

From Just-in-case To Just-in-time Competing demand for the water in the Waimakariri

Sam Beechener, MS Srinivasan, Denise Bewsell



Irrigation companies have reported record demand for water in many areas of Canterbury, New Zealand, as farmers have relied on their irrigation systems to keep crops and grass growing in the dry conditions over the summer and autumn of 2015. It was against this background that we spent a few weeks in April and May 2015 in the Waimakariri region meeting and interviewing a wide-range of stakeholders that have a shared interest in Waimakariri Irrigation Limited's (WIL) water use efficiency pilot projects. The particular focus was on a pilot project with WIL, led by a research organisation, NIWA. This project is applying a co-innovation approach that brings together stakeholders in the development of a novel information system designed to help users to make better informed decisions with respect to scheduling irrigations. This article reflects on the key themes emerging from the fieldwork and subsequent discussions that took place at the project's annual review

workshop, held in Oxford, Canterbury at the end of May 2015.

Irrigation schemes and their stakeholders, policy-makers, regulators, agencies, industry, academics, leisure-users, and interest groups are among those to have their own perspectives with respect to water use. Their views may sometimes align and sometimes conflict, but they are interacting. For example, as demonstrated in Figure 1, changes in any one of the key drivers of sustainability, efficiency or reliability may be expected to impact on the other two.

Variable, at times unreliable, water supplies are a particular feature of the Waimakariri River. At the scheme level, consent is being sought for the construction of storage ponds with a view to delivering improved levels of reliability to farmer shareholders. At farm level, irrigation systems have been adapted by farmers over time in an effort to offset the constraints of an unreliable supply. To

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an extent, these adapted systems have become the norm. They may not be ideal but they are tried and tested, and the challenges and opportunities that they bring are understood by those that use them. However, the irrigation systems and the associated operating decisions, tend to be based on a 'just-in-case' rather than 'just-in-time' basis.

In this context, just-in-case refers to the scheduling of irrigation influenced by the risk of restrictions being imposed should the river's flow drop below abstraction threshold; and just-in-time refers to decisions made in an effort to best-match current soil-moisture and forecast weather conditions with crop requirements and available water supplies. Feedback from farmers in the pilot project indicates they are very aware that water availability may make the difference between crop success and failure. In the face of unreliable water supplies and/or the absence of reliable

From Just-in-case To Just-in-time (Continued)



soil and weather information on which to inform decisions, the business argument for a just-in-case approach is a powerful driver. This comes with a greater risk of over-watering and excess run-off and/or drainage than the needs-based, just-in-time approach. While there are efficiency gains to be made in moving towards a just-in-time approach, making the transition from just-in-case towards just-in-time entails risks for producers as they move from the familiar to the unfamiliar, and committing to a just-in-time approach requires farmers and growers to place considerable trust in the data informing their decisions.

NIWA's Farm Weather Briefing is one of the technologies being piloted. It provides daily reports in an easy to read format delivered to participants' computer or smart phone. The briefing does not provide an 'irrigate/do not irrigate' instruction but presents information that assists producers, as decision-makers, to be as well-informed as possible. Information relating to observed rainfall/irrigation events, soil moisture and temperature, local drainage data and estimates of evapotranspiration, as well as NIWA's 2, 6, and 15-day weather forecasts are all provided. Where the system has

been trialled, participants' report potential for improved efficiencies through reduced water use, accompanied by reductions in energy costs and nutrient losses, as well as increased productivity through more accurate targeting and timeliness of irrigation applications. Quantifying some of these benefits, i.e. understanding the economic impact of these benefits, was a key component of the 2015/16 season's pilot activities as feedback from farmers and others involved in the project has indicated that understanding how large or small these benefits are is of interest to them. However, the co-innovation approach recognises the complexities arising from what can be competing demands among different interest groups. By building trust, identifying a shared vision and encouraging openness between these groups, a basis for making progress towards shared goals can be established.

Change is not restricted to the physical infrastructure. Under Canterbury's Land and Water Management Plan there is a growing emphasis on improved sustainability that will be achieved, in part, by better controlling nutrient run-off and leaching from farmland. Changes at this level, however, ripple-out in various ways, and not always as expected, as stakeholders understand and adjust to the new operating environment. Looking ahead, although the NIWA water use efficiency pilot began with the aim of helping users to decide when to start irrigating, the importance of understanding when to stop is emerging as increasingly important. During the course of discussions at 2015's annual review workshop, monitoring soil moisture and the movement of water through soils were recurring themes that were associated not only with the opportunity to schedule irrigation more effectively but also the ability

to demonstrate good management practice. Early work around the economic and environmental costs of water, and nutrients, lost through drainage also generated much discussion at the workshop. At a time when farmers are looking to maximise returns from all inputs, this was expected to be a key driver in encouraging more efficient use of irrigation water in future. The wider impacts, on sustainability (including environmental measures) and reliability, are not easily quantified but better understanding of these complex interactions will be important as the trial makes the transition in scale to include more farmers within the Waimakariri scheme and expands beyond the scheme into neighbouring schemes. This process of scaling-up and scaling-out, or extending and expanding the reach of the programme, will not only benefit from the experiences emerging from the pilot trial in the Waimakariri but will itself also bring fresh insights through an ongoing process of reflection and a commitment to learning.

With respect to co-innovation, it appears that the trust that has been established among the pilot project participants, with sometimes opposing viewpoints, encourages the sharing of ideas and information with respect to achieving a shared-aim, in this case of improved water use efficiency. To what extent this approach is effective as the project develops will continue to be monitored over the coming months.

Fieldwork took place at the end of March/early April, 2015. It was made possible by: the kind support of those stakeholders that took part, including trial participants and neighbouring landowners, national and regional policy-makers, advisors and scientists; and WIL, by supporting the initiative. We also acknowledge the funders of this work: the Ministry of Business, Innovation and Employment through a Biological Industries Targeted Research grant (the Primary Innovation programme CONT-30071-BITR-AGR), as well as SRUC Scotland's Rural College for PhD support.

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Interview with John James

Maryse Bourgault



Good day John and thank you for taking the time to talk to me about your experience with webinars and online technologies in general. Can you tell me how it all started? What made you want to get into webinars?

G'day Maryse! It's a pleasure to talk with you. My interest in webinars originated back in 2006 as a frustrated extension officer! I wanted to be able to better connect with people, without any of us needing to travel. As part of the NextGen extension project, we were travelling all over Queensland and we wanted a way to keep in touch with

people and engage with them after the first workshop and ask them what measures they had implemented and if it had worked for them. We also wanted participants to be able to share with each other as a bigger group.

I could see other people using web conferencing but every time I phoned our IT helpdesk they just said it wasn't available. I must have hassled them a dozen times but to no avail. I even developed a business case for them - a 10-page document with lots of detail showing how useful they could be, but even this did not go anywhere. It has

been a real struggle to get new technologies introduced inside the Department. It seems our IT people are rather risk adverse and prefer we use existing corporate software (by a well-known international company that we will not name) which tries to be all things to all people, but that didn't meet our business requirements.

How interesting! I always thought of new technologies from the perspective of the "sender" and thinking about getting people to use them, so I can communicate with them effectively, but I never considered the blockages we and our organisations might put up.

That's right and it is very frustrating! Our beef producers across the top half of Australia love the BeefConnect webinars we deliver and say they want more of them, but generally our staff have been slow to start using the webinar technology themselves. We've had over 600 producers register to attend a single webinar, and they continually provide positive feedback about how much they appreciate hearing the latest information without needing to travel from their properties. So, it's as if we are the 'laggard' in the system. That's kind of what motivated me with my recent PhD studies, looking at the factors that affect the adoption of Web 2.0 technologies.

Oh, yes. Tell me more about that, John. Why a PhD?

Well, yes, that has been an adventure as well! I am a big believer in continuing



FROM THE EDITOR

Welcome to the new edition, and our first ever online edition! As you might recall, this has been in the works for a while now, and it has been a difficult journey, a little bit like starting renovations, and realising that the wall you are tearing down to make an open space actually contain weight bearing structural beams, and you can't quite remove them without the house crumbling down on you... So this edition does not actually look like what I had in mind originally, but I like it a bit better even.

Honestly, it is still a little in a state of flux too, so feedback and comments are welcomed, as always. If you have printed the pdf copy and might like to keep receiving a paper copy, we would like to hear about it too.

We would like to have the next edition about the carbon farming initiative and climate change, so if you have experiences you would like to share or strong opinions about the role of extension in this, please let us know.

Maryse

Interview with John James (Continued)

education, and it made sense at the time to do a PhD part-time while working full-time. However, my first supervisor left the university, and then another half-dozen did likewise, so it was very difficult to find someone with the appropriate expertise. After changing institutions and finally locking in my research question, I was able to make good progress.

I'm glad! I know first-hand how hard a PhD can be emotionally! So, what was your question, and what did you find?

I looked at use of the technologies by staff in our Department, and at the factors that encouraged or discouraged the use of the Web 2.0 technologies (eSurveys, webinars, and YouTube videos). I found that overall, technologies that were easy to use, that saved time and money, and if appropriate support was provided, this would encourage adoption. On the other hand, the lack of training on how to use the technology, the lack of access to equipment, lack of departmental support and if end-users are not receptive to it, then these are factors that discourage adoption.

That's a great story. But, John, getting back to webinars, how did you succeed in getting the support needed to get them going? Obviously, you must be using webinars and teleconferencing on a regular basis now?

Well, our new Director-General called for project proposals around doing things differently, and liked the idea of using new technologies to increase engagement and reduce costs. Obviously getting staff to travel extensively is both expensive and it can be difficult for families as well.

Yes, indeed it is good to have support from the top!

Indeed. So we got the eExtension project up and running, and employed our own IT staff member and embedded them in the IT department which meant we were able to change things from the inside out.

Do you find that people that you really want to reach are scared of the technology, or are they on top of this by now?

It's a little bit of both. Some still need to be walked through the process of registering or signing in, but increasingly people are getting comfortable with this, and many people are now expecting it. For example, with the eExtension in beef, we are covering a very large geographical area, so we could not reach 600 people effectively without online technologies. But usually, it's not a problem.

Before I let you go, John, can you tell us how you came to run the Enabling Change and Innovation seminars for APEN?

The idea of these webinars came from wanting to build the capacity of the extension officers in our FutureBeef team who are spread across Queensland. So it seemed obvious to use webinars as a way to deliver the professional development content. However, we soon realised that it would be difficult to attract high calibre speakers to present to our small group of staff. I thought that similar extension folk in other organisations would be interested and around that time APEN were looking for a webinar coordinator. So I applied and soon after we delivered the first seminar, 'Predicting and improving adoption of agricultural innovations' with Rick Llewellyn as the presenter. We had 200 people register and 130 attended the event live. Since then, the recording has been viewed over 500 times, which demonstrates how effective YouTube videos can be. That's not the most popular recording though. The recording 'The seven secrets of good monitoring and evaluation' with Jess Dart has now been viewed almost 30,000 times.

Obviously, these can be very effective. So, John, in summary and based on your experience, what would you say to someone who would like to start using this technology? What do you think is the best way to use it?

Ideally I find that it is best to start with a face-to-face meeting or workshop. Then, once you have developed trust and rapport with your audience, you can invite them to continue the learning journey by using the Web. We'd show them how to register and what it looks like while we are still at the first meeting, so there are not too many surprises when they join the webinar for the first time. By taking people on this learning journey for 12 or 18 months it is far more likely they will adopt the innovations we discussed at the initial event. If we're clever, we can get the early adopters to share their experiences with the yet-to-adopters, and this then helps them hear it from people they can relate to. That's what makes me so excited about using these new technologies – it helps spread new ideas without having to spend excessive time travelling and being away from home.

John, thank you so much for your time and sharing your experience with us!



Young Extensionist Corner

Pru's Top 10 Tips for Agricultural Extension using Social Media

Prudence Cook

In this edition of the Young Extensionist Corner, Prudence Cook, former GRDC Manager Online Communities, now with the Birchip Cropping Group, shares with us her tips on social media and how we use it for agricultural extension. Here are Pru's Top 10 tips for social media and agricultural extension:

1. Know who you want to talk to and where they are

Agriculture presents a unique opportunity when using social media as our audience is finite. We already know a lot about the volume and communication preferences of the people we're trying to target so look for quality interactions – not quantity. I often get asked what platform is best – it's the one your audience is already using.

2. Get involved

It's not enough to just schedule tweets and respond to queries as they come in. Set aside time each day to monitor social media. Look for conversations happening in your industry; can you contribute and add value? Would others in your organisation be interested in these conversations? Watch what competitors and contemporaries are doing; look for areas to improve, identify new trends and features and develop benchmarks to track your own performance.

3. Add value, don't sell

Anything you post needs to add value. I always ask myself "Will our audience members find this information useful? Can they do something with it that will help them improve?" before I hit the publish button. Users will associate far more value with you and your organisation if they've received something that helps them on-farm. Direct sell jobs tend to get little traction and, in some instances, can even lead to negative responses.

4. Don't try to be everything to everyone

Often there is a high degree of confusion around what purpose social media serves – it can be a customer service channel, a broadcast channel, an information gathering tool or any combination of the three. There is no one way to use social media, but if you try to do everything, you'll end up with

segments of your audience switching off. Understand what you're aiming to get out of social media, who your target audience is and stick to key themes that are of interest to them. A consistent approach means your followers know what to expect and will derive more value from your efforts.

5. Internal buy in and involvement is a must

Having your team aware of the types of people and conversations happening on social media is critical to getting relevant content and speedy responses to questions. If your organisation is new to social media, choose a champion, develop up a campaign to promote their project and use the results as a case study to get other staff members on board. Actively encourage individual staff accounts; this gives your content a wider audience and allows quicker responses straight from the expert. Additionally, growers are far more likely to engage with an individual than they are a company logo. Ensure that staff choosing to use social media in their work have access to training and support, and are familiar with the objectives of your social media strategy.

6. Social media won't answer all your questions

I'm often approached by people asking if they can use social media to gather feedback relating to farm practices or seek industry input into project design. At best, you'll get a handful of responses, depending on the size of your network and the existing relationships you have within it. Use social media to complement other channels, but don't rely on it as a single source of truth.

7. Allocate time and budget to do social media properly

If social media is an 'add on' to your role, then when you get busy, it's the first thing to get forgotten. As part of your social media strategy, work out how much time you need to monitor, develop content, schedule and evaluate in order to meet your objectives. Depending on these objectives, this may only need an hour or so a week. You'll also need a budget, particularly if your audience is active on Facebook. Once again, as we are working with small audience sizes,

the budget doesn't need to be huge. Paid promotion will allow you to better target your posts and ensure a wider audience is able to see your content.

8. Data based decision making

We rely heavily on numbers to help with decision making in agriculture – social media is no different. Get familiar with Google Analytics; this will give you insights into who you're talking to, when they're most active online, what information they're after and what platforms and formats most appeal. Then use analytics from each of your social media accounts to further refine who your audience is, what type of information they're interested in and how they want to receive it.

9. Act your age

Stay true to your brand and don't try to be something you're not. If you're trying to convey agricultural information, don't try to be too trendy or cute. Analytics suggests that growers respond well to timely and relevant technical content. Presenting a clear value proposition is the best way to drive engagement.

10. Be prepared to let things go

Sometimes this is straight forward. With the relative ease you can publish information, it's easy to say 'this content isn't relevant, we'll avoid it in future' should a post perform poorly. It's much harder to let go when you've invested a lot of time in a campaign, or even an entire platform. I was a big fan of Google Plus; I loved the functionality, the look and the concept. Unfortunately, my target audience didn't feel the same way, so I concentrated my efforts back into the platforms they were already using.

Prudence Cook was responsible for implementing GRDC's social media strategy and managing social media operations, providing digital extension to Australian grain growers and the broader grains industry. Pru has a Bachelor of Agricultural Science from The University of Melbourne and a Graduate diploma in journalism from LaTrobe University. Pru was also a guest speaker at the APEN conference workshop where her presentations were well attended and highly appreciated.



Opinion Piece: Communicate until the “rules” say stop

Shaun Coffey

About two months ago I posted a comment on the APEN LinkedIn Group page referring to an article by Cassidy Sugimoto from Indiana University reports on disciplinary action against academics involved in “improper” use of social media. She calls for policies protecting academic speech on social media. (see “*Tenure can withstand Twitter*”: *We need policies that promote science communication and protect those who engage*. <http://blogs.lse.ac.uk/impactofsocialsciences/2016/04/11/tenure-can-withstand-twitter-thoughts-on-social-media-and-academic-freedom/>)

When Maryse asked me to write a comment for ExtensionNet on this article, my first reaction was to ask why is public communication still such a contentious issue in the research and academic worlds, Surely, I thought, most organisations now have robust guidelines on public communication, and surely these should be robust enough to extend to new channels of communication, such as social media.

Yes, I am continually surprised to see that organisations do not appear to have clear guidelines, but I’m not surprised that we continue to struggle with what is “proper” and “improper”. There is a lot of room for shades of grey. Here are some reflections, in no particular order of logic:

- In the almost 40 years that I have had the pleasure of leading communities of knowledge workers, predominantly in research and extension, I have always found it more difficult to get scientists, researchers, or experts to comment in the public arena, than it is to stop “improper” involvement. There are a number of reasons for this, but most often it has been about uneasiness of communicating in an environment where the audience is seeking absolute certainty, and the expert knows that they only can comment to the extent of known facts. There is always an element of risk that cannot be removed.
- And, for completeness of the record, I have had some situations where I have had to intervene. In circumstances where the facts being communicated are clearly incorrect, or misrepresented, the interventions have been easy. In other cases, there has been unpleasant conflict but this relates mainly to individuals communicating confidential

organisational information or issues in a manner that could be described as “airing the dirty linen in public”. In this latter case situation, there is often a case to be argued that management has failed to do its job in the first place – in my days as a CEO, I used to call this the wake-up call telling me that I needed to communicate, communicate, and then communicate some more.

- In any case, the relative handful of “misdemeanors” is far outweighed by the many, many instances in which experts are engaging in effective science communication. So, there may be an element of us beating ourselves up over the exception rather than the rule. This, also, is an area in which most experts do have a strong, professional capability to self-regulate.
- I do acknowledge that I have often had staff say to me they don’t know if they’re allowed to engage in communication, and there are reports that in some organisations, engagement in public communication activities is not encouraged. Staff may not communicate because they are fearful, or uncertain, of what the response by management will be.
- Management does have a responsibility, especially in publicly funded organisations, to provide a supportive environment that encourages public engagement in science communication. More time spent on discussing what to communicate, and how to communicate will reap dividends - and is certainly more productive than trying to delineate what cannot be done. The psychologists will tell us this has something to do with positive and negative reinforcement. To me it’s just plain common sense.
- Similarly, we have an obligation as experts to communicate responsibly. Much of the debate around public communication is anchored in the concept of academic freedom. I am happy to use the definition quoted by Sugimoto which states that scholars should “impart the results of their own and of their fellow-specialists’ investigations and reflection, both to students and to the general public, without fear or favor.”
- This definition implies some boundaries,

but particularly requires that we contain ourselves to areas in which we have expert knowledge. This, I can refer you back to my first dot point, one experience that I have often had in trying to find people to comment on science in the public arena is that individuals often overly prescribe, and restrict, their area of expertise to very narrow, very specific fields. In trying to make sense of science for the public, we often have a far greater understanding and capacity to communicate than we acknowledge ourselves.

- A model of communication that I find useful is that developed by American political scientist and communication theorist Harold Lasswell in 1948 (*Lasswell, Harold (1948). Bryson, L., ed. The Structure and Function of Communication in Society. The Communication of Ideas. New York: Institute for Religious and Social Studies. p. 37.*)
 - o Who? Says what? To whom? In which channel? With what effect?
- Any discussion about what is proper or improper inside communication could be informed by understanding a model such as Lasswell's. It is true that the rise of social media has bought new opportunities and new complexities to the issue of communication, but the social media collectively just represent additional channels, or media, through which to communicate. If any guideline about public comment is to be effective, then the critical question that needs to be discussed is "Say What?". It is not what channel you use that is contentious rather it is the message. Any attempt to restrict the use of social media fails to address the fundamental issue.
- Social media does have a different dynamic to the communication channels many of my generation grew up with, and there is an implicit need to understand how it works if our science communication is to be effective (the fifth of Lasswell's questions). So part of the responsibility we need to accept, is an obligation to understand how our communications are impacting and how they are being used, and to guard against misuse. Whilst, however, the medium is new, these issues have always existed. They remain, and will remain perhaps always, as reminders to us that communication - the creation of common meaning and understanding - is always difficult.
- I would like to depart at this point from a general discussion to talk about a particular enthusiasm of mine, and that is to reflect on some issues relating to science communication in contentious areas, such as climate change and genetic technologies.

These issues often play out in the public arena as debates over opposing positions, in contrast to a dialogue creating common understanding and meaning.

- In a recent book, James Hogan (*I'm right and you're an idiot*. New Society Publishers) talks about the toxic state of public discourse globally. He points that common experience now public arena is that public intellectuals often find themselves in situations that go beyond just been told that their arguments are wrong, that the critics go further and *accuse you of being a "wrongdoer"*. People are not always open-minded, persuaded by facts and believe that those who are presenting information to people of goodwill, and not deliberately trying to manipulate them. Against such a background it's not surprising that many experts choose not to engage publicly. But engage we must.
- Public communication of science can often be a lonely business. Critics do appear. But perhaps it is not the critic we need to fear – often it is the silence of our friends reluctant to join the what you can communicate in public discussion. (See: <http://www.crawfordfund.org/wp-content/uploads/2015/01/What-happens-when-we-remain-silent-Coffey.pdf>)
- Do we need more "rules" controlling public communication of science? Maybe. Do we need more public communication of science? Yes. A resounding yes!
- Discussions in organisation *about what and how we communicate, about how to take a proactive approach, and about what are our obligations to the public*, will be more productive than endless rounds of rulemaking.
- So, communicate, communicate, and then communicate some more - and keep going till someone says stop. Then.....

Shaun Coffey is the non-executive director of Food and Agribusiness Solutions, editor of the Journal of Agricultural Research, and adjunct professor at the University of Queensland and Victoria University of Wellington in addition to several other roles on advisory boards. Shaun is a highly effective communicator with government, business, industry and the wider community. This includes very significant experience directly in policy formulation and in the provision of high-level advice to Ministers and senior officials in Australian, New Zealand and Indonesian Governments.



APEN's position on Agricultural Innovation

APEN Management Committee

A few months ago, APEN contributed a submission to the House of Representatives Standing Committee on Agriculture and Industry on the topic of Agricultural Innovation.

This is what we had to say:

Dear Sir/Madam,

Thank you for the opportunity to provide a submission around this important subject in Australian agriculture. As the peak professional body for rural extension in Australia we feel we are well positioned to make an informed comment around Australia's agricultural innovation system and assert a number of recommendations that would assist in setting it on a more assured course in the 21st Century.

In Australia, the agricultural innovation effort involving research, development and extension, in accompaniment with associated engineering developments; and demand pull from other sectors, has since the 19th Century freed up the relative proportion of the Australian population directly engaged in agriculture. This has allowed that workforce to be used to develop other areas of the economy. RD&E can also be demonstrated to have reduced operational costs within farm enterprises and lifted overall national agricultural productivity, adding to the national terms of trade, reducing food costs, and providing many flow-on benefits in technologies and scientific advances to many developed and developing nations globally.

It is now also being appreciated in Australia that agricultural RD&E investments are critical drivers for achieving productivity gains essential for agricultural industry viability and the ongoing production of safe and affordable food both domestically and internationally. Maintaining consistent positive productivity gains is critical for Australian agriculture. We have a high cost agri-economy, and one of the only advantages where we have is historically strong productivity gains consequent of adoption of advancements in technologies and practices by farmers and graziers.

The value proposition associated with justifying the investment of funds in agricultural RD&E remains a challenge – it

is not a convenient and closed experiment. It remains a complex environment where the combined impact of research and development inputs, and the lag times in adoption of different technological or systems innovations are not always immediately understood.

The issue of lag times in the realisation of the benefit of RD&E investment is important. The dividends from agricultural RD&E are not always obvious in the short-term but have a delayed impact and an often extended legacy in an economy. Lag times can be as long as 15–35 years before the full dividend of technical or systems innovation is achieved. Conversely, the results from divestment in RD&E will have sustained negative consequences decades onwards.

This emphasises the need for ongoing effort to enhance agricultural productivity gains given future global challenges around increasing world population, increased food demand from a rising middle class in Asia, pressures on natural resources (especially access to affordable water and vital crop nutrients such as nitrogen and phosphorus); and the yet to be fully understood effects of climate change.

The impact of the combined public and private agricultural RD&E investment from 1918–2003 has been calculated at a benefit to cost ratio of 12.2:1, an internal rate of return of 16%, and sustained productivity growth of 2%. However the hollowing out of research intensity and divestment in extension services has seen the rates of return decline since the early 2000s.

It is heartening that the Australian Federal Government is now recognising the issue of reduced rates of productivity gains in certain sectors of Australian agriculture, and that productivity gains are critical if Australian rural industries are to remain competitive in often distorted global markets. Productivity gains are therefore being seen as essential for the survival and progression of rural industries and their communities, for providing affordable and safe food domestically; and as a consequence of Australia being a significant exporter of various agricultural commodities, also having an influence on the price of food in the global market place. Affordable

food in global markets translates into alleviating suffering in developing nations and promoting international stability and security.

Policy changes since the 1980s saw rural industries and the Commonwealth take a greater role in agricultural RD&E. Consequently the State Governments saw an opportunity to divest from these services and began to withdraw as traditional providers of production-orientated RD&E services to agriculture. Recent estimates indicate that public investment in agricultural RD&E in Australia has been static for around two decades, and declines in the rate of gain in agricultural productivity in certain industries are beginning to be observed as a result.

With State Government investments in sustained decline, the rural sector has seen the appearance of multiple actors in the agricultural RD&E landscape. It has led to opportunities for private enterprise with some former state departmental officers and others establishing their own advisory services, especially in more populated farming regions. However, an assumption held by policy makers that the private sector would sufficiently fill the gap left by the public sector exit across Australia's farming regions has proven to be over-optimistic, with evidence of failures in service provision of RD&E. Governments in some jurisdictions still provide production orientated expertise in RD&E, but these are largely diminished in terms of capacity across almost all industries compared to previous decades.

APEN wishes to provide a set of recommendations to the Australian Government in the agricultural innovation/ RD&E space. They all relate back to the central theme of increasing productivity gains in our rural sector through the building of capacity in our farmers, institutions, and service agents, for the benefit and prosperity of their regional communities and Australia as a whole.

Yours sincerely,

Jeanette Long
APEN President

Recommendations

1. Recommendations around reorganisation of the Australian agricultural innovation system

The case exists for discussing alternative structures for organising and delivering agricultural RD&E, and new systems to fund investment to prevent existing Australian export industries from becoming uncompetitive against other nations who are investing more heavily in agricultural innovation. Australia is not developing significant tracts of new arable lands for food production; in fact numerous valuable agricultural zones have already been subsumed by urban expansion. Therefore, increases in productivity must be made using the existing land and water resources. This requires increasing investment in agricultural RD&E.

1.1 Develop industry-owned RD&E institutions

With a retreating level of State and Territory Government investment, industry-owned RD&E institutions offer the best prospect for building and retaining long-term human capital in the agricultural research and extension sciences for industries. It is critical to move beyond the existing Research and Development Corporation (RDC) framework that simply brokers projects on a competitive basis, to develop agencies that possess research and extension staff and preserve RD&E capacity on behalf of their industries. The new institutions would understand the importance of capacity building. They would not fund at the margins but contribute to the whole RD&E effort of the industry, i.e., investing in core activities that underpin industry success. Such institutions could ensure succession of knowledge and skills over time. This is vital for ongoing industry development. Institutions can also build and better sustain social capital between themselves and their client base by having staff that are in periodic contact with them. Where there are multiple agencies involved in particular industries' RD&E efforts, rationalisation of those assets under single corporate entities for the purposes of efficiency must occur.

1.2 Further expand producer, processor and government co-investment in RD&E and agri-food industries

This will require negotiated statutory investment levies which may surpass the existing level of contributions under the current RDC scheme. If the Australian Government is attesting to the value of R&D investment, grower and processor funds should continue to be matched by the Commonwealth. An expanded role for extension must be embedded in these new agencies to ensure that new knowledge, systems and technological innovations proceed more efficiently. Processors of agricultural products have long benefited from advances of agricultural RD&E but in the case of many industries, they have contributed limited amounts to the investment and advancement of RD&E. This was argued strongly by several high-profile submissions to a national review of the RDCs in 2011; however it did not receive the support of the Commissioners. Producer, processor and government co-investment arrangements have been demonstrated in the Australian sugar industry for many decades and remain the central plank for its ongoing RD&E capacity. This position is defensible in industries where field-based factors have a significant impact on factory performance, and importantly factory throughput, which drives the processor's profitability – a clear case of mutual dependence that is often forgotten.

1.3 Avoid total deregulation of RD&E

Findings from a review of New Zealand's Crown Research Institutes in 2010 indicated that a completely deregulated RD&E competitive framework should be avoided. Formed in 1992, CRIs were effectively given a charge to become financially viable and to operate on commercial lines. According to the Crown Research Institutes Taskforce, a past policy imperative of government for the CRIs to be economically sustainable has had some negative impacts upon the nature of the science generated and affected the net benefits to client industries. It stated

that there were inconsistencies between creation of value for the organisation as opposed to the greater good for New Zealand. These commercial drivers also led to the pursuit of competitive contracts that were short-term, relative to the time frame in which science can be expected to produce results. This has had a detrimental impact of CRIs ability to operate strategically. Furthermore, the existing funding and governance arrangements for CRIs inhibited collaboration with universities and the private sector and effectively made them competitors in what should have been a collegiate function of government in enabling industrial advancement.

The CRIs have also had little in the way of extension capacity. New Zealand discharged its public sector involvement in extension in 1987, and consequently R&D generated by the organisations relies on industry service providers or private consultants to undertake many active extension works. The function of extension, or as articulated in the review 'technology transfer', also came under scrutiny. This role was seen to have been undervalued by the agricultural CRIs and was highlighted as a core responsibility with an emphasis to develop, invest in and manage intellectual property or innovation with the intent of expediting its passage into outcomes for stakeholders. On these observations a completely deregulated agricultural RD&E system is unlikely to deliver the outcomes Australia needs.

1.4 Integrate research and extension capacity within institutions

Extension services must not be considered as additions, they must be fully integrated into the process and delivery of research, and be active in providing feedback from industry stakeholders to research elements, as well as in identifying farmer innovation which can be tested through science. Extension agents should function as credible technical experts in their specific roles, and be present in the field. An absence from the field results in a decline in support for extension services. Appropriate planning, provisioning, and skilling of extension in adult education skills and process should be used to complement and not be a substitute for technical competency.

1.5 Reduce bureaucracy

Any new institutional arrangements (either quasi-government, industry-based or private), must eliminate excessive management hierarchies common to the former public sector 'Departmental' models. Less complex management structures allow for more flexibility, increased responsiveness to resolve issues, and reduced cost structures.

1.6 Create a new focus for State Government Departments of Agriculture

Should industries and Commonwealth take full responsibility for mainstream agricultural industry RD&E, State and Territory Government Departments of Agriculture will be able to be realigned to become development support agencies for new and emerging agricultural industries. Presently many State Governments are focussed on working with the larger established industries as they can more easily obtain matched Commonwealth funds through which the States and Territories can then supplement their Departments. The larger and established industries should be encouraged towards greater independence. Subsequent to these changes, State and Territory Government RD&E entities could focus on longer term strategies for increased industry diversity and greater value-adding to enhance gross state agricultural product. Because of collective public benefit outcomes, State and Territory governments must maintain ongoing commitments to biosecurity, product integrity and policy functions.

1.7 Embed a consumer focus within RD&E effort

RD&E effort should be considered in reference to its contribution not just to the producer, but how the investment translates to benefiting consumers. RD&E institutions will require systems that ensure organisational awareness of the needs and wants of consumers so as to facilitate better targeting of RD&E efforts. This will reduce the risk of divisions along

interest lines of professionals within agencies, or with industry stakeholders involved in decision making that might have separate and even selfish agendas. It is essential that a balance be maintained in effort dedicated to the various resource management, production, and value-adding streams along the value chain, else there will be a risk to industry capacity to resolve different bio-physical or market orientated eventualities.

1.8 Positive externalities outcomes must be considered

Planners and implementers of RD&E efforts must consider issues in the context of economic, environmental and social responsibilities and outcomes. Rural industries operate within communities, and their impacts and benefits cannot be evaluated in isolation of these component parts. This is where the public investment component can be further justified in terms of collective Public-good benefits.

1.9 Ensure that rural industries partner more closely with universities

The possibilities of universities partnering with industries, and functioning as learning and service hubs for agriculture should be further explored. This concept could be focussed around universities strategically positioned to service rural industries in formalised service partnerships. This could translate into situations where industries invest in university facilities in order to guarantee both RD&E services, as well as ongoing skilled technical professionals.

1.10 Ensure strategic use of private sector actors

There will be ongoing expansion and utilisation of private sector capacity where industry-owned institutions require additional expertise or geographic positioning of RD&E capacity. Private sector actors will continue to act as instruments of institutions to undertake certain research or extension functions particularly in areas where an institution's service delivery is absent.

1.11 Further develop international collaborative arrangements

Further international and agency agreements between sister industries in other nations, and increased sharing of personnel and interchange of skills and innovations will further enable potential maximisation of innovation. As an example the Australian Centre for International Agricultural Research (ACIAR) plays an import role in our national RD&E space which benefits the counterpart countries, provides a source of students to Australian universities, but also enhances international collaboration and learning by the Australian partner institutions. The insights into solving problems in developing countries often forces a rethink of how we conduct our own RD&E.

1.12 Maintain professional diversity in governance of institutions

An increased commitment to ensuring a level of professional diversity in the governance and management of industry-owned RD&E institutions is critical to avoid conflicts of interest, and any potential aversion to innovation amongst industry decision makers. The Productivity Commission in 2011 encouraged the movement of industry RDCs towards skills-based as opposed to representative selection of board members.

1.13 Focus on industry and national outcomes

Strengthening of performance monitoring and enforcement, both at the micro-level with specific projects conducted by the institutions, as well as at the macro-level over individual organisations, is essential to ensure sustained confidence in the institutions by contributors of funds.

1.14 Ensure proper oversight over the use of public funds

A reformed agricultural innovation system requires system oversight by an independent umpire (e.g., an ombudsman or commissioner). This is to oversee the collective institutions framework and ensure probity with the use of public funds. This will provide additional rigour to the Australian agricultural RD&E process. Prior to when many RDCs became corporatised,

APEN's position on Agricultural Innovation (Continued)

Government Directors were appointed to RDC boards, and a Parliamentary Secretary oversaw the different bodies and acted as a conduit between the RDCs and the Minister of Agriculture. This structural arrangement has since been abandoned by most corporatised RDCs, and has been blamed for the emergence of some contentious governance issues within them.

1.15 Local action in a global context

Agriculture now functions in a global context. There is an omnipresent risk in that sometimes the forces of globalisation can result in negative impacts on a nation's agricultural interests in terms of market power and processing. The proposal to raise and invest in national industry-owned RD&E institutions offers an assurance that future innovations in Australian agriculture are not gradually accumulated and centralised in an oligopoly of globalised agribusiness and food corporations. Externally-based stakeholders will not necessarily always have the Australian national good as their first priority. Should there be gradual centralisation of Australian agricultural innovation in the hands of trans-national corporate agribusiness, situations could emerge where, either inadvertently or deliberately, Australian trade or national food security interests could be compromised. The approach to establish industry-owned RD&E institutions with government co-investment provides an anchor for ongoing development and innovation to remain in the hands of Australian industry. It is a paradigm of capacity and resilience building as opposed to cost shifting.

2. Recommendations around information technologies hardware and infrastructure

Information technologies offer a real advantage to enhance innovation and add to productivity gains through either direct application in farming systems, or through the value they can add via allowing increased access to capacity building opportunities – especially for those more remote and regional centres where professional services are difficult to secure.

2.1 Information technologies hardware and infrastructure

Expansion of real-time telemetry for farming regions allows for remote regional access for farm machinery diagnostics, servicing and advice with repairs direct from the manufacturer e.g., John Deere or Caterpillar technical support services access from the United States.

IT infrastructure and increased telemetry band width is essential in order to support adoption of precision farming techniques which can aid and assist adoption farming practices that have both net productivity and environmental advantages e.g., precision tillage and fertiliser practices.

Adequate real-time telemetry capability is essential for modern harvesting and logistics coordination. In industries where farmers supply large centralised processing units e.g., the likes of a sugar mill, cotton gin or milk processing plant; real-time IT allows for efficient allocation of transport assets and onsite preparation for receivable of incoming produce. As the remote regions of northern Australia are further developed to large-scale agricultural regions e.g., the Ord, the southern Gulf of Carpentaria, and the Fitzroy and Pilbara regions, the IT infrastructure required to support this expansion will become increasingly essential.

Consequently, the extension of geospatial coverage of IT capacity to service regional and remote areas is becoming a significant issue in the northern development narrative. The current Telstra investment doctrine is not strategically focussed when it comes to the development of the north. Its strategy is based on meeting the service needs of the 'existing' populations (not future). This is because the principal incentive is to realise a swift return to shareholders. APEN recommends that a rethink of the Telstra business investment model to be more strategic be undertaken, especially when it comes to further developing the

agribusiness potential of rural and remote Australia.

2.2 Capacity building function

Increasing IT access and bandwidth in remote and regional Australia for interactive remote learning technologies can facilitate knowledge exchange and thereby aid capacity building that would otherwise be unavailable to farmers or rural service agents. Failures to address these issues will also act as a barrier to adoption and adaptation of either current or future best practices.

3. Expand knowledge networks through farmer-to-farmer knowledge exchange using farmer groups

One way to create knowledge networks and bolster innovation is to support farmer-to-farmer knowledge exchange via farmer groups. There is a growing trend in Australia for farmers to join formal grower groups that, along with private expert advice conduct their own on-farm research programs. In addition to the research value, it appears that a key reason for this trend is that these groups provide the 'like-minded' people that farmers identify as helping to maintain motivation, provide access to other innovative farmers, and function as an effective network for information exchange and moral support. Group extension networks are proven as effective mediums for innovation adoption and review, and provide solid social capital to farmer/grazier members. Many built their social capital as a result of the investments in the Landcare movement, an example of the long-term benefits of such investments. Extension strategies that utilise group techniques are not antiquated – they are being re-applied in many districts and sectors in rural Australia. The role of extensionists in the innovation process remains, as they can assist people to 'develop broadened perspectives and reasoned judgements' on critical issues. Farmers and graziers like to see extension agents functioning as catalysts, i.e., not just being the ones who hand out the information and prescribe the process, but rather the ones who facilitate people to obtain information and define the process.

Considerable applied RD&E has been funded through farmer groups in some industries e.g. grains, which has encouraged collaboration between farmers, departmental research and extension, CSIRO, universities, and private sector researchers, sales representatives, advisory personnel and consultants. The problems addressed by these groups then provide an indication of relevant problems requiring pure research needed to support applied research and in turn the pure research has drawn on the benefits of blue sky research. This processes also serve to shorten the adoption lag times because of the increased relevance of the research.

Not all producers are prepared to commit to group processes or may not have the farm information details that are needed to successfully apply such a process. However, those that do engage can drive regional innovation and industry development.

There is evidence that learning gaps have occurred in certain cohorts and sectors since the widespread withdrawal of public-sector extension in Australia. This is despite the presence of private extension providers. Where industry-funded interventions have been made to fill those gaps it has been found that there was a hunger for information and learning – simply because it wasn't being provided through other mechanisms. This in itself is not an argument for returning to the free, ad-hoc provision of government advisory services. It does, however, make a case for targeted industry-funded programmes to address identified information and learning gaps critical for farm viability and sustainability. There is a place for proactive knowledge management apart from (only) allowing market forces to operate.

It must be remembered that the rural industry client base in any sector is neither homogeneous nor static. There is a mix of learning styles and propensity for engagement that requires an application of different

learning methodologies and techniques. One size does not suit all. Additionally, the clients groups are not static. There is a continuous state of succession as former operators leave industries, and new ones (whether they be kin or otherwise) enter. Each of these business management units leave or enter with a set of skills and capacities. Sometimes skills are lost, other times gained. The maintenance of agricultural competitiveness can be helped by these adults having access to adult educational streams such as those provided by targeted rural extension programs as part of a complete innovation system.

4. Build knowledge networks via participatory processes

Participatory research can be a good basis for new partnerships. Participatory research refers to a process of interaction between local and external actors to co-create innovations. Participatory approaches are not new. Unfortunately, farmers' knowledge remains undervalued and the traditional bias towards academic pathways of research dissemination remain. Having effective grower liaison capacity via extension agents enables the feedback mechanisms to function and provide continual improvement in the innovation process. Systems must be re-established in Australian agriculture to reconnect the researcher discipline areas and end users in a way that provides effective service delivery, as well as meaningful feedback on programs and needs.

5. Further building on human capital in agriculture by attracting new entrants

Attracting new farmers to agriculture is another important step in building human capital. It is crucial in safeguarding the transfer of knowledge and expertise to future generations and to reinvigorate the sector with new talent, ideas and enthusiasm. This is needed because the number of young owner-operator farmers has declined since the 1970s. Since 1976, the number of farmers under the age of 35 has fallen by more than 75%. The Commonwealth Extension Services Grant of the 60s and 70s had a large role in revolutionising extension and research processes in Australia, the benefits of which are still being felt today.

6. Enhance the practice of extension

Good extension practice is critical for the adoption of emerging technologies and the efficient and effective performance of the innovation system. Two possible ways to enhance extension practice in Australia are recommended.

6.1 Training in Extension Methodologies

Extension training must introduced into the undergraduate courses in agriculture and natural resource management at Australian universities. This training should include the practical experience in extension provided by the public and private sector.

6.2 Establishment of an Innovation System Centre of Excellence

It is important that extension practice continues to evolve – this requires commitment to the funding of research into extension and the innovation system. We propose that an "Innovation Centre of Excellence" be established to undertake research activities and the ongoing training of those involved in the innovation system for agriculture. This should not be a "bricks and mortar" institution but rather a Co-operative Research Centre style collaboration of universities, government, private consultancy, agribusiness, RDCs and end-user participants with the aims of continual improvement in the innovation system operating in Australian agriculture. They will be responsible for:

- Undertaking research in extension and the innovation system through post-graduate studies
- Providing evidence based advice for future policy direction in agricultural and natural resource management extension
- Foster the continuous improvement in extension practice amongst practitioners in the agricultural innovation system

ENET

New APEN members

If you've recently joined APEN, welcome! You'll reap plenty of professional and personal rewards. If you've been in APEN for a few seasons now, be sure to say hello to the new members.



Andres Jaramillo

Andres is now the Adoption Officer – Irrigation for Sugar Research Australia, based in the Burdekin. He has a Bachelor in Agricultural Engineer, a MS in Irrigation Engineering from Utah State University and one in Water Management from Colorado State University. He has worked in capacity building projects in North, Central and South America and in Australia and Pakistan with the International Irrigation Center, Colorado State University and the International Water Center. Combined with his experience in extension and facilitation, he has also worked as Irrigation and Environmental Engineer and Geohydrologist in the USA and New Zealand. He travels frequently to Brisbane where his family lives. He looks forward to becoming an active member of the APEN community and to liaising with other extension professionals.

Welcome to these new members who have joined since last edition. We're glad to have you all on board.

| | |
|--------------------------|---------------------|
| Sarah Brookes | <i>Qld</i> |
| Nina Hooper | <i>NSW</i> |
| Paterno Rebuelta | <i>Philippines</i> |
| Ayodeji Araba | <i>Nigeria</i> |
| Ernesto Babuglia | <i>Uruguay</i> |
| Craig Findsen | <i>Qld</i> |
| Joanna Jones | <i>Tas</i> |
| Kylie Brewer | <i>NZ</i> |
| Hayley Eames | <i>Qld</i> |
| Penny Hooper | <i>Tas</i> |
| Leah Garnett | <i>NSW</i> |
| Ruth Underwood | <i>New Zealand</i> |
| Emma Egan | <i>Tas</i> |
| Mirza Baig | <i>Saudi Arabia</i> |
| Heather Beever | <i>Vic</i> |
| Gavin Beever | <i>Vic</i> |
| Hamish Dickson | <i>SA</i> |
| Erica Schelfhorst | <i>Vic</i> |
| Luke Gaynor | <i>NSW</i> |
| Rachel Gordon | <i>NSW</i> |
| Andres Jaramillo | <i>Qld</i> |
| Shaun Coffey | <i>Qld</i> |
| Rachele Osmond | <i>Qld</i> |



Dr Mahesh Chander, PhD

Dr Mahesh Chander, PhD (Extension Education) is Principal Scientist with Indian Council of Agricultural Research (ICAR), holding the position of Head, Division of Extension Education at Indian Veterinary Research Institute, Izatnagar, India. He has been actively associated with research, teaching, training and field extension services for agricultural development since 1991. He has guided over 28 Master's & PhD students in Agricultural Extension Education and published over 100 research papers, book chapters, booksets on agricultural & rural development issues. The students guided by him are holding important positions in several organizations. For his contributions in teaching, he was awarded by the ICAR with Bharat Ratna Dr C Subramaniam Award for Outstanding Teachers in 2010. Also, he received Young Scientist award from Indian Society of Extension Education in 2005. He has been associated with Global Forum for Rural Advisory Services (GFRAS) and Agricultural Extension in South Asia (AESAs), through organizing events, writing blogs, meeting notes etc. on agricultural extension issues. He is also a focal point in India for AESA. At International level, he has been associated with IFOAM and Sustainable Agriculture Network of Rainforest Alliance, USA as member of the International Standards Committee, as also an elected member of International Society of Organic Agriculture Research (ISO FAR).



Dr Paterno I. Rebuelta

A registered agriculturist, researcher-extensionist and a farmer, Dr. Paterno I. Rebuelta is a graduate of PhD in Agriculture major in Farming System from Cavite State University in 2013. He finished his MS in Soil Science with minor on Extension Education from University of the Philippines at Los Baños in 1988. He graduated his Bachelor of Science in Agriculture (Cum Laude) from Aklan Agricultural College in 1979. Dr. Rebuelta started his employment at Bureau of Plant Industry in 1979, and then with the Bureau of Soils as a Soil Technologist 1980. In March 1993, he transferred to the Philippine Rice Research Institute with a position of Sr. Science Research Specialist where he conducted investigations on rice crop and soil management, and lead in implementing the Rice Specialists' Training Course. In 2001, Dr. Rebuelta joined the Aklan State University where he taught subjects on Soil Science, Farming Systems, and Agricultural Extension. He conducted various experiments and extension projects, and engaged in consultancy services. At present, Dr. Rebuelta holds the academic rank of Associate Professor, and was recently (29 June 2016) designated as the Dean of the College of Agriculture, Forestry and Environmental Sciences.



Tony Butler

Based in Launceston, Tasmania, Tony is the Project Officer for the Tasmanian Institute of Agriculture (TIA) Herbage Development Program (HDP). This involves working closely with the Tasmanian pasture seed and extensive grazing industries in a development and extension role. Projects range from assisting to identifying industry growth restrictions, generating education material, coordinating scientific projects and industry promotion.

Tony has been involved with the Tasmanian agricultural industry for over five years having moved from Christchurch, New Zealand. There, he was involved with postgraduate research focused on irrigation management with pasture based systems within Canterbury as well as within the dairy industry. Prior to working with the HDP, previous experiences include working in the agricultural sector in the UK as well as the private agricultural research industry within Tasmania.

He has a strong interest in pasture, pasture seed production and grazing technology. Having been aware of APEN and its value for the last 1.8 months, Tony joined earlier this year and has taken on the Cluster Coordinator role for Tasmania.



Sally Dickinson

Sally Dickinson is the Cotton Info Regional Development Officer for the Goondiwindi, St George and Dirranbandi cotton growing regions in Queensland. Since the mid-1990s Sally has been facilitating community, grower, industry and government groups to achieve beneficial change for individuals, communities, industry and organisations at both the individual on-farm, regional and strategic industry levels. Most of this work was in Victoria however more recently Sally has been working in the Cotton Industry in Northern New South Wales and Southern Queensland. Sally enjoys the enthusiasm and the innovation of the cotton industry and has been working with the industry and its growers for 5 years. Her passion and commitment to the industry is firmly cemented. Sally has a particular interest in supporting farmers to be profitable and sustainable and through her involvement in Wincott (Women In Cotton Industry Network) and current role as chair of this group works to support rural women in agriculture and to support the recognition of the role that rural women play and the contribution that they make to their community. Outside of work Sally enjoys the uniquely Australian horse sport of campdrafting.



Rachel Gordon

I am the Regional Officer for NSW with the Livestock Biosecurity Network (LBN). My position is based near Orange, in the Central Tablelands of NSW. I frequently collaborate with NSW DPI and Local Land Services to speak with producers about on-farm biosecurity, what it is, why it is important, and what they can do to reduce the impact of unwanted diseases, pests, and weeds. I come from a wool-producing background, growing up in the south-west Riverina. The agricultural and livestock industries have always been an interest to me, leading me to study a Bachelor of Applied Science (Agriculture), and then a Master of Veterinary Public Health Management. I enjoy working with producers, and looking for practical solutions to enhance their on-farm biosecurity.

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Guidelines and Deadlines

Submissions should be made in MS Word 6.0 with minimal formatting. A portrait photograph of the author is required. All photographs, figures and/or tables ought to be provided as separate files (preferably TIF or JPEG; photos scanned at 300 dpi). Feature articles should be around 1000 words and minor articles 500 words. The editor reserves the right to edit submitted material to meet space restrictions. Letters to the editor or general items of news of interest to the network are welcome. Articles should be submitted at least four weeks prior to publication.

Preference is given to articles that are grounded in some form of project or event.

Editing: Maryse Bourgault

Layout: Ross Tasker, Snap Albury Wodonga, Victoria.

Production management: Rosemary Currie, APEN Secretariat, Wodonga, Victoria.

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Stories and photos (next edition) due to Editor 15th August 2016