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## *Closing comments:* **The digital revolution in agriculture**

Dr Colin Chartres

The Crawford Fund



I don't intend to make a very long wrapping-up session; but I do want to make a couple of comments.

We try and pick a conference topic which is innovative and exciting and forward-looking and I really think this one has pretty much hit the nail on the head in that regard.

I was reflecting that about 25 years ago I was a scientist in Division of Soils in CSIRO and I advised our then Chief of Division that really we should be trying to put our data together. We had a lot of very valuable data on soils and water and other areas, and when we put that to many of the scientists they basically said to me, "Well, you can get lost. It's my data and you're not having it". We gradually fought through that battle and some very good technology came out of the group on digital soil mapping, where we did get that data and we extrapolated information from that data. So we made some small steps.

A few years later, I found myself as a Chief Science Adviser in the National Water Commission, and there we were trying to develop a national approach to water management. And one of the issues we had then was that the Federal Government and the states in Australia have responsibility for land and water issues. The states had most of the data on water in this case. Barnaby Joyce, our Deputy Prime Minister, this morning mentioned the Murray-Darling Basin which runs across four states and one territory, and so you need common data sources. And we had to work around this problem, because the states told us originally, "No, you're not having it. It's our data." But Ken Matthews, our then CEO, very cleverly got them to agree to a set of principles, and he went down the list: "Would you agree to this? Would you agree to that? Yes, that's wonderful. Then why won't you agree to data-sharing?". And they had no answer. So we gradually got more data together.

I think now today we can see the absolute value in having those data sets at national level, and at farm level, openly accessible. I think we've still got a long way to go, in some countries. In Asia for example, India: the water data on the Ganges is still considered a security issue and is held fairly tightly to the chest of the Indian Government. But again, releasing that data is going to be invaluable for the developers of these techniques and farmers if we're going to progress. I think we've seen quite a rapid change over the years and it all comes down really to a phrase that I've coined before and that many others have used: You can't manage what you can't measure.

We've heard wonderful examples today of that adage. If you want to manage something, you need to know the quantities, the amounts, the seasonalities, and

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This paper has been prepared from the transcript of the closing comments.

then we can make progress. And we've got these wonderful technologies at our fingertips. I think if we come back in ten years' time and revisit this topic we'll have advanced dramatically further, in terms of both food and natural resources and the nutrition side of food as well as the quantity.

I also have an apology to make to you. We try and have a gender balance among the presenters. This year we failed in that regard. We've had wonderful presentations from both genders, but fewer female presenters. I put it to the young scholars in the audience, many of whom are female, and say: "Look, this is a wonderfully challenging area. You've seen the potential and the opportunities. In ten years' time if we run this kind of conference again I want to see 70% female presenters rather than the few we've had here."

Finally, I want to thank all the speakers for their inspirational and exciting presentations, and the Chairs who've done a brilliant job keeping us on or ahead of time throughout, and also our sponsors (see pp. v–vi in this *Proceedings*), and our talented and hard-working conference organising team – and you, the audience, with your keen and insightful questions.

Dr Colin Chartres has had a long and successful career in the private sector, academia and government roles. Before joining the Crawford Fund in 2014 he was Director General of the International Water Management Institute (IWMI), a CGIAR Research Centre, headquartered in Colombo, Sri Lanka from 2007 to 2012. Previously, he was Chief Science Adviser to the National Water Commission, and held senior management roles in the Bureau of Rural Sciences and Geoscience Australia. He worked with CSIRO Division of Soils from 1984 to 1997 where he focused *inter alia* on soil acidity, soil structure and salinity issues and their impacts on agriculture, and during 2002–2004 in the Land and Water Division where he was involved in business development and international science linkages. Colin has a strong interest in the key nexus between science and policy, and through his work with IWMI, specialist interest in water scarcity and its impact on global food security and on science leadership and management best practice. Colin currently Chairs the Expert Review Panel for the Australian Water Partnership, is an Honorary Professor in the Crawford School of Public Policy at ANU, and is a member of the International Steering Committee of the Water for Food – Daugherty Global Institute at the University of Nebraska.



# Highlights from the Crawford Fund Annual Conference 2017

Dr David McGill, Miriam McCormack & Dr Madaline Healey

Researchers in Agriculture for International Development (RAID)

The digital revolution has dramatically impacted our daily life, with change occurring at an increasingly rapid pace in the agricultural sector. The collection, collation, analysis and application of data digitally, has transformed global agriculture through precision technology, forecast modelling and sounder decision making along the supply chain – from demand-driven plant breeding, through food processing, to the delivery of products.

This year's Crawford Fund Conference considered what impact the digital revolution could and/or would have on the developing world. Could access to better interpretation of data and information herald improvement in agricultural productivity and profitability in these countries and Australia? The simple answer is yes. However, there is still a long way to go in revolutionising agriculture technology for the smallholder farmer, and digital mechanisms alone are simply not enough. We need to take a farm, systems and global approach. However, as stated by Dr Lindiwe Majele Sibanda in her Sir John Crawford Memorial Address, to make digital mechanisms sustainable, to make them useable and ensure they have impact, we need a new narrative. We need a new narrative for hunger, to set the tone for not just producing more food from less, but producing more nutritionally sensitive food – quality over quantity. Current agricultural systems are not nutrition sensitive: for instance, we have 800 million people hungry vs 1.8 billion people obese or sick. We need to deliver nutrition-sensitive agriculture using our global data resources.

## Conference overview

The Hon. Barnaby Joyce set the tone for the conference in his opening address, saying that Australia has an incredibly honourable role to play in global food security through agriculture. During this one-day conference – which has been heralded as Australia's most significant international food security conference – this was evident.

We heard from a range of disciplines and stakeholders, sharing their knowledge, research and reason on the application of digital technology. One of the key themes of the conference was ensuring data is findable, accessible, easy to understand and, critically, allows us to make more informed farming choices. One of the challenges we face in use of global data is incomplete information, which sparked conversation around how can we obtain more robust data from growers. Born out of these discussions was the view that whilst we are all rising to the challenge of nutritional food security and digitalisation as a mechanism,

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<https://www.crawfordfund.org/news/news-keynote-listeners-report-highlights-from-the-2017-crawford-fund-annual-conference-august-2017>

there needs to be institutional change by government and policy to get us there. However, as stated by Dr Lindiwe Majele Sibanda, first and foremost, we need to attract youth and a new generation of agriculturalists, and bring in the technology that is required to ensure we can meet the demands of a food-secure and nutritionally-secure world.

### **How can big data transform small-holder farmers' lives and livelihoods?**

André Laperrière, in his morning keynote address, provided an overview on where the data revolution currently sits with particular reference to farmers in developing countries and with food and nutrition security. He asked how data can be used to forecast where agriculture is going, and could go, in terms of both feeding the world's growing population and helping farmers climb out of poverty. The answer: by packaging and delivering technology in a manner that informs and translates knowledge to farmers. Data is knowledge and empowerment. We need to make data – environmental, agricultural, climatic and demographics – findable, accessible and easy to understand, and work with smallholder farmers to make use of it to make better and more informed farming decisions. Too much of the world's data is inaccessible, poorly recorded and very messy, concluding that we need to make data open and available and ensure it is used to solve real world problems.

### **Uses and challenges of big data for agricultural development**

Speakers across the conference agreed that there is a need for guiding principles for ethical collection, ownership and use of data. However, the topic of open sources or commercialisation of data was open to debate. Steve Mathews touched on this when discussing the fact that there is no common language that industry uses to record data information. This makes it hard to understand and hard to implement on-farm in a useable format. Robust data in the right format can be developed into global solutions to provide tools for smallholders to make better decisions and more informed choices. However, currently agriculture is the least digitalised industrial sector (McKinsey Global Institute Digitisation Index) and whilst it stands to reap the most critical gains from big data, we are constrained in the large gaps in our data sets. The free market has a role to play in collating bigger and more robust data by incentivising data procurement as a tradable commodity. Steve Mathews highlighted a need to move away from a reliance on government policy and process to shape these changes and look to commercialisation. Paying for data, rather than free sharing, makes it a tradeable commodity and therefore more likely to get people to invest their data. Ask for something of value, and people should get something of value in return. A commercial model is therefore far more sustainable, in terms of producing, managing and maintaining high-quality data for profitability.

Dr Mario Herrero supported these sentiments, emphasising that it is important to understand smallholder systems and transitions in agriculture, and currently researchers are trying to fill some of the gaps, likening it to a 'black art', where the data is incomplete, old or unavailable. We need to continue to gather transdisciplinary data – economics, biodiversity, farm size and nutritional output – to compare farms across systems, globally. We are now at a point with

technology that we can use this information to create time-series data for real analysis of development impact, creating a global integrated assessment to move forward in using technology to create a more food- and nutrition-secure world. He referred to Dr Lindiwe Majele Sibanda's comments that we need a more integrated farm and global approach for food security, using nutrition as a driver for shaping supply response in agriculture. Mario shared Steve's sentiment that we need to fill this knowledge gap, but he takes a more open and collaborative approach, sharing the data, keeping it open source rather than a commodity value solution. Data is valuable, and his approach is to collaborate and share data through goodwill, with open source data a better solution.

In his case study presentation Dr Ken Street's focus was on developing rational methods for efficient data mining of our genebanks to improve plant breeding through the Focused Identification of Germplasm Strategy (FIGS). He stressed that science does not have to be complicated: it can be very simple, and we need to look for these more targeted and efficient solutions, particularly as we are limited in our resources, time and funding. Using the example of plant breeding, we need to become more effective at evaluating our enormous genetic resources to identify small subsets of germplasm that have a high probability that they will contain the plant traits we need for delivering on-ground solutions. We need to marry the simple and the super-sophisticated technologies to offer the opportunity for better crops for farmers and consumers the world over.

### **ICT adding value for smallholders**

In his overview presentation, Dr David Bergvinson, echoing the views of other speakers, proposed that we need to attract young energetic people into extension and market integration, and part of this is harnessing the benefits of ICT in communication, which is crucial in science. He indicated that agriculture touches on all 17 of the SDGs in some shape or form and that there are many dimensions to ICT for development to benefit smallholder farmers. The importance of communicating science to farmers, community and policy makers is in attracting the next wave of agriculturalists and farmers, but we must also engage with farmers, peers, community and researchers to gauge problems and take steps to develop solutions built on these narratives.

Stuart Higgins continued this narrative in his case study, saying that if you want to solve agricultural, environmental and health problems, then engage a farmer: start a dialogue, engage and communicate. He spoke about how digital innovations, such as CommCare, are taking this principle in the other direction by providing a chance to pay the farmer back, with knowledge, in real-time, potentially providing inspiration to implement change.

The second case study, presented by Dr Andrew Mude, also stressed the importance of partnerships between the commercial sector and farmers for smallholder success, with interaction and communication key to this strategy. He said they have been running a large program with one of the companies providing insurance to smallholder livestock farmers. A key part of this is having agents understanding the products. Once-off training doesn't work: field staff need on-going interaction to keep updated and continue to develop their

skills. It is about continuing this dialogue, and continuity in training, to ensure a sustainable and effective uptake of technology and solutions on the ground.

### **Transformational change based on innovation platforms**

Dr Mike Briers postulated that we need to use scientific data for impact and as evidence, and borrow from other industries and disciplines to rethink and repurpose innovation platforms. In discussing digital agriculture and robotics, he stressed that we need to make agriculture a knowledge intensive industry and bridge the divide between agriculture and technology. This is of critical importance, with agriculture lagging in terms of digitisation and the need to attract the next generation of farmers and agriculturalists. Agricultural digitalisation and innovation could be critical in filling these roles.

Professor Salah Sukkarieh followed on from this when discussing the situation:

ageing workforce + children leaving agriculture = labour shortages in many countries. He put forward the notion that building agricultural robotics can engage youth and teachers, and prepare the next generation of farmers. The robotics being developed in his laboratory represent a futuristic leap towards digitisation of agriculture and livelihoods. Robotic tractors have the potential to reduce on-farm labour and improve efficiency of input use. If a prototype can be developed at an affordable price, some smallholders may soon be working plots via a remote control.

Concluding this session, Dr Pham Thi Sen presented an example of innovative platforms delivering data-aided decision making for vegetable farmers in Vietnam. Using QR codes, consumers can trace their food back to a cooperative of farmers working to reduce their inputs to improve food safety and sustainability. The consumer is ready to pay a higher premium price for their produce, in parts of Vietnam. Diversifying the platform, in which origin of food is transparent and local, delivers another digitally aided strategy to engage with consumers and further sustain innovation of smallholder-grower market strategies.

### **How to digitalise agricultural systems in the developing world**

Robust data that is accessible and useable; agricultural systems tailored to nutrition security and communication; extension and engagement with farmers, community and industry; developing digital technologies for sustainable smallholder development: these are some of the key themes interwoven throughout the *Proceedings* of the conference, and Dr Andy Jarvis tied them all together in his afternoon keynote address. Actionable personalised information is what we need. Extension adapted to the situations and locations of these farmers is the way to go, but it is not as simple as knowing the right information. Trust is important and is part of the equation which will help build the critical relationships needed to pass on complex information and help farmers adapt to their changing systems.

Andy reiterated what many speakers had indicated, that agricultural data needs to be findable, accessible, inter-operable and useable and we need young entrepreneurs to unlock the power of 'big data' to support farmers. There is a growing need to develop appropriate technology for smallholder

systems, particularly as modern precision agriculture and robotics may not be suitable for the 70% of 500 million farms of less than one hectare. With 6 billion people owning mobile phones, this is the game-changer for data collection and information dissemination and agricultural digitisation, but data still needs a human interface to be truly useful. He said that we need to get more systematic about valuing data as a public good, and as something that will drive innovation forward in agricultural systems.

### **Final thoughts**

After the conference, it is time for us all to take stock and ask: What is needed to overcome impediments to successful use of big data for transforming agricultural systems? We need a worldwide contemporary agenda of the convergence of agriculture, health and environment, to digitalise agriculture and develop efficient and useable technologies, and we need to be working towards this together. We need a new narrative to bring agriculture, food and nutritional security into the digital landscape. As Dr Lindiwe Majele Sibanda said, we need a new narrative on nutrition-sensitive agriculture. We need to go the last mile into the households, as it is the most important place to go to understand the food systems better. We need to bring dignity back to the business of farming, attract a new generation of agriculturalists, and bring the required technologies along with them to deliver nutritional food security globally.

Dr Madaline Healey studied for a Bachelor of Agricultural Science at the University of Melbourne and a PhD in thrips ecology at Central Queensland University, before heading off to Laos as a volunteer and then mentor in the Crawford Fund's plant pathology and mentoring activities there. On returning to Australia in 2015, Madaline started working at the University of the Sunshine Coast on ACIAR projects in Laos, Cambodia, Thailand and Vietnam. Her interests are integrated pest management, biological control and all things vegetable.

Miriam McCormack is currently working as a Research Program Officer at ACIAR. In 2015 she completed a Bachelor of Agricultural Science (Honours) at University of Tasmania, Hobart. Her honours thesis focused on the knowledge transfer and technology adoption of smallholder beef farmers on the south central coast of Vietnam. Miriam is interested in farmer decision-making and motivation. This year her work is focusing on gender and agricultural extension in international research for development projects.

Dr David McGill completed a Bachelor of Agricultural Science degree at the University of Sydney and his PhD at Charles Sturt University working on quantitative genetics. Over the last eight years David has been the project manager/leader of an ACIAR project working on improving smallholder dairy production by working with local extension and research departments. In early 2016 David started working at the University of Melbourne in an international R4D role in animal production. His interests range widely, from genetics and epidemiology to impact assessment using the big data that can be captured using mobile technology. David maintains strong links and partners from time he spent in Pakistan.



## Conference delegates 2017

\*Conference scholars are marked with an asterisk

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ANU = The Australian National University.

ACIAR = Australian Centre for International Agricultural Research

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West, Vincent	Charles Sturt University
West, Elspeth	Department of Agriculture and Water Resources
Wickes PSM, Roger	The Crawford Fund
Williams, Thomas	Graham Centre for Agricultural Innovation, Charles Sturt University
Wilson, Pip	Centre for Plant Energy Biology, ANU
*Wilson, Cara	Charles Sturt University
Wilson, Peter	CSIRO
Windsor, Peter	The University of Sydney
Wong, Vanessa	Monash University
Woodhead, Alice	University of Southern Queensland
Woodman, James	Department of Agriculture & Water Resources
Wynn, Peter	Charles Sturt University
Yargop, Rohan	The University of Adelaide
Zalcman, Emma	Ausvet Pty Ltd
*Zeb, Tahseen	Tasmanian Institute of Agriculture
*Zhang, Yanchen	The University of Adelaide

# Conference media coverage 2017

In date order

## 7 AUGUST

- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – Resonate Regional News QLD from Radio release  
– coverage across 13 stations
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – Ballarat Voice FM from Radio release
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – National Rural Comm Network – multiple locations  
from Radio release
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – Hobart Hit 100.9/Triple M – from Radio release
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – AIR National News – from Radio release  
– coverage across 92 stations
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – Nth Qld Local radio from Radio release  
– coverage across 5 stations
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – Albury/Wodonga 2AY – from Radio release
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – Bendigo & Castlemaine KLFM VIC – from Radio release
- Dr Ken Street 'On the Hunt for Future Crop Solutions'  
Radio – Gippsland (Cooma) – Capital Radio– from Radio release  
– coverage across 3 stations

## 8 AUGUST

- Dr Ken Street 'High tech methods unearth ancient crop secrets'  
[http://www.theaustralian.com.au/news/health-science/  
high-tech-methods-unearth-ancientcrop-secrets/news-story/  
b6e9d15ab0ac0c55cb90e42c07c682db](http://www.theaustralian.com.au/news/health-science/high-tech-methods-unearth-ancientcrop-secrets/news-story/b6e9d15ab0ac0c55cb90e42c07c682db)  
Print/online – *The Australian*
- Dr Lindiwe Majele Sibanda  
'Drought, long-running conflict bring on brutal  
food crises in Africa'  
[http://www.abc.net.au/news/programs/the-  
world/2017-08-08/drought,-long-runningconflict-  
bring-on-brutal/8787538](http://www.abc.net.au/news/programs/the-world/2017-08-08/drought,-long-runningconflict-bring-on-brutal/8787538)  
Video, 5m36s  
TV – ABC News *The World*



**8 AUGUST** *continued*

- Dr Andy Jarvis     Radio – ABC Canberra – live
- Dr Andy Jarvis     National rural news  
<http://www.2gb.com/podcast/national-rural-news-august-8/>  
From 3m56s to 4m30s and again at 11.55  
Radio – 2GB Radio National Rural News
- Dr Ken Street     ‘Sought after seeds could be our saviour’  
<http://thewire.org.au/story/sought-seeds-saviour/>  
Radio – The Wire – National Current affairs across  
Community & Indigenous Radio
- Dr Ken Street     ‘On the Hunt for Future Crop Solutions’  
Radio – Nth Qld Rural from Radio release  
– coverage across 5 stations
- Dr Ken Street     ‘On the Hunt for Future Crop Solutions’  
Radio – Sydney 2SM (Super Radio) from Radio release  
– coverage across 38 stations
- Dr Ken Street     ‘On the Hunt for Future Crop Solutions’  
Radio – Kingaroy – Crow FM

**9 AUGUST**

- Herrero, Mathews, Ritman, Sibanda, Laperrière  
‘Data for a food secure world: Takeaways from the  
Crawford Fund annual conference’  
<https://www.devex.com/news/data-for-a-food-secure-world-takeaways-from-the-crawford-fund-annual-conference-90843>  
Print/online – Devex.com
- Dr Andy Jarvis, Dr Herrero  
‘Big data to deliver food security through  
smart device revolution’  
<http://www.farmonline.com.au/story/4843167/how-to-tap-tech-and-feed-a-hungry-world/?cs=5376>  
Print/online – *Farm Online* (Fairfax Regional)
- Dr Andy Jarvis, Dr Herrero  
‘Big data to deliver food security through  
smart device revolution’  
<http://www.stockandland.com.au/story/4843167/how-to-tap-tech-and-feed-a-hungry-world/?cs=4582>  
Print/online – *Stock & Land* (Fairfax Regional)
- Dr Andy Jarvis, Dr Herrero  
‘Big data to deliver food security through  
smart device revolution’  
<http://www.theland.com.au/story/4843167/how-to-tap-tech-and-feed-a-hungry-world/?cs=4582>  
Print/online – *The Land* (Fairfax Regional)

**9 AUGUST** *continued*

Dr Andy Jarvis, Dr Herrero

'Big data to deliver food security through smart device revolution'

<http://www.queenslandcountrylife.com.au/story/4843167/how-to-tap-tech-and-feed-a-hungry-world/?cs=4582>

Print/online – *Queensland Country Life* (Fairfax Regional)

Dr Andy Jarvis, Dr Herrero

'Big data to deliver food security through smart device revolution'

<http://www.stockjournal.com.au/story/4843167/how-to-tap-tech-and-feed-a-hungry-world/?cs=4582>

Print/online – *Stock Journal* (Fairfax Regional)

Stuart Higgins

<http://www.abc.net.au/news/rural/programs/nsw-country-hour/2017-08-10/nsw-country-hour-wednesday-9-august-2017/8792648>

13m35s – 20m30s

Radio - *NSW Country Hour* (possibly others)

**10 AUGUST**

Mario Herrero

Q&A: CSIRO on big data to support the SDGs

<https://www.devex.com/news/q-a-csiro-on-big-data-to-support-the-sdgs-90850>

Print/online - Devex.com

Stuart Higgins

'Former farmer looks to improve agriculture in developing nations using technology'

<http://www.abc.net.au/news/rural/2017-08-10/former-farmer-looks-to-help-farmers-in-developing-nations/8790044>

Radio/online - ABC Rural

Andy Jarvis

<http://2ser.com/episodes/on-the-money-700pm-10th-aug-2017/>

Approx 10 minutes into 30m segment. Interview runs for 9m30s.

Radio – “*On the money*” National Community Radio

Stuart Higgins

'New data harvesting system can help Pacific farmers says researcher'

<http://www.abc.net.au/news/programs/pacific-beat/2017-08-10/new-data-harvesting-system-can-help-pacific/8794668>

4m34s (NOTE: Expires 08/11/17)

Radio – Radio Australia *Pacific Beat*

## 11 AUGUST

Andrew Campbell Q&A: Bringing Australia's 'best kept secret' on food security into the open  
<https://www.devex.com/news/q-a-bringing-australia-s-best-kept-secret-on-food-security-into-the-open-90853>  
Print/online – Devex.com

## 12 AUGUST

All Conference 'whip around'  
<http://www.raidaustralia.net/index.php/component/k2/item/684>  
Print/online – RAID Australia



THE CRAWFORD FUND  
*For a Food Secure World*

For further information, to support us or to be kept informed of  
the Crawford Fund's work, contact:

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