solve a problem. It's very much about problem solving, which is a fantastic skill for our young people to grow up with."

WHY

Tech startups could grow into successful companies with the potential to create...

\$109
billion



540,000
jobs by

2033



Potential **economic contribution** of the tech startup sector

540 K
Jobs

\$109
Billion

TECH STARTUPS
REVENUE

2013

2023

2033

HOW



Enhance culture and community **engagement**



More entrepreneurs with the right **skills**



Open up markets to Australian tech **startups**



More early stage **funding**



Improve the regulatory **environment**

Startup:

High growth company

Technology:

Innovative products and services that result from the practical application of knowledge

To reach the \$109 billion, another **1,600 startups** need to be founded in 2014

2014

29%

29% of Australian founders have a computer science degree, but CS graduates only make up **2% of the yearly total**

CHARACTERISTICS OF A TECH STARTUP

Technology is central to the product or service being provided

High leverage of the labour input to the product or service so that the business can scale rapidly

Product or service is a 'disruptive innovation' in that it helps create a new market or new supply chain / network which disrupts an existing market

Revenue under \$5 million per year

**OVER
1,500**

Startups
in **Australia**

"It's never been a better time to be an **entrepreneur!**"

- Alan Noble, Director of Engineering, Google

9 of the top 10 people on the

2013 BRW YOUNG RICH LIST

made their fortune in tech

TOTALLING

\$2 billion



Mike Cannon-Brookes and Scott Farquhar

Co-founders and Co-CEOs, **ATLISSIAN**
- enterprise software for software developers

\$550 million



Simon Clausen

Founder, **STARTIVE VENTURES**
- early stage venture seed funding
and angel investment

\$350 million



Ruslan Kogan

Founder and CEO, **KOGAN**
- online consumer electronics
retailer

\$315 million



Hezi Leibovich

Founder and Director,
CATCH GROUP - online group-
buying retailer

\$190 million



Matt Barrie

Founder and CEO,
FREELANCER.COM - online global
outsourcing jobs marketplace

\$185 million



Mitchell Harper and Eddie Machaalani

Co-founders and Co-CEOs, **BIGCOMMERCE**
- e-commerce platform for online businesses

\$135 million



Matthew Tripp

CEO, **SPORTSBET** (formerly)
- online bookmaker

\$115 million

2

ENTREPRENEURS

“In the US, everybody grows up knowing that business means jobs and the taxi driver, the person who stamps your passport wish you good luck if you’re building a business because they know ultimately that makes jobs.”

Deb Noller, CEO Switch Automation



BUILDING WITH CODE

FRAN MOLLOY

Over the last two decades, Australia has enjoyed a period of substantial economic growth, with our annual per-capita income rising to the fifth-highest in the world in 2012 - in part propped up by demand for commodities. But Australia's economic future beyond the slowing global commodity boom will depend on its ability not only to boost local productivity, but also to add to add new, high-value jobs to the economy.

We have our work cut out for us. If we're not able to reverse the current decline in productivity growth of -0.7% since 2007, we're all going to take a pay cut.

It's easy to talk in abstract terms about the need for Australia to accelerate the invention and application of innovative technology – but it's our young people who will have to stand up and actually make it happen. Today, young Australians grow up wanting to be doctors, lawyers, and work in lucrative mining jobs. For us to collectively add hundreds of thousands of new-economy jobs in Australia, more and more young people will have to dream much bigger – they must dream of creating the next Googles, Apples, and Amazons right here in our country. Simply put, we need to infect our young people with the same startup bug that makes 'entrepreneur' the coolest, most-respected job title in Silicon Valley and Israel.

PwC research shows that Australian tech startups have the potential to contribute \$109 billion and 540,000 jobs to the economy by 2033. To build the sector to this level, in the short term, Australia needs 2,000 more tech entrepreneurs drawn from the existing workforce each year. The key will be leadership, communities, and culture.

Our startup leaders

Startups like software company Atlassian, out-sourcing marketplace Freelancer.com and games developer Halfbrick, have achieved breakout commercial success around the world, and are our xamples of what is possible when true insight and entrepreneurial grit combine.

Increasingly, Australia's 'innovation generation' is making their fortune in tech, with nine out of 10 people on the 2013 BRW Young Rich list involved in tech in some form. Those nine represented a personal worth totalling almost \$2 billion – Matt Barrie, for one, recently listed services marketplace Freelancer.com on the ASX with a current valuation of approximately \$700 million. This is a significant change from the resources, finance and property makeup little more than a few years ago. These tech stars must become our new business stars – sought after for their views, on the front page of newspapers.

It's them, rather than banking and mining CEOs, who know what it's like to be at the forefront of rapidly changing, fast-growing industries – and they are uniquely placed to tell us how we can encourage other young people to follow in their footsteps. We all talk about what it would take for tech startups to flourish here, but these teams are actually doing it, we must learn from them.

Supportive startup community

So often, startup success happens not in a vacuum but within a supportive community. Expertise is shared, failures are dissected and then celebrated, and inspiration is easy to come by. Incubators and accelerators across Australia like Fishburners, Pollenizer and iLab are creating the kind of environments in which startups are celebrated and supported for the heroic endeavours that they are.

Two Australian cities were recently nominated in the Startup Genome report as among the world's top 20 startup ecosystems, with Sydney ranked 12th and Melbourne 18th. Both of these cities have strong local incubator and accelerator programs, and a 'vibe' that marks entrepreneurs apart as stars, not weirdos. In addition to this, in an attempt to create increased virtual support and solidarity, members of the startup community recently banded together as StartupAUS, a nonprofit organisation with the mission of fostering and building the community of technology entrepreneurship in Australia. StartupAUS is focused on encouraging entrepreneurs and strengthening the education system.

As their first major initiative, in September 2013 StartupAUS coordinated a three-week long, nationwide festival called 'Startup Spring' to celebrate tech entrepreneurship and shine a light on the many success stories flying just under the radar in this country. The success of Australia's first-ever startup festival is a clear sign of the maturation of the this ecosystem; more than 160 events ran in cities all around Australia, and more than 6500 people attended.

A 'have a go' culture

The stark truth is that entrepreneurs often fail-upon which 40% immediately try again and the other 60% re-enter the workforce with new skills. The key thing is encouraging our entrepreneurs to take the plunge, and then supporting them so that they try again, armed with a stronger set of skills.

Google is encouraging aspiring entrepreneurs to 'have a go' at starting their own tech company through a variety of means. Google has started an ongoing series of information and networking events called "Google SUDO" that offer practical advice from experienced tech founders on things like how to attract funding, connect with business partners, and leap into marketing.

Google wanted to go beyond occasional efforts and take a bigger step towards building peoples' entrepreneurial confidence. While accounting, consultancy and laws firms have long had summer programs which help young people get a sense for what it would be like to pursue that career path, there had never been a way to do that for young entrepreneurs.

Google partnered with online educator General Assembly to offer a free eight-week Summer School called Introduction to Startup Entrepreneurship to encourage young Australians to do their first tech startup, with participants offered the chance – if selected in the top ten – to do a two-day in-house 'bootcamp' at Google. Over 4,000 people have signed up for the online course. Google also partnered with INCUBATE, a program developed by the University of Sydney Union to help launch successful startup ventures on campus, with successful applicants receiving seed funding, on-campus co-working space and alumni mentoring. The program is being expanded nationally to other Australian universities.

Role of Government

Governments are often called upon to set the right conditions and make the right investments for industries to flourish. For the tech startup sector, the role of government is not in picking winners, but nourishing a broader supportive environment for innovation and entrepreneurship – one that celebrates existing success stories, creates a supportive community, and removes the barriers to 'having a go'.

Indeed, perhaps the key contribution government can make is symbolic. Through it's ability to influence the national conversation, government can give significant support to the aspiring entrepreneur by assuring them that they're on the right path, and that tech startups can and will grow Australia's wealth and productivity over the long term.

— STOP COLLABORATE AND LISTEN

PROFILE: PETER BRADD



Peter Bradd is immersed in startup culture, and he says building businesses in co-working spaces helps entrepreneurs with collaboration and support.

Peter Bradd is one of the leaders in the Australian startup world. Starting out with a degree in agricultural economics, he says his many years of experience running various businesses, since he and his twin brother started mowing lawns at the age of 12, put him on the path of entrepreneurship.

Peter says that having a co-working space helps entrepreneurs collaborate, develop and succeed. He is on the board of Fishburners, a nonprofit that hosts Australia's largest tech co-working space and networking events.

"Fishburners is a charity tasked with fostering entrepreneurship in Australia. We invest a lot of money in providing office space for entrepreneurs, but we also focus on accelerating and incubating, and taking best practice from co-working accelerators and incubators around the world," he says.

Members are trained through peer-to-peer networking and through access to experts and knowledge sessions, he says. Members sign up for a low regular fee, which starts at less than \$50 a week, but Peter says that the co-working side of the organisation runs at a loss and is subsidised by corporate sponsors. The model spawns a natural incubator culture with members keen to network and collaborate, but one of the biggest draw cards is the big event space.

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"If you want people to be entrepreneurs they have to have some type of exposure to entrepreneurship at a young age, before they choose what career they're going to do and start investing in university degrees and careers post-university degrees."

"We also provide access to experts, such as professional advisers from PwC, business lawyers, user experience experts from Westpac's IT Division, and HR legislation and contracts advice from The People Department – all that stuff," he says. The expert advice is donated by companies, as part of their sponsorship of the program, Peter says. "It's all pro bono." Unlike some other for-profit accelerators, Fishburners doesn't offer financial support to members, he says – but there's also no equity transfer in joining.

Peter says that, unlike the US, Australia doesn't have a strong entrepreneurial culture. "The first time I realised that you could create your own job by creating your own business happened with our lawn mowing," he says.

Some years later, Peter bought a range of men's toiletry products and hired someone to sell them for him at a market stall.

"I was collecting a few hundred dollars a day and didn't need to be there; that's when I realised the advantage of employing other people."

Since then the entrepreneur founded a startup called ScribblePics which has major travel organisations as its clients and allows people to create and send a postcard from a photograph. He is also on the board of StartupAUS, a nonprofit tech advocacy group, and works at Fusion Labs, a consultancy that helps corporates innovate.

"If you want people to be entrepreneurs they have to have some type of exposure to entrepreneurship at a young age, before they choose what career they're going to do and start investing in university degrees and careers post-university degrees," he says.

Peter believes that the easiest way to change attitudes about entrepreneurship is to introduce entrepreneurial programs into schools, but adds that some kids will already be out there running lemonade stands.

"If your parents are doctors or accountants or lawyers then they want you to be accountants and lawyers – they don't encourage you to be software engineers because that's a world that they don't know."



SOFTWARE STARS

PROFILE: MIKE CANNON-BROOKES



Atlassian's Mike Cannon-Brookes is taking a long-term approach to recruitment by inspiring tomorrow's generation of computer scientists, today.

Mike Cannon-Brookes is the co-CEO of Australian software success story Atlassian, a company worth an estimated billion dollars, which he co-founded in 2002 with fellow University of NSW science/IT student Scott Farquhar.

The pair funded their company with \$10,000 of credit card debt, and now employ over 750 staff and plan to take the company public in the near future.

Their flagship product, Jira, is a project management and issue tracking program, and the company sells over \$100 million worth of software each year to more than 130 countries.

Mike and Scott have topped the BRW Young Rich list several years in a row now and Atlassian ranked second on the 'Best Places to Work' survey in Australia.

The company is now growing rapidly and is struggling to get the staff it needs, he says. "If we're going to build an industry, we need skilled people, we need experienced people, and importing them is the only way to get them in the short term."

He's critical of some of the requirements under the 457 visa program, such as the requirement to pay one percent of revenue for training employees.

"For Atlassian, it's not a big deal, we have a full-time person who deals with this stuff, but if you are a company with three employees, what exactly do you do there?"

He says that hiring experienced people from overseas adds huge value to the company and eventually the economy.

"We hire a lot of smart young people out of university, but we need experience to train them," he says.

"I need to get guys from Microsoft and Amazon and Oracle and the great enterprise software companies in the world, get them to Australia and sit them with three really smart, young Australians and say, 'You guys learn every single thing that guy knows before he goes home, because he's got ten years working at Microsoft and fought the wars about Windows and Office and Single-Server and all these things and we haven't.'"

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"At Atlassian, we know in the next 20 years we are going to have to hire a truck load of computer science people. We've got to start breeding them way earlier. We need to train them, at school, now."

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"Seven years ago, this group of high school kids came on a site tour of Atlassian where they were given soda and gummy bears and shown what it looks like to actually write code and they wandered around with big eyes."

Mike is a big supporter of introducing computer science into education and says, "Constantly educating people on future technologies, retraining existing workers, is a big part of what needs to change. School education around computer science and technology is important but fairly appalling in this country." The company has sponsored the National Computer Science Summer School for a number of years – and recently hired two former summer school students.

"Seven years ago, this group of high school kids came on a site tour of Atlassian where they were given soda and gummy bears and shown what it looks like to actually write code and they wandered around with big eyes," he says.

"Two of our recent hires are people who went through the National Computer Science Summer School in high school, did four years of university and ended up here in a great job, six or seven years later."

Mike calls it Atlassian's "long term recruitment program. "At Atlassian, we know in the next 20 years we are going to have to hire a truck load of computer science people. We've got to start breeding them way earlier. We need to train them, at school, now."



AD-VENTURE CAPITALIST

PROFILE: NIKI SCEVAK



Venture capitalist Niki Scevak says that returning Australian entrepreneurs are a 'brain boomerang', bringing skills and connections to the local economy.

Things have turned around for Niki Scevak; as co-founder of Australian investment fund Blackbird Ventures, he's moved from startup tech entrepreneur, to being the guy with the cheque-book, assessing the longevity of others startup ventures.

Niki's love of tech ventures began at university, when he teamed up with Atlassian co-founder Mike Cannon-Brookes to set up a company called The Bookmark Box, which was a way to manage and share browser bookmarks online.

Niki moved to New York, selling the company to a New York firm in 1999 when the dot com boom was in full flourish, then spent the next five years in the US where he started another tech business. Returning to Australia after selling his last company, he had planned to start another business but says he discovered how much he enjoyed helping other entrepreneurs.

—
“While these are all quite a significant size, we’re asking, who will be Australia’s \$100 billion company? Atlassian is already a billion dollar company and has the chance to become that \$100 billion company.”

“I realised that while tech companies weren’t finding it too hard to get anything from \$50,000 to \$100,000 to start an idea, there was a big gap from that point to the \$10 million mark – where big investors come in,” he said. That’s where Blackbird Ventures comes in, he says – the fund targets home-grown Internet-based companies that want to take their business global, investing amounts between \$250,000 and a million dollars into each venture.

“It’s extremely hard to get a venture capital fund up and running in Australia,” he says. “Blackbird is a startup unto itself and for me it’s the most impactful way for me to help entrepreneurs.” He says that the Australian tech marketplace has two generations; the first is local-facing businesses such as Seek, CarSales and REA Group – all worth around \$6 billion.

“While these are all quite a significant size, we’re asking, who will be Australia’s \$100 billion company? Atlassian is already a billion dollar company and has the chance to become that \$100 billion company,” he says. A host of other companies are approaching one billion in market capitalisation, he says, but without substantial investment locally, they move overseas to attract capital.

However Niki thinks that the ‘brain drain’ is actually a ‘brain boomerang,’ with most Australian tech entrepreneurs coming back to Australia once they have established themselves.

“People call it a brain drain, I call it a brain boomerang, where they’re flying over, but they’re coming back a few years later and bringing all that skills and knowledge they’ve had in Silicon Valley back to Australia.”

Returning tech entrepreneurs who are willing to invest in the local economy – not just with their money, but with their skills and connections, have boosted the local startup scene, he says. “If you add up all the economic value of all the companies started by Australians that stayed in Australia it far dwarfs the economic value of companies that Australians started in other countries,” he says. He believes that Australia has a very supportive environment for entrepreneurs.

“They have incredibly generous programs like the R&D tax concessions, various grants, Commercialisation Australia which helps out startups,” he says. More critical, though, he says, is founder-led activity. “When people who have started these kinds of successful tech companies are leading initiatives that’s when real progress is made, rather than when government is leading initiatives.”

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“People call it a brain drain, I call it a brain boomerang, where they’re flying over, but they’re coming back a few years later and bringing all that skills and knowledge they’ve had in Silicon Valley back to Australia.”

BUILDING SOMETHING FROM NOTHING

PROFILE: DEB NOLLER

Deb Noller's Melbourne-based company is growing to tackle big players in global market places, providing automated systems for building management.



Deb Noller is the CEO of Switch Automation, a cloud-based building automation company she set up with co-founder John Darlington in 2005.

She says her career has been 'mostly accidental,' and trained initially in parks management before enrolling in a Bachelor of Commerce degree which required business students to study an introductory computer science unit.

"I just loved computer science because you get to build something out of nothing."

She became a software engineer, joining forces with John Darlington – also a software engineer – over 22 years ago. Switch is their fifth business together after working in a variety of industries including mining, logistics and shipping.

"John has always been passionate about taking tragic applications and making them look better visually, have better architecture and operate better, while my focus has always been on taking a big business and making it more efficient."

"We have to attract technology to stay here."

At Switch, they produce products for multi-residential automation such as an online intercom system and energy management for buildings.

She expects the market for their product will expand rapidly worldwide as building owners are under increased pressure to control costs, but is struggling to launch into the US market.

"Launching into a global marketplace puts you up against companies from enormously successful US incubator programs with strong venture capital backing," she says.

"In the US, everybody grows up knowing that business means jobs and the taxi driver, the person who stamps your passport wish you good luck if you're building a business because they know ultimately that makes jobs."

Deb says the Employee Share Option Plan (ESOP) tax is stifling innovation. "In the US, startup companies have very little cash but can often attract talent through equity-for-wages deals, but without incurring a tax and superannuation liability until the shares are traded, because nobody has realised any money," she says.

"What's most likely to happen is an American investor will buy the company and the IP and then the Australian government never realises the true value of what they assisted to build."

"We have to attract technology to stay here."

Jumping into the global market requires capital, Deb says, and generally that level of capital will come from a foreign investor – often US based – who will want to move the company.

"Ultimately I'll have to make a financial decision which makes sense for our company and to attract investment may be forced to move our company into the US or Asia or Europe because mostly they aren't comfortable with big investments in companies that aren't US owned for example. It's not what I want to do, I'd really like to be Australian-owned and operating here". She believes that Australian investors don't have a strong appetite for risk and encouraging that 'leap of faith' is important. For example, she suggests a one percent tax break on investment in innovation be offered to large investors and banks.

"Incentives that encourage companies to actually invest in innovation will create a culture of financing these things – because most innovative companies leave here to get finance."

In the US, she says, the culture around business is very different to Australia.

"In the US, everybody grows up knowing that business means jobs and the taxi driver, the person who stamps your passport wish you good luck if you're building a business because they know ultimately that makes jobs."

BIG COMMERCE FOR SMALL BUSINESS

PROFILE: MITCHELL HARPER

Since 2003, Bigcommerce co-founder Mitchell Harper has been helping small businesses setup online stores, without a big cost.



At just 32, Bigcommerce co-founder Mitchell Harper thinks he could be well on the way to leading a billion dollar business.

Mitchell met his Bigcommerce co-founder, programmer Eddie Machaalani, in an online chat room in 2003 where both were looking to solve a programming problem; they soon realised that we were both working on similar software, lived close by and were probably the only ones in Australia doing this kind of development.

Growing up in suburban Sydney, Mitchell admits that he was a classic computer nerd. "I started programming when I was 12, I had an old IBM-XT and would build games in Basic," he says. "Gaming really fascinated me, and that's how I built a foundation in programming. Then when I was about 17, I launched a website where I would teach people about programming. As soon as I would learn something, I would write an article simplifying it on my website."

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“That pain point of not being able to find something that I could use while I was an employee of a small business to set up an online store stuck with me.”

By 2001, Mitchell was working for a computer hardware company in Sydney that wanted an online store. “There was nothing that I could buy because we didn’t have a big budget – margins were slim – so I was given the job of building the online store.”

At that stage, he recalls, an IBM online shopping cart cost around \$200,000 and needed to be customised. “I said, screw that – I’m going to learn ASP (a web programming language) and build one from scratch.”

That formed the foundation for the knowledge he needed to set up Bigcommerce.

“That pain point of not being able to find something that I could use while I was an employee of a small business to set up an online store stuck with me.”

Mitchell left to set up a new business, and not long after met Eddie. The two joined forces, combined their expertise and developed several products including an email marketing tool, a support portal and a publishing platform, launching their first company, Interspire, in 2003.

By 2007, he says, the pair had over 30,000 paying customers – and their customers wanted hosted software, and they wanted shopping carts. “I couldn’t ignore them anymore,” he says. “So I locked myself up in a room for six months and built the precursor to Bigcommerce.”

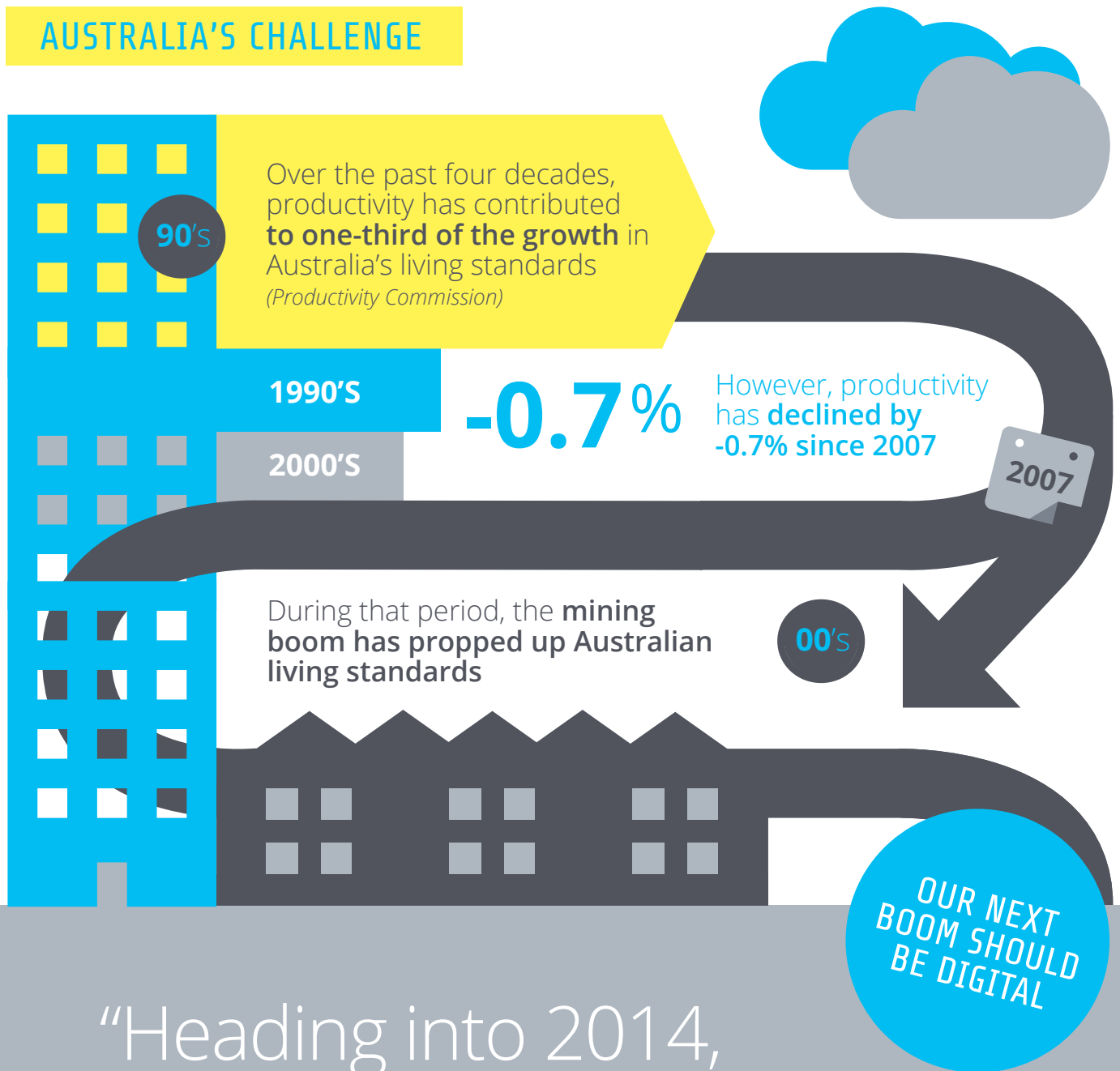
By 2009 the company was relaunched as Bigcommerce, a hosted retail service. They now have well over 50,000 customers and will soon hit three billion dollars in orders processed through the platform.

The business is doubling in revenue year-on-year, has 315 employees, and has \$75 million dollars over three different rounds, all from US investors. ‘We’re on track to try to go public in a few years’.

Mitchell says that while it can be hard to world-class engineers, most of the company’s 80-person product and engineering team is in Sydney – but though he’s keen to keep it that way, as the company grows, that might not be possible. “In the end, Australia has to be able to compete with the US.”

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“The business is doubling in revenue year-on-year, has 315 employees, and has \$75 million dollars over three different rounds, all from US investors. ‘We’re on track to try to go public in a few years.’”

AUSTRALIA'S CHALLENGE



"Heading into 2014,
as the **mining boom** fades,
we need to increase
productivity or take a pay cut."

- Jim Minifie, Grattan Institute

3 THE FUTURE

"It's time for the lucky country
to make its own luck."

Jim Minifie, Productivity Program Director, Grattan Institute





THE ROADMAP

IT, entrepreneurs and innovation

JIM MINIFIE, GRATTAN INSTITUTE

From the days of the gold rushes, to riding on the sheep's back, to the banking and mining booms of the last 15 years, Australians have long worried that most of the world's innovation was happening somewhere else.

Did our good fortune deter Australians from innovating? As one journalist posed the dilemma: "Do we want to be digging dirt or digging ideas?" In fact, we don't have to choose. Australia is and will long remain a resource exporter. But it is also an innovator. In the resource sector itself for example, miners now oversee their Pilbara iron ore mines, in real time, from 'remote operating centres' in downtown Perth. They are doing much more than just digging holes in the ground.

Firms in every sector are doing the same old things in radically new ways. These Australian innovators are combining information and communication technologies in a stunning variety of forms.

They mix and match from a suite of technologies, including mobile devices, cloud computing, crowdsourcing, digital fabrication, remote monitoring, distributed sensing, and big data. These new mixes yield new processes, tools, products, services and jobs.

The innovations made possible by these technologies are blurring old boundaries and eroding old barriers. Four examples among many give a sense of how deep the changes may go.

What counts as knowledge is changing: the basics are accessible to all online, but the depth needed of a true expert has never been deeper. What counts as talent is changing: some human skills that once were prized are becoming automated, while other and new skills are coming into their own.

What counts as a firm is changing: you can now build and run an online store from your mobile phone. And what counts as a market is changing: even small firms can now sell to the world, while niche interests can be found and served.

Much of this innovative activity is led by entrepreneurs scattered across the economy. What, if anything, can policymakers do to tip the balance towards success? These four areas give a scope of the opportunities.

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“Firms in every sector are doing the same old things in radically new ways. These Australian innovators are combining information and communication technologies in a stunning variety of forms.”

First, we need to plug the leaky innovation pipeline.

Some innovations travel down a pipeline. A light bulb goes on in a professor's mind. A lab proves it can work. A venture capitalist funds a startup to take it to market. The startup sells to an established firm. The established firm scales up to mass production.

For each stage in that pipeline, government provides support or sets legal frameworks. For the light bulb moments, the Australian Research Council and other grants support peer reviewed science. For more light bulb moments in applied labs, research and development is undertaken by CSIRO and others. Venture capitalists and startups are supported by grant schemes, Commercialisation Australia, the Innovation Investment Fund and employee share option schemes. Many established firms are entitled to R&D tax concessions. And all organisations are subject to intellectual property policy.

But there are leaks in the pipeline. Much research is never cited and much cited research is never applied. Some intellectual property doesn't seem worth protecting. Many innovation grants are made yet little is known about their value. Employee share taxation is failing startups, which rarely use a tool that should be a great fit for them. Some R&D tax concessions seem to reward investment that is not really R&D.

More than this, we don't even know where many of the leaks are. Research might be leading to commercial breakthroughs, but we don't track it; grant monies may be well spent, but much of it is not well monitored. Policy makers need to figure out where the big leaks are in the standard innovation pipeline. And then they need to fix some of the leaks if they can.

Second, we need to think in networks, not just pipelines.

Most innovations do not go down a pipeline. Instead, they form in a network. Musical innovator Brian Eno coined the term 'scenius' to describe the genius of a chaotic creative scene that produces more than any member could. Musicians co-create in a jam session; artists best one another's work in a downtown art scene. To put it another way, 'Nobody is as smart as everybody': genius may be in the genes, but innovation is in the scenes.

The innovation scene is partly global – you can source ideas from anywhere, use tools from anywhere, and collaborate with someone from anywhere. And you can sell to anywhere. Part of the scene is local: networks form in cities. Finally, some scenes are very local indeed: the ferment of startup accelerators, incubators, and co-working spaces shows the value of proximity to peers, role models and mentors.

To host 'innovation scenes' in our cities we need to mix local and global ingredients. We need local talent and global networks; local startups and global firms. So we need openness – to uncomfortable disruption by foreign firms and foreign talent. And we need liveability, so mobile talent will want to stay.

Critically, we need the right infrastructure (transport, communication) to bring the local ingredients close together, and link the local to the global.

Third, for all the genius of ‘scenius’, we need the old fashioned individual kind, too. But what kind of genius do we need now? We need to train people who can tell machines what to do: that is, we need scientific, technical, engineering, and math (STEM) talent. So we need the kind of smarts that can analyse and build things. Our schools do not rate well on mathematics and science. In some cases, our universities have produced quantity STEM, but nobody wanted to buy. We need higher quality STEM, as well as higher quantity.

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“It’s time for the lucky country to make its own luck. We can maintain our current prosperity if we can drive productivity growth by spreading new innovative practices across the economy.”

But STEM skills by themselves won’t be enough. We also need to train people who can do what machines can’t do: people who can coordinate, coach, care, and create.

And we need “T” shaped talent: all-rounders who are also technically deep in at least one area. For those whose depth is STEM, the breadth will be ‘softer’ human skills or business skills; leadership, creativity, finance, entrepreneurship. For some, the human or business skills will be the deep part of the “T”, with technical breadth rather than depth.

To get there, we need to fix remaining quality gaps in STEM education, then build out the all-rounder skills. We need to put the all-rounder classes close to the STEM core curricula (“entrepreneurship for coders”, “coding for entrepreneurs”). And we need to give young people early exposure to the world of work, apprenticeship and mentoring.

Fourth, we need to take a broad view on how government can support innovation. Government has a huge influence on how things are done. Roughly a third of GDP (including transfer payments) goes through its coffers. Government services are among the largest employers. Government is the largest buyer of information technology services. Tax, human services and social welfare systems touch everyone in the country. Government sets the rules of the game in health, in education, in finance and beyond.

Government can foster innovation by opening up where the costs of failure are low. The potential here is enormous, but the levers will need to be delicately reset. Government remains risk averse, feeling its way forward in many areas. Risk aversion is understandable, since the costs of failure can be high in government.

But blanket caution is the wrong rule. Government can do far more to offer data for the community to re-use, for example by choosing open data protocols as standard, rather than releasing data only in documents, and to open government processes to input from private or community innovators, for example where new health recording devices could send data to managing GPs.

Government can also foster innovation by getting out of the way in many areas. Where the regulatory burden is high, government can reduce barriers and compliance costs. Regulatory changes that permit smaller firms with new ideas to access capital, manage cash flows, and share risk will be key. The regulations that limit the use of crowdfunding for equity should be removed, and tax treatment of employee share options needs to be more flexible. Those reforms could help to unleash a new set of startups.

It’s time for the lucky country to make its own luck. We can maintain our current prosperity if we can drive productivity growth by spreading new innovative practices across the economy. Tech startups are the pointy end of innovation. Their emergence in industries from health to mining can act as a catalyst contributing to broader economy wide improvements.

