

Australia's Nobel Laureates

Volume III

*State of Our
Innovation
Nation 2020
and Beyond*

Editorial and Campaign
Purpose Information
Memorandum –

For Senior Leaders in Business,
Government, Universities, NFPs
and NGOs



Our Australian Nobel Laureates are true Australian heroes who deserve wide recognition for their magnificent endeavours

"One of Australia's most valuable assets is the great capacity of our people to innovate and adapt to change.

Our history and achievements provide proof that Australians are resourceful and flexible. In today's increasingly globalised world, these qualities are even more important.

It is important to raise the profile of our successful

innovators and pioneers in the scientific community.

The publication Australia's Nobel Laureates celebrates their work.

The inclusion of contemporary profiles of innovation demonstrates how companies and institutions are adapting and innovating to meet new challenges.

Investment in innovation is

crucial to secure our economic future.

Backing Australia's Ability - the Federal Government's \$3 billion commitment to innovation over five years - is built on pursuing these endeavours."

**John Howard
Prime Minister of Australia**

from John Howard Introduction, NL1, 2003



"Our nation is honoured to have produced 14 Nobel Laureates – gifted men and women whose brilliance has been recognised by the whole world.

Our Nobel Prize winners reflect the nation's strong record of innovation and scientific achievement, and they summon us to further achievement in a century that will be defined by our mastery of human and intellectual capital.

Our Nobel Laureates are proud examples of the great work being done by our research community, whose commitment to excellence has the admiration and respect of our whole country."

Julia Gillard
Prime Minister of Australia

*from Julia Gillard Introduction,
NL2, 2011*



Australia's Nobel Laureates, Volume III

HISTORY

Our publishing company has been active in the creation, explication and promotion of science, technology and innovation since 1982 – in many forms.* In 2003 we originated the first and only ever book devoted to a celebration of our Nobel Laureates.

Australia's Nobel Laureates Volume I was both a major, overdue tribute to these great national heroes, and an awareness campaign as to the importance of science and innovation to our country. It was deliberately conceived as a hybrid volume, containing many pages devoted to profiles in innovation, a feature which readers found a compelling and useful addition.**

In 2011 we were asked by a number of leading organisations, including the office of the Prime Minister, to substantially update and revise the publication. In the intervening years Australia had won an additional 4 Nobel

Prizes, including our first female Laureate, Dr. Elizabeth Blackwell, and our first prize for achievement in the field of Astro Physics, Dr. Brian Schmidt. Again, a wide range of relevant innovation profiles were included and a special chapter devoted to "Women in Science" created.

Most Australians appreciate the value of ideas and of the people who produce them.

The Australian Government shares that appreciation – which is why we have increased support for science, research and innovation by 25 per cent this year. Australia's Nobel Laureates is a book about brilliant individuals and the nation that enabled them to shine. It is an inspiration to us all.

**Senator Kim Carr
Minister for Innovation,
Industry, Science and
Research**

REVISION AND MAJOR OVERHAUL

Volume III will be a somewhat larger, significantly richer and more enhanced book than its predecessors. We have set out to make it the finest production in the series, in a number of ways.

Each Laureate biography will be reviewed and updated. And our important 2017 Nobel Prize winner (ICAN) given a major and definitive treatment. The book will be printed on the highest quality paper in elegant hardcover with dust jacket format, with an entirely new design scheme – **superior to past editions.**

BOOK STRUCTURE

This edition, Volume III, will be divided into five sections.

The first section will contain essential front matter on the Nobel Prize itself, its history and meaning, followed by lengthy, richly illustrated biographies of our Laureates.

**for extended description of our company's somewhat unusual history in both publishing business innovation and technology see www.onemandate.com and especially page 52 of this document.*

***Additionally a standalone Nobel Laureates only book was published and widely distributed, promoted and sold at retail.*

— Why?

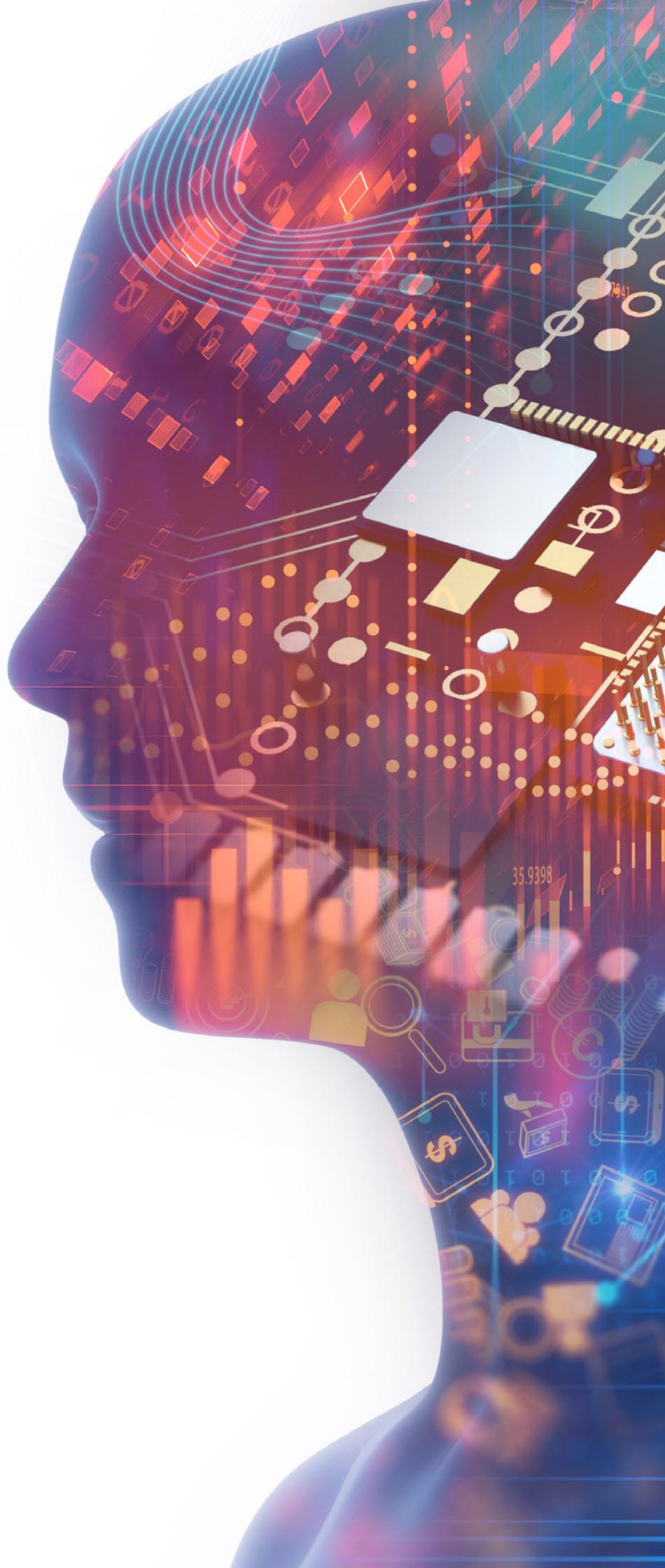
Each biographical portrait will be reviewed and extended based on a renewed study of their histories, especially for those still active. New personal interviews of the living Nobel Laureates will be conducted, where possible. Updated material will include contemporary context on the furtherance of their work and careers since their Nobel Prize accomplishments (approx. 160 pages).

WOMEN IN SCIENCE AND TECHNOLOGY

The second section is devoted to Women in Science. In Volume II, this was a major sub-theme of the book and a resounding success, as measured by direct response, retail sales and our own research. For this edition we will create a slightly wider platform, 'Women in Science and Technology' (approx. 24 pages).

A LIVELY, EXPRESSIVE SECTION: LEADERS SPEAK

The third section will provide the reader a vibrant intellectual and visual experience. It will follow a format we have used for over 20 years, with excellent reader response.



We call these **Leaders Speak™** pieces. The section will comprise short (50-100 words) thoughtful and polished quotes on the subjects of science, innovation and technology in Australia today. In spirit this section follows **our previous global project with IBM** in transforming their largest ever world CEO innovation survey into a publishable book.

These are meant to be insightful short observations on current trends, past lessons learned and future potential which resonate – readers long remember a pithy quote.

We will seek out leaders of various kinds, whether those confined to specific research areas or captains of industry, and various C-level managers – individuals with the **wisdom, experience and knowledge** to make an important editorial contribution that will be remembered.

History shows our Leaders Speak pieces are subsequently often re-quoted. Social media has amplified this trend – on occasions, ex-

ponentially. Our editors will personally collaborate using a short interview with individual invitees to contribute a Leaders Speak piece: an efficient and effective process, which allows the presence of more significant voices to be heard – and listened to – within the volume (approx. 12 pages comprising 60 individual entries).

The vitality of the LS pieces provides a stimulating lead-in to our much-pondered section four:

STATE OF OUR INNOVATION NATION ESSAYS

The fourth section represents **an entirely new editorial element** we will introduce with this volume. It is considered of the greatest importance by our editors, after months of research, interviews and reading. Please note again the subtitle of the book itself: **'State of our Innovation Nation, 2020 and Beyond.'**

This will be a collection of seminal essays written primarily by Australian practitioners in science, technology, policy, business, edu-

cation, finance and related sectors. The unit as a whole seeks to explore and examine in detail Australia's quality and quantity of innovation, obviously in science and technology but also – of fundamental importance – in business and finance, and sub-sets of these such as human resources. Education is, of course, another essential area of this evaluation.

It will stand as the most definitive and focused examination we are aware of on this subject, with the largest audience (with respects and compliments to the Department of Industry, Innovation and Science, which has provided solid and sustained reports on this subject over past years).

IMPACT

At approximately 60 pages, it is likely that this fourth section will be spun off in digital standalone form for wide dissemination, and possibly in a separate print version as well, pending demand. **It is expected to make an impact** – we believe a major one – on thinking in a number of areas:

- the relationship of innovation to the productivity and output of our business community;
- commercialisation of new ideas;
- the dynamics of our venture capital community;
- the strength — and appropriateness — of our education system including the STEM disciplines;
- **indeed, about our whole culture of innovation in Australia** – our total innovation ecosystem.

This section of the book will address policy potential weaknesses as well as successes – it is essentially a critical document, which strives to stimulate a national discourse among our current and rising leaders on change to improve the country.

You may have noticed that science is absent from the above list, as we speak of innovation. But no. It is **assumed** here that one of the primary enablers of an innovative culture is a healthy scientific culture, both deeply curious and dynamic.



Indeed, the major sub-theme which guides the entire collection is the linkage – or lack of – in the ‘supply chain’ relationship between science, research, commercialisation, finance and technology and business success. Are these sectors of our economy interacting at peak performance?

What models in other countries exist which may inform us? How do we stack up internationally, especially in STEM enrolments and R&D funding? What are the measures of effectiveness for a healthy innovation ecosystem? How can we clarify and define what exactly is ‘innovation’ when modern usage of the word is so widespread? What are the key issues government ought to address in seeking an improved innovation culture in our country?

In all, sections three and four of Volume III seek to spur an **active collaboration among many of our best minds** and to produce a critical evaluation and a constructive

prescription for an improved ‘State of our Innovation Nation, 2020 and Beyond’. We strive to produce a publication that not only celebrates our Laureates but which will inform, provoke, resonate and create positive change for many years.

The writers for this section, who will be prominent thinkers, educators, scientists, academics and business leaders, are being carefully selected by our editors now with a four-page written brief based on personal discussions, by way of selection criteria.

DEMONSTRATIONS OF EXCELLENCE – COMPANY AND ORGANISATION PROFILES

Section five is pivotal to the concept of the entire book – selected sponsor’s pages. Our company has specialised in the quality presentation of well over 200 of our top 1,000 companies over the past decades in this manner.

These important pages will serve as **vivid illustra-**

tions of quality innovation at work across all spheres, whether technical in nature or from the biggest two fulcrums for innovation – larger business and government.

But we do not ignore for a moment the fact that innovation of importance occurs vitally across the SME spectrum, or from other less-appreciated corners such as human resources, design, marketing, packaging, agriculture, mining and many others.

Their stories, derived from our research, have prompted our invitation to these outstanding companies and organisations to participate in Volume III, where they will be given the opportunity to showcase their finest achievements through quality visual and textual storytelling.

Their stories – in two or more page formats – will be dynamically presented and written by appropriately knowledgeable journalists and experts.

Those now being invited collectively represent a spectrum of active evidence of Australia's innovative prowess. They stand as inspiring lessons and motivations for CEOs, professors, the media, as well as – of great importance in our minds – the youth in our country, who will carry on to build a better, more scientifically robust and innovative Australia.

SPONSORS AS KEY EDIT

60 sponsors are expected as a minimum, based on the editorial value of their inclusion – for the reader, they fit naturally into the editorial scope and intent of the total book production.

Indicatively, five have already signed on enthusiastically prior to the production of this confidential info-doc; another dozen are already in advanced discussion with us.

“As Editors, we see a lineage which runs from fundamental science to technological innovation and onwards to business commercialisation. Culturally these are not three separate activities. Funding cuts to science research are no less than the beheading of a crucial, progressive process which leads to business and economic growth.”

“The subject of urging closer collaboration between these sectors will be a primary preoccupation in Volume III. We want Australia to do better. Those nations which will grow and prosper in the next 30 years will do so primarily owing to their scientific and technological creation and application – it’s a hard fact.”

“Anyone who examines the calibre of basic research at Stanford University, and its immediate proximity to technology entrepreneurs and a rarefied financial and VC sector, will witness a compelling story of productive exchange and interplay. The results are obvious.”

Keiron Costello, Managing Editor, following a recent Editorial Board Review of Volume III

Digital page samples and how they work



Ruralco: linking consumers to the best Australia has to offer

With over 45 companies in the Ruralco group providing agribusiness services and expertise across the whole spectrum of farming enterprise, Ruralco's businesses are household names in Australian agriculture. And with two of these groups – Frontier and Ruralco Property – Ruralco is also expanding its reach into Asia.



Frontier International's new state-of-the-art live export ship, the Greyman Express

Formed in 2013, Frontier is the live export arm of the Ruralco portfolio, supporting livestock to China, Indonesia, Vietnam, and Cambodia. Drawing on alliances with the best livestock breeders in the country, Frontier provides a fully integrated service covering the whole supply chain from sourcing of livestock to shipping and logistics.

The big challenge for Frontier is meeting the demand of the booming Asian middle class. By 2030, two thirds of the world's middle class population (including 3.5 billion people in China and India alone) will live in Asia – and demand for Australian meat has never been higher.

A level of demand this high is obviously pushing up prices across the country – in early 2014, the Cattle Young Cattle Indicator (the benchmark for Australian cattle prices) was 395 cents per kilo. In January 2015 it hit 600 cents per kilo for the first time and in August 2016 reached new heights at over 700 cents. And according to Frontier Managing Director Will McEwin, this is just reward for the effort of Australian farmers.

"We're seeing unprecedented values for Australian cattle, and they're very well justified. Australia has the best livestock product – especially in cattle – in the world," says McEwin. "Most demand indicators are at their peak or close to a record high – whether it be domestic or international markets for beef or live cattle."

Well positioned to service the demands of this growing middle class, Frontier rises above its competitors by focusing on technical expertise. According to McEwin, this expertise is a response to the challenge of complying with strict standards of animal welfare, quarantine and traceability.

"We're seeing unprecedented values for Australian cattle, and they're very well justified"

"We assist the customer to make the most of the livestock they purchase from us, and make sure that our expectations – as well as community and government expectations – around animal welfare standards are exceeded," says McEwin. "This reinforces the world's acknowledgement of Australia's value as a supply source, but also a supply source of quality."

Frontier adheres to traceability by tracking every movement of every single animal in its care. This tracking is done through several pieces of technology including Radio Frequency Identification (RFID) ear tags, photographic scanners and GPS technology. Every movement an animal makes – from feeder to part to foreign abattoir – is scanned and recorded, ensuring that Frontier is capable of supplying the entire movement history of each and every animal.

Leaving no stone unturned in the quest to provide the best possible service to international customers is a quality that is shared by another arm of the Ruralco group – Ruralco Property. A provider of rural and regional real estate and property services across Australia, Ruralco Property has an annual turnover exceeding \$1 billion, and has 300 staff in over 100 outlets covering every state and territory in the country.

Despite operating across the entire expanse of Australia, it's local knowledge that sets Ruralco Property apart. The depth of knowledge within the company makes Ruralco Property perfectly suited to facilitate connections between buyers – both domestic and international – and Australian sellers. Carefully chosen staff all over Australia living and working in rural areas gives the company an unrivalled local knowledge when it comes to selling property.

This local knowledge not only gives Ruralco Property a well-known and trusted presence amongst those looking to sell in rural areas, but also gives pro-



Emeralda Station in the lower gulf region of Queensland

spective buyers comfort in knowing they're dealing with experts in local regions. For international buyers, these community ties are a huge plus.

"With Ruralco Property, buyers get access to staff whose local knowledge is a massive asset," says Northern Australia Real Estate Manager Andrew Adcock. "Our local service backed by the strength of the Ruralco group provides clients with the certainty they require during the buying and selling process."

There is no better example of the Ruralco advantage in local knowledge and expertise than the recent sale of Emeralda Station, a 480,000 hectare cattle breeding property in the lower gulf region of Queensland. Including almost 30,000 high grade Brahman cattle, a property with a herd of that size is a rare sight on the Australian market. As such, the property generated strong interest from overseas investors looking for a sizeable piece of the Australian beef industry.

Emeralda Station had been listed for sale a few times dating back to 2006, but the opportunity to market it was first offered to Ruralco Property – represented by Troy Trevor and Peter MacPherson of the Queensland Rural office – in early 2015. According to Troy, his office's pre-existing relationship with the owners was the reason they opted to employ the services of Ruralco Property.

"The owners had tried other agencies in the past to market it, they'd been there and done that," says Trevor. "But we've been handling their livestock business for the past ten years, so they gave us the opportunity to market the property. They picked Ruralco Property because of their relationship and connection with us."

Due to go to auction in March 2015, the sale of Emeralda Station was postponed due to seasonal conditions and offered for private sale. Thanks to the hard work of Troy and Peter, a deal was reached with Gusn Agri (trading as Cunningham Cattle Company) and the sale was made. While the price for the transaction was not released, the property was listed for private sale at \$40,000,000 on a walk-in walk-out basis.

One of the biggest sales of the agents' careers, the sale of Emeralda Station would not have been possible without their local knowledge and community ties – the hallmark of the Ruralco Property organisation.

Ruralco displays leadership in both the Australian live export and property industries by leveraging technical expertise, uncovering innovative methods and anticipating the needs of overseas markets. This kind of leadership has a beneficial impact on the entire domestic industry, raising the bar for quality and service, as well as raising the profile of Australian excellence. The examples of Frontier and Ruralco Property ensure that the Ruralco name continues to stand for the best in agriculture and agribusiness.

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An aerial photograph of a large agricultural farm. The landscape is divided into numerous rectangular plots of different colors, including green, brown, and dark red, indicating various stages of crop growth or different types of soil. A winding river or stream flows through the center of the farm. In the background, there are rolling hills and a large body of water under a clear sky. The text 'Simplot's cooperative approach to competitiveness' is overlaid in white on the left side of the image.

Simplot's cooperative approach to competitiveness

Much has been said about the ample opportunity for Australia's agricultural industry to play a critical and lucrative role in meeting rising Asian food demand in the coming decade and beyond. Less has been said about the Australian food processing industry participating effectively in this growth trajectory. Simplot Australia's CEO Terry O'Brien talks with **GRAEME PHILIPSON** about the opportunities and challenges.

In line with most Australian manufacturing, food processing is facing a seemingly never ending escalation in costs, leading to reduced international competitiveness. Many food processing companies are relocating their plants offshore or even closing their doors for good.

An exception is Simplot Australia, a diverse food business which operates nine major manufacturing sites across the country. It directly employs around 3,000 people and processes over 400,000 tonnes of Australian grown vegetables and potatoes each year. Simplot's Edgell vegetable cannery in Bathurst was the nation's first in 1926, and that facility along with its vegetable plant in Devonport Tasmania means it remains the only Australian processor of frozen vegetables.

Simplot Australia is a wholly owned subsidiary of the US-based and family owned J.R. Simplot Company. It is home to some of Australia's favourite food brands, such as Edgell, Leggo's, Birds Eye, John West, LeanCuisine, I&J and Chiko.

Terry O'Brien is Simplot Australia's CEO. He believes the Australian food processing industry is in danger of losing its relevance in the global trade in processed food items. "Australia has long enjoyed low energy costs and a comparatively favourable exchange rate," says O'Brien. "Unfortunately this has led to complacency in some quarters about the rise of other business imposts, such as high labour rates and on-costs and inefficient work and management practices.

"Energy costs in Australia are now moving towards or beyond the global average, and while the exchange rate has moved back towards its historical average after a period above parity, it is still volatile and subject to the vagaries of global sentiment rather than economic fundamentals. But innovative businesses have identified niches in the market and have managed to fund the necessary investment to take advantage of the opportunities they have identified."

O'Brien says Simplot has been able to do this. "Improved yields and new technologies have meant that Simplot has been able to meet market prices despite large increases in other input costs like labour, energy, packaging and raw materials. This means a win not just for Simplot but for its customers and end consumers."

He gives as an example the rapid identification of emerging Pulsed Electric Field (PEF) technology by one of Simplot's senior food scientists and presented at the New Food Processing Technology seminar in Europe in late 2011.

The conventional method of cutting potatoes into chips using water knives causes significant fracturing and feathering of the chips, explains O'Brien. In cooler climates this means the uncooked chips need to be warmed or pre conditioned in hot water first, resulting in significant energy use. It also affects the texture of the chips.

PEF works by applying an electric field pulsed at a high frequency to the potatoes in water prior to cutting, which softens them and eliminates the need for pre-conditioning, as well as providing better cutting quality and higher yield.

Simplot worked in collaboration with the developers of this technology and invested in pilot scale and factory trials prior to implementation in Australia and globally in early 2013. Since then Simplot estimates it has saved over 300 million litres of water and more than 100,000 gigajoules of energy.

A SPIRIT OF INNOVATION

The Simplot story began in the US state of Idaho in 1929, when 14 year old J.R. 'Jack' Simplot began a one-man farming operation, developing a new method of dehydrating onions and potatoes for storage. His innovations meant the company saw massive growth in World War Two supplying the US army.

Today Simplot is a global food and agribusiness enterprise with major operations in the US, Canada, Mexico, Australia and China. The company's brands have a long legacy in Australia. In 1894 Henry Leggo began selling his mother's authentic bottled tomato based sauces to appreciative miners in the goldfields, and the iconic Chiko Roll first appeared at the Wagga Wagga agricultural show in 1951. Simplot is extremely proud of this tradition, and has blended it with the innovations that have made it one of the most successful companies in the Australian food industry.

"Jack Simplot was a pioneer in what we now refer to as green thinking," says O'Brien. "Simplot maintains his legacy of 'bringing earth's resources to life' through a commitment to sustainability and the three pillars that guide its efforts: Spirit of Innovation, Passion for People, and Respect for Resources." Simplot's NPI (New Product Introduction) process is a unique method the company has evolved to translate its technological innovation into commercial products. Simplot currently has 110 NPI projects running simultaneously across multiple portfolios and delivering a 55 to 60 per cent success rate – practically twice the industry norm.

Simplot has one of Australia's leading technical and pilot plant facilities at its headquarters at Mentone near Melbourne. "Our culinary centre is a class leading resource which employs chefs, culinary technologists and food stylists as important members of the cross functional project teams," explains O'Brien. "The centre has an advanced sensory testing facility where every product is optimised, assisted by over 300 registered panellists who regularly participate in this vital activity."

O'Brien says R&D and technology adoption are key contributors to the successful growth of the business. Simplot's food scientists, engineers, technologists and subject matter experts are constantly seeking new opportunities to innovate across the technological landscape.

The role of the states in innovation

Former Victorian Premier **JOHN BRUMBY** takes a look at the role of the government - both federal and state - in fostering innovation.



There are a number of measures governments can and should take to support, grow and secure ongoing viability of regional communities. Basic services must be adequately funded and well maintained. Moving headquarters of government services to regional areas will stimulate local economies. Reliable and well-targeted infrastructure is also vital to regional communities and industries. But it's also important to recognise that without a strong push toward innovation in regional and agricultural industries, none of these measures will be anything more than temporary.

Regional Australia is no stranger to the need for innovation. Agricultural life has never been easy. Early settlers were forced to innovate as they adapted agricultural techniques brought from the old country to a new land. Farmers still face traditional threats such as drought and disease, and as climate change continues these are likely to get worse, not better.

As Australia's resources boom tapers off, many commentators, politicians and business leaders are aware of the need to tackle a lag in productivity growth masked to some extent by the growth in resources investment. Innovation is required right across the board, and agriculture and agribusiness are no exceptions.

There are new challenges to be faced, as well as new opportunities. The rise of Asia, for example, means the Australian agricultural sector must act quickly to seize the opportunities presented by a growing middle class. The World Bank predicts the global middle

Regional Australia is no stranger to the need for innovation.

class will expand from 1.8 billion in 2009 to 5 billion in 2030. Rising wealth brings increased demand for protein-rich food, wine and other agricultural products.

The China-Australia Free Trade Agreement (ChAFTA) creates a wealth of new opportunities. Tariffs will be progressively eliminated on beef, many dairy products, wine and many horticultural products. Australia's agricultural, forestry and fisheries exports to China are already worth \$8 billion; we can expect this to grow considerably if Australian exporters are nimble enough to take advantage of a changing world.

But to meet the challenges and seize the opportunities of the 21st century, we must find new ways to increase crop yields, combat diseases, mitigate the effects of drought and develop new crop varieties to meet changing and growing demand. That means we need innovation. And improved quantity and quality is not enough; innovation is also needed to add value to agricultural products. Improved packaging, greater freshness and shelf life, lower environmental impact – today's markets demand progress across the board.

There is a prevailing myth that innovation is the role of business, and the best thing governments can do is get out of the way. This is not right. There's no question that the private sector can and should be a powerhouse of new ideas, experimentation and early adaptation of new technologies. But the fiscal, tax, regulatory and infrastructural environment in which innovation can occur is largely determined by governments.

The UK think tank Demos has pointed out that Silicon Valley, long seen as a triumph of the private sector, was the recipient of a great deal of government support in the early days (much of it through Stanford University), and that the algorithm that powers Google to this day was developed on a US National Science Foundation grant.

These are just two small examples of a larger truth: if government 'got out of the way' innovation would grind to a halt. While avoiding 'picking winners', governments can apply targeted inter-

ventions to encourage research and its application to old tasks and new challenges. Commercialisation is another area in which governments can play a role, and the current federal government is just now beginning to discuss what might be done to improve the commercialisation of Australia's medical and other research.

In Australia, state governments also have an important role to play in encouraging innovation in general, and innovation in agriculture and agribusiness in particular.

Our government in Victoria took a particular, place-based approach to the regions, which involved looking at the needs and opportunities identified by local communities, and recognising that government has a role in stimulating growth. We restored services and invested heavily in infrastructure through the **Regional Infrastructure Development Fund (RIDF)**, encouraged industrial giants such as IBM to move to regional centres like Ballarat, and led the way by decentralising government services such as Vicroads, State Trustees and the Transport Accident Commission (TAC). This 'regionalist' approach was subsequently adopted by the federal government.

But we also knew that a sustainable future for the regions meant bringing cutting edge research and technology to bear on traditional industries. Perhaps the best example of this is AgriBio at Latrobe University. Our government entered into a \$288 million public private partnership to build AgriBio, which is dedicated to finding new ways to increase productivity, fight disease and reduce the environmental impact of agricultural activity through biotechnology.

Biotechnology is the use of biological substances or processes for human purposes and scientists around the world are using it to tackle some of the biggest challenges we face, such as cancer and heart disease. The application of biotechnological breakthroughs to agriculture is no less important: the prediction that by 2050 the world's population will reach 9 billion means food production will need to increase by 70 per cent. There is a finite amount of land – we have no choice but to make that land more productive.

Scientists associated with AgriBio have recently been involved in working out how certain environmental changes can interact with a plant's genetic structure (known as 'epigenetic change') to help farmers maintain crop yields without the use of expensive fertiliser. This is important work, which could have important commercial implications down the line, but it cannot be done by the private sector alone. Government must invest in the facilities and scientific infrastructure to make it happen. Though the payoff may not be immediate, it will come in time.

US President Barack Obama put it well when he was pressured to cut science spending at the height of the Global Financial Crisis. This would, he said, be "like lightening an overloaded airplane by removing its engine. It may make you feel like you're flying high at first, but it won't take long before you feel the impact."

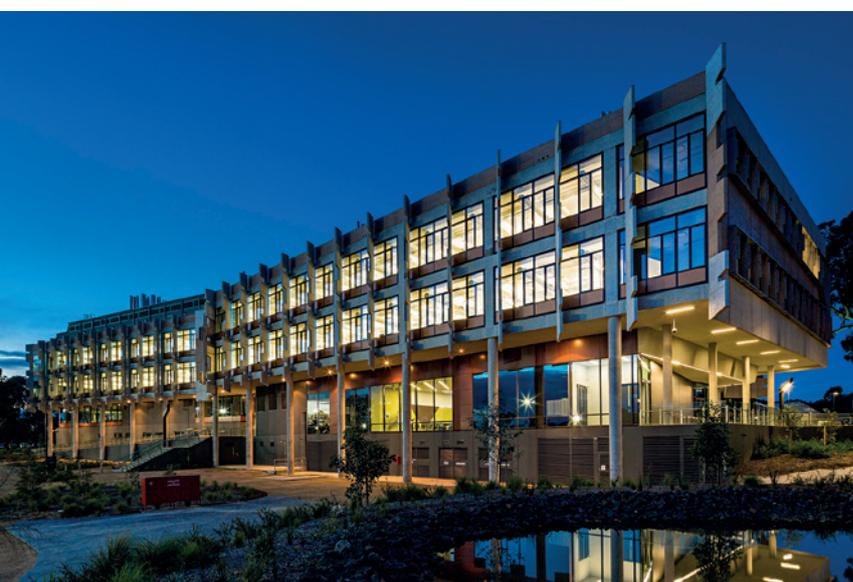
To their credit, both Prime Minister Malcolm Turnbull and Leader of the Opposition Bill Shorten have acknowledged the value of becoming an innovative nation, and begun to lay out plans by which we can reach this goal. It's therefore an exciting time in Australia. Both government and opposition are engaged in a conversation about the kind of nation we want to be post-mining boom. But we must remember state governments also have an important role to play, including in the areas of agriculture and agribusiness.

That means continuing investment in biotech and other agricultural research. It means fostering research partnerships in Asia, with whom we share so many challenges and opportunities, and where there are increasingly important markets. And it means creating strong communities in the regions, to attract and retain the people who will drive the future of our regional industries.



AgriBio: an enviable record in scientific research

AgriBio, the Centre for AgriBioscience is attracting worldwide attention for its genetic research. AgriBio's staff have produced more than 70 patents in the last seven years, and hold an impressive track record in producing valuable research and technology for the agricultural sector.



AgriBio is a \$288 million joint venture between the Victorian government and La Trobe University. The facility is Australia's first integrated agricultural systems biology research centre and one of Australia's premier agribioscience facilities. AgriBio was conceived by the Victorian state government, which has a long history of contributing to animal and plant genetic improvement. It is housed at La Trobe University's Melbourne campus in Bundoora, and this co-location has enabled ground-breaking, cross-disciplinary work in the areas of dairy genetics, grains research and plant and animal biosecurity.

AgriBio was host to the Dairy Futures Cooperative Research Centre (CRC) until its conclusion in 2016, and will continue to deliver profit and growth to the dairy industry via the new DairyBio joint venture between Agriculture Victoria and Dairy Australia. The Dairy Futures CRC contributed to doubling the rate of genetic gain in Australian dairy herds, and paved the way for an entirely new approach to commercial pasture breeding.

Continuing and expanding on the research conducted by the Dairy Futures CRC, DairyBio is expected to deliver gains in the order of \$800 per hectare of dairy farm per year through improved pastures, and \$350 per cow per year from improved herds, representing an estimated \$2.5 billion benefit over 25 years at a national level.

"Scientists who are now part of the team at AgriBio have been responsible for fundamentally re-shaping dairy cattle breeding in Australia and achieving massive genetic improvements," says Professor Ben Cocks, Research Director Genomics and Cellular Science, who is based at AgriBio.

"Each dairy cow in Australia is now producing double the milk compared with 30 years ago, and on half as much land."

Agriculture Victoria – with its capabilities based at AgriBio – is a major research partner in the Plant Biosecurity CRC. Agriculture Victoria staff at AgriBio and other sites have run research programs in disease and pest management for the horticulture industry and, under a bilateral agreement with the Grains Research and Development Corporation (GRDC), have developed advanced genetic innovations for the canola and pulse industries.

With 100 staff from La Trobe University and over 300 from the Victorian Department of Economic Development, Jobs, Transport and Resources (DEDJTR), AgriBio's biggest research advantage is the ability to combine different disciplines in one facility.

"Here at AgriBio we have people specialising in plant productivity, animal productivity, biosecurity and animal disease all working together," says Professor German Spangenberg, Director (DEDJTR) AgriBio. "Our facility is possibly unique in the world in having people from all those disciplines working together."

A key point of difference for AgriBio is the specific focus on translating research to industry outcomes. The government-owned company Agriculture Victoria Services (AVS) manages Agriculture Victoria's intellectual property, patents and plant breeder's rights.

Agriculture Victoria at AgriBio has a range of commercial partnerships with industry leaders, such as a nine-year innovation partnership with Dow AgroSciences that is focused on developing transformational technologies for improving crops.

"We've made some breakthroughs in genetic improvement in grains, particularly around accelerated precision breeding using genomic selection and genome editing in canola and wheat," says Professor Spangenberg.

In addition to delivering research that benefits the agricultural industry, the facility also provides advantages for La Trobe University's education systems.

"We've got this fantastic facility that is on the La Trobe campus, and it is such a good environment for post-graduate education," says Professor Cocks. "We can use large, industry-funded projects to provide our 60 PhD students with real-world problems to work on."

AgriBio's unique strength – its collaborative, cross-disciplinary nature – is the result of the leading expertise and strategic support of the Victorian government. With its impressive achievements in genetic research and strong commercial partnerships, AgriBio proves that governments in Australia can play a significant role in innovation.



Value-added foods – leveraging Australian attributes

Australia enjoys an enviable and deserved reputation as the producer of safe, clean, green foods and agricultural products. **PROFESSOR MIKE GIDLEY** – Director of the Centre for Nutrition and Food Sciences at the Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland – examines how this reputation can be leveraged to develop value-added foods.



COMMODITIES AND SPECIALITIES

In the export market, there are typically two categories of products supplied by the agri-food sector. The current dominant category for Australia involves large-scale primary products such as grains, animals, fruits and vegetables, or first-stage processed products such as milk powders or meat. The common characteristic of these products is that they are traded and eventually sold to consumers on a per weight basis.

This makes for easy price comparisons and decisions by food manufacturers, retailers and consumers, and the commoditisation of produce. Australian produce can often be shown to have superior

attributes to similar produce from other countries with a lower cost base than Australia. However, cost/benefit trade-off decisions are inevitability made by food manufacturers, retailers and consumers who determine whether it is worth paying more per kilogram for Australian produce.

The second category of agri-food product is that of value-added foods, which are typically sold to consumers per meal or serving rather than on a per weight basis. This results in a decoupling of weight from price and can lead to much higher margins, but must be accompanied by added value to consumers

Agriculture research and innovation at QUT

Feeding the world's rapidly growing population without exhausting the available land and water or degrading the environment is a massive challenge for the agricultural industry, governments and researchers this century.

Worldwide food production needs to increase significantly by 2050 to feed the projected population of 9 billion people. Agricultural practice needs to be transformed to become more productive, profitable and sustainable.

Queensland University of Technology (QUT), based in Brisbane, utilises its transdisciplinary expertise and infrastructure to conduct cutting-edge research in four key areas of agricultural innovation (described in detail over the following pages):

- Biotechnologies for tropical crops, including for bananas, rice, mungbeans and chickpeas
- Transformational technologies, including gene regulation platforms and agri-environmental intelligence
- Sustainable agriculture techniques, including nitrogen use efficiency and biopesticides
- Biorefining technologies, processes and products

QUT is a research-intensive Australian university focused on high-impact applied research with end users. QUT works with industry and government partners to identify their business challenges or research problems, and engages transdisciplinary teams with diverse expertise and experience to create innovative solutions. QUT's researchers work in an environment designed to foster teamwork and innovation, supported by state-of-the-art research infrastructure and facilities.

TRANSDISCIPLINARY RESEARCH INTO GLOBAL PROBLEMS AND SOLUTIONS

The grand social, economic and environmental challenges confronting the world do not divide neatly into traditional academic disciplines, so researchers must go beyond conventional ways of thinking and working. Agricultural research and innovation at QUT is driven by the Institute for Future Environments (IFE). The IFE is at the forefront of a shift to transdisciplinary integration and collaboration. It brings together experts from a diverse range of fields – from biotechnology and robotics to environmental monitoring and innovation systems – to work on large-scale research and innovation projects.

The IFE's mission is to generate knowledge, technology and practices that make our world more sustainable, secure and resilient. The IFE partners with industry, government, other research organisations and the community to deploy real-world solutions to the grand challenges humanity faces this century, from feeding the booming global population to managing scarce natural resources and threatened ecosystems.

Researchers at the IFE are studying the rapidly evolving and converging environments we live within:

- the natural environment – life, land and water
- the built environment – infrastructure, buildings and technology
- the virtual environment – networks, models and data



Researchers from QUT's Centre for Tropical Crops and Biocommodities (from left to right): Professor Sagadevan Mundree, Distinguished Professor James Dale, Professor Roger Hellens and Professor Peter Waterhouse

TROPICAL CROPS

Biotechnology can enable farmers to grow more food, lose less of what they grow and use less water and fewer chemicals. The Australian state of Queensland is a perfect base for biotechnology studies and trials of the tropical crops that are crucial to feeding the developing nations in the tropics and subtropics. Queensland is blessed with an ideal climate, cutting-edge research facilities, sophisticated agricultural production, political support for emerging bioindustries and a defined regulatory environment.

QUT has a strong track record of tropical crops research and innovation, primarily through its Centre for Tropical Crops and Biocommodities (CTCB). Researchers in the CTCB are developing new varieties of tropical crops with higher yields, greater resistance to drought, diseases and pests, and improved nutritional value and taste.

QUT's expertise

- Genetic modification of tropical crops (sugarcane, bananas, chickpeas, mungbeans, etc.)
- Transgene expression – novel expression technologies (INPACT), expression of inhibitory or toxic products; promoter discovery and development
- Biotic and abiotic stress resistance
- Gene silencing and crop protection
- Crops as biofactories (tobacco and sugarcane)
- Protein purification from plants
- Biosafety and regulation of GM crops
- GM crop field trials

Led by Professor Sagadevan Mundree, the CTCB brings together a unique mix of international expertise in plant biotechnology, process engineering, industrial chemistry and commercialisation. This variety of expertise creates a continuum of research and development from laboratory studies through to products, from gene discovery and genetic manipulation through to field demonstration and pilot plant scale production. The CTCB provides major research and development services for a range of tropical agriculture industries and supports agricultural advancement in developing countries.

The CTCB has broad expertise in plant biotechnology, with a particular emphasis on the expression of novel genes in tropical crops. Its research program has three major components:

- biofortification of tropical crops to improve human nutrition
- development of biotic and abiotic stress-tolerant tropical crops through the deployment of novel resistance genes
- characterisation of viruses for the development of diagnostic techniques facilitating distribution of clean planting material

The focus is on developing new crop cultivars through genetic modification for nutritional biofortification and plant disease resistance, as well as developing plant disease management technologies.

The CTCB's researchers have extensive experience in tissue culture and transformation, plant molecular biology, plant gene discovery and transgene expression technology, plant virology and plant disease resistance. This expertise has underpinned the development of a number of advanced transgenic plant lines through to field trials, including virus resistance in papaya and biofortification and fungal disease resistance in banana.

The robotic systems coming soon to a farm near you

By Professor Salah Sukkarieh, Professor of Robotics and Intelligent Systems at The University of Sydney

Australia has a proud history in the research, development, commercialisation and operationalisation of field robotic systems. Field robots are outdoor mobile platforms that need to operate all day, in dull, dirty and/or dangerous conditions. We see examples of these in the air, on the ground and underwater.

Our wide land and relatively small population mean that our mining, aviation, logistics and infrastructure industries have been great supporters, funders and beneficiaries of field robotic systems. These systems have helped them deal with difficult environment and business operational conditions, while also advancing their international competitiveness.

Agriculture, although relatively new to the area of field robotics, has rapidly adopted the technology, benefiting from the investment and experience of other Australian industries. Field robotics promises benefits

to farmers in the form of continuous monitoring, precision information acquisition, input cost reduction, reduction in their own time labouring, external labour savings and improvements in yield and minimisation of yield variability.

This recent adoption has also been facilitated by the reduction in computing, sensing and actuation costs, making it cheaper and easier to have on-farm robots. The capability of sensors is growing, and when coupled with recent advances in artificial intelligence, modern sensors are providing farmers with health and growth prediction estimates down to the individual



plant and animal level, and in real time. This gives farmers the information they need to make precision decisions.

ROBOTS IN THE PRESENT

Robotic platforms such as [RIPPA](#) (Robot for Intelligent Perception and Precision Application) are now solar electric, providing green alternatives to on-farm platforms and the ability to self-charge and operate over long periods of time. RIPPA, developed by Sydney University's [Australian Centre for Field Robotics](#) (ACFR) in collaboration with [Horticulture Innovation Australia](#), is a useful example of what can be done in a relatively



structured environment, such as in row crop applications.

The main objective is to straddle the rows and allow for the ‘plug and play’ of a variety of sensor and actuator systems underneath the robot to look at and act on the crops. Current examples of what can be achieved include individual crop detection, weed classification, directed spray targeting of crop and weeds and research into individual crop health and yield estimation.

PLAY VIDEO



[Click here to watch a video of RIPPA in action](#)

[SwagBot](#), on the other hand, is an all-terrain robot focusing on unstructured environments also developed by the ACFR with contributions from Meat and Livestock Australia and philanthropic funds. This includes hilly and rugged country that would be found in the grazing livestock industry, or in tree crop applications where tree density can be problematic with sensing and navigation. The robot has the ability to manoeuvre around obstacles as well as go over them. Current capabilities include pasture monitoring and the detection of shrubs and weeds as well as intelligent spraying.

SwagBot also opens up the possibility of animal monitoring as there have been extensive demonstrations of calm behaviour of animals (cattle) around the robot, including the ability to lead the cattle to new pasture areas and to use sensor systems on the robot to remotely detect the health state of an individual animal.

PLAY VIDEO



[Click here to see a video of the first field test of SwagBot](#)

The ACFR’s [Digital Farmhand](#) – also developed with the aid of philanthropic funds – takes robotics to smallholder farmers all around the world. The focus is on a low-cost entry point, which, although it might not be able to meet all the objectives of the previous two robots, can still undertake tasks such as intelligent spraying and weeding and crop monitoring. Delivering robustness at a low cost is the major challenge in the development of this technology. The robot has been trialled on a number of farms across Australia, Indonesia, Fiji and Samoa, along with a rollout into rural schools to encourage children to take on a digital career in agriculture.

PLAY VIDEO



[Click here to watch a demonstration of the Digital Farmhand](#)



ROBOTS IN THE FUTURE

Over the next two to five years we will see the introduction of commercial robotic platforms that can be used by consultants and farmers to do tasks such as robotic weeding, intelligent spraying and pest detection, automatic seeding and, eventually, harvesting. These systems will allow for better management of the land because of the precision they provide, the reduction in chemicals they allow and the significant improvement in yield they will deliver.

Simultaneously, we will see major advances in robotic technologies because of the robotic building blocks. Faster computing power and 3D printing will mean more advanced tasks – such as pruning or fruit harvesting – will be done in real time. Greater sensing capability along with intelligent robotic arm actuation will deliver the capability of sampling the environment in real time without the need for laboratory testing. Robotic tools will also be able to conduct pest management without the need for chemicals.

Within the decade, many farmers will be in a position to own their own robotic plat-

forms and be capable of commanding them to do various tasks around the farm. The Digital Farmhand is one such case where, over the next couple of years, we will see the rollout of this technology to consultants and some farmers who will own them. As their usage spreads, within five years they will become as common as drones with the significant added advantage of being able to do physical tasks. More advanced robotic systems such as RIPPA and SwagBot will be better suited to large-scale commercial growers who will see them as a significant commercial benefit. The rollout of these robotic systems commercially is expected within the next two years.

A further benefit that we will see in Australia, as it continues to be the leader in this technology development and operation, is the opening up of farmable land. Robotic systems can deal with extreme temperatures and weather conditions, operate day and night and do so at millimetre precision. Farmers who have found it hard to expand their operations because of the difficulty in attracting labour to deal with harsh conditions will find friends in field robots.

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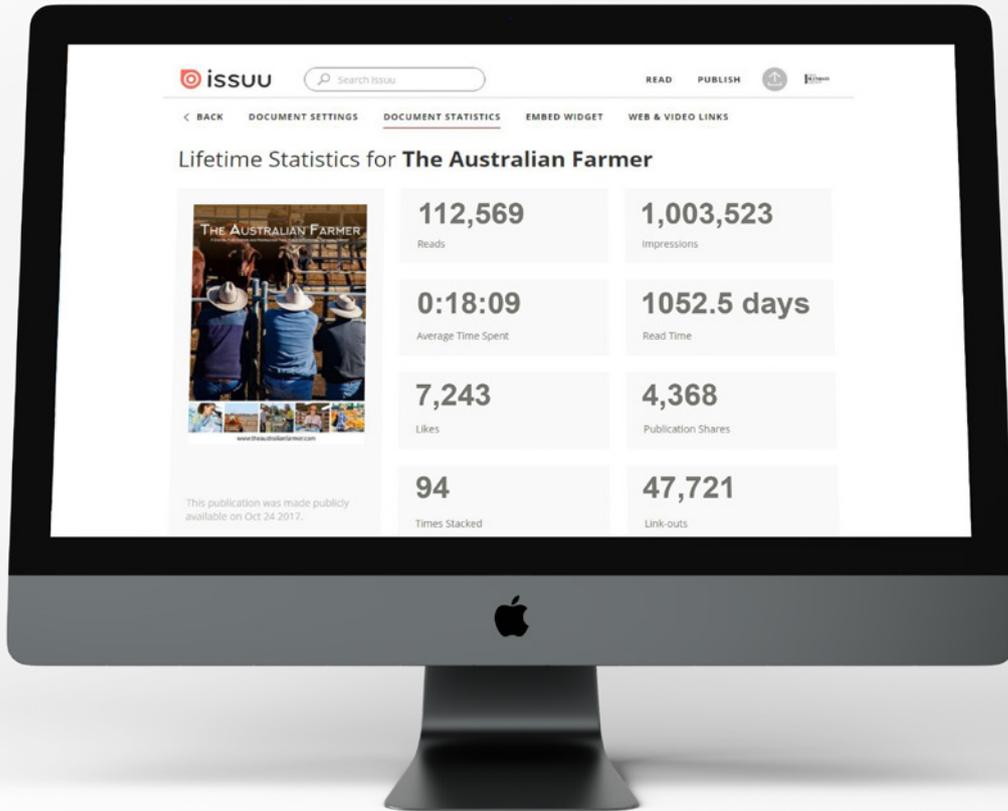


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[Click here to read about the innovative company creating dairy-farming robots](#)





MEDIA DATA REPORTING ACTUAL EXAMPLE

The Australian Farmer

digital annual book Vol I



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1 ONE
MANDATE
GROUP

A LONG HISTORY AS PUBLISHERS AND HANDS ON INNOVATORS

In 1982, nothing like it had been done before. One of our founders, a former director of Scientific American conceived the largest ever exposition of Australia's Scientific, Technology and Innovation enterprise ever created for a world audience This was 52 page report on Australia which reached over 1 million readers globally.

Our small company was born with that project. Scientific American, the longest continually published magazine in America, was then the world leader in its field; it holds the record for the highest number of Nobel Laureates published within its pages.

We were determined to alert the world as to Australia's under-recognised achievements and potential. In 1982, we had little idea where this would lead us ...

A FEW HISTORICAL HIGHLIGHTS FROM THE 1MG ARCHIVES:

1982 — Launched the first and only dedicated publishers representation firm (IMR) devoted to international titles in Australia. Goal: promote Australia overseas. Clients included the Economist, Harvard Business Review, the NY Times, and over 70 other leading print publications. Hong Kong office established.

1984-1985 — Created with the direct involvement of then Treasurer Paul Keating the largest ever international banking conferences in 1984 and 1985 in partnership with Euromoney, a definitive global journal on banking. Concurrent to the float of the Australian Dollar and the creation of foreign banking licenses, over 1000 senior bankers from more than 35 countries attended for one week. Milestone events in Australia's economic opening to the world.

1986 — First major publication in Chinese on Australia (significantly devoted to our science), distributed at senior levels throughout the company in Scientific American's translated edition – Ke Xue.

1988-1989 — created The Australian Adventure, a 500 plus page deluxe and very different travel and adventure book on our country. Best seller across multiple re-printings.

1989-1994 — Originated Australia's first narrow cast television channel, Doctor's television Network.

1989 — Bought Asia Pacific rights to Snuba, a patented sport diving system, still in operation today. The technology was simple yet exciting.

1990-1992 — launched print publication Australian Enterprise Review, an annual about Australian products and technological skill targeting Asia.

1991-1992 — Special contract to advise and support launch of "Television Australia" the ABC's first commercial venture : Satellite TV, trans Asia. Reported directly to David Hill, CEO.

1994 — founded IRG, amongst the country's first internet development firms. Clients: CBA, Toshiba, Citibank, Sunrice, Westpac.

1995-2001 — developed in alliance with IBM the world's first FX and Money Markets internet based trading system, Velocity Systems. Deutsche Bank Private Equity and Federal gov-

ernment financial backing.

2001-2013 — ETN Communications, which produced many books, magazines in print and digital form, podcasts, the first edition of Nobel Laureates, 2004, and the award winning magazine FAST THINKING devoted to innovation – sold in over 35 countries internationally.

2004-2005 — designed a unique CD ROM instructional tool for leading funds managers including Magellan, Colonial.

2008-2011 — ETN commissioned to create and manage a magazine "Private Word" for NAB private bank's 35,000 clients.

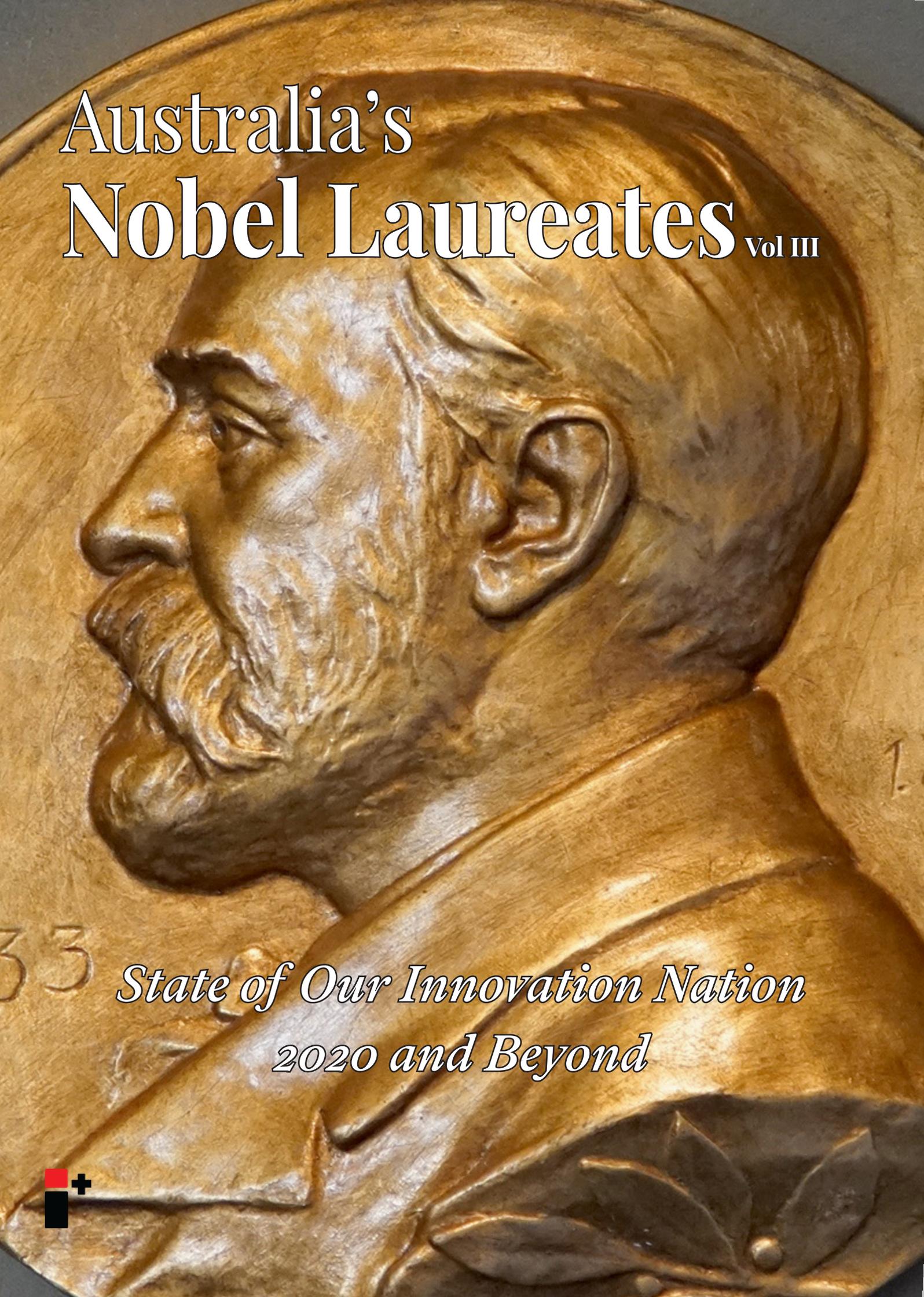
2009 — ETN enjoined IBM, NY as partner in an upgrade of its annual survey on innovation to full book form – became international best seller. "Rethinking Innovation." The IBM innovation survey on which the book is based remains the world's largest ever – 1400 lengthy interviews with CEOs in 13 countries, including China and India.

2011 — Encouraged by corporates, Federal government, PMC, CSIRO and several Universities, prepared an all new edition of "Australia's Nobel Laureates, Adventures in Innovation Volume II".

2014 — One Mandate Group

(1MG) founded as a Social Enterprise encompassing many individuals involved in previous pursuits as well as newcomers. "Innovative Ideas for Business and Social Betterment". 1MG produced a deluxe print book "Boundless Plains to Share" on Australian agribusiness and 2 annual editions of The Australian Farmer (TAF). Science, innovation and technology centric, these three publications pioneered new methodologies in digital book delivery and their measurement to wide audiences. TAF is now the largest readership publication for farmers in Australia, ongoing.

OUR PRIMARY IDENTITY HAS BEEN THAT OF PUBLISHERS AND COMMUNICATORS, WHICH HAS LEAD US INTO DIFFERENT SECTORS, THOUGH SCIENCE AND INNOVATION HAVE BEEN THE CONSTANTS. SERIOUS FORAYS INTO ENTREPRENEURSHIP ACQUAINTED US FIRST HAND WITH NEW COMPANY FORMATION, CAPITAL RAISING AND THE OFTEN DIFFICULT BUSINESS OF BUILDING COMPANIES BASED ON NEW TECHNOLOGIES AND IDEAS.



Australia's
Nobel Laureates Vol III

*State of Our Innovation Nation
2020 and Beyond*

