Q&A: Transformational change based on innovation platforms

Chair: Jane Haycock

Director, innovationXchange, Department of Foreign Affairs & Trade

Q: Caspar Roxburgh, *The University of Queensland*

Salah, I was blown away. I'm curious, how much do those two wheel robotic units that can pack into the back of a car, how much does that actually cost at the moment?

A: Salah Sukkarieh

Parts-wise they are about $6000–$10,000. Obviously that doesn't include the labour but that's what they cost at the moment. Looking ahead to using the scooters etc., you can bring them down to about $2000 or $2500, which is the objective.

Q: Bob Furbank, *The Australian National University and CSIRO*

A question for Salah. I'm a big fan of your robotics work. What kind of decision support tool are you going to convert the smartphone information into? Because there's not going to be much processing capacity to give a 3D reconstruction or a volumetric estimate, so is the output just going to tell the farmer when to harvest? Or are you going to analyse colour to tell him there's enough nitrogen nutrition? What are your plans for analysing the data?

A: Salah Sukkarieh

It's a good question, and the answer comes down to who the end user is. For a lot of the commercial applications, the bigger robots have enough computational power on board to be able to compute things in real time. And so, operationally, you collect the data and you can sit the bot on the site for the night and it processes that data; and then it knows the map and so forth, and it goes out and just does the task. With the smaller robots, yes, you have less computational power, but it's quite easy, from the software perspective, to be able to move the data to a desktop. So in Indonesia, one aspect we looked at was how you would translate data across to a desktop. We know what we would need to do but we haven't gone down that path because we're trying to understand the social implications, or what happens if you were to remove some of that decision-making process, or not remove it, etc. I don't want to explore that aspect of the work too quickly until other aspects are understood a little bit more. But from a technology perspective we'd either do it on the bot or do it on a desktop computer.

Q:

Another question for Salah. It was a really fascinating presentation. I'm interested in this kind of nexus between robotics and labour, and I was wondering if I could get you to talk a little bit more about how you see

This report of the Q&A has been prepared from a transcript.

something like the Digital Farmhand, or robotics generally, transforming labour in horticulture, because it is obviously a very labour-intensive industry – or traditionally has been. I'm thinking both about the labour experience of farmers that you're working with, and also of others who are involved in providing labour at different parts of the horticultural production process.

A: Salah Sukkarieh

I've been working in robotics for 25 years in different industries and I think the first time I ever received hate mail was when we started to do some stuff in agriculture. I think there's a 'disconnect' about where food comes from and from whom, and most of that hate mail comes from the public who seem to think you're putting all the farmers out of work. It was interesting because in Indonesia I got the same comments as I had in Australia: that farmers are getting older, the kids have gone off into the city and don't want to come back; it's very hard to get labour or they probably can't afford to get the labour that they're really needing at that particular point because they're competing against the mining industry and other infrastructure industries that are paying a lot more as well. So that is one aspect: that I have yet to see where we're losing labour because of robotics when it comes to on-farm activities. It's more about helping the farmer.

On the other hand, I am concerned about losing knowledge about farming, because you're digitising that process. That is why, from a policy perspective, there's a bigger social licence issue around that.

The most intense work in the horticulture industry is weeding and harvesting. We are not proposing to do anything about harvesting because they use big machines already for that. But with weeding, the intention from a robotics viewpoint could be to completely remove the need for herbicide. That really was the focus: to do that you are going back to hoeing, but you are doing it with an automated system instead of a person. But then there are big questions around that as well in different ways, and it's capitalism, not robotics, that drives that process. If farmers want to get more efficient, more productive, then what do they do? They look around at different aspects to try, and automation is one of the possibilities.

In northern Queensland, we heard a lot more about the potential impact on contract workers, and that's a significant point. When you speak to farmers they say things like: "Well you bring 'em in one day but then they disappear the next day because the guy next door is giving more money or whatever it may be". So labour availability is an issue there. It's a big question, and outside my area, but I know there are lots of those issues ahead.

Q: Alyssa Weirman, *Australian Plant Phenomics Facility at ANU*

My question also is for Salah. What kind of functional changes can you make to your machine? I'm thinking about plant researchers here. I can see that your design is centred on lettuce at the moment, but is there the capacity to raise the height of the instrument so that you can go across wheat? Is there any kind of functional capacity to change the heights of the instruments?

A: Salah Sukkarieh

Yes, one of the robots that you saw, which we call RIPPA (which stands for Robot for Intelligent Perception Precision Application), came out of a previous robot that we called Lady Bird. Lady Bird is more of a phenotyping bot which has adjustable heights, adjustable widths and so forth, and its sensors have much higher precision. It was more of a science platform, while RIPPA became more of an operational platform. Of interest here is that we built the system so that it is all modular: the wheels have their own drive trains; the sensors are plug-and-play. The idea is that you come along, see that the row is 3.5 m wide or whatever, redesign the frame to suit, and send it off to work. Everything is just modular and adapted from there.

Q: Peter Wynn, *Charles Sturt University*

Pham, I have a question to you about your vegetable systems in Vietnam. Do you integrate animal production into your smallholder vegetable production systems, and if you do, how do you recycle nutrients to ensure that the ecosystem is sustained?

A: Pham Thi Sen

Actually, in our project we have not integrated animal production into our vegetable systems. But naturally and traditionally our farmers do raise animals along with production of vegetables. The problem is that we want our farmers to produce high quality vegetables, meeting safety requirements, and so we have to support them in treating the solid waste and water from animal production. We are working on that, and we are supporting them to build some kind of system for treatment of water and waste from animal production. When the groups meet all the requirements, they will be able to get certification for safe vegetable production and then they will be able to use the logo as I mentioned, to stamp on their vegetables.

Q: Tim Reeves, *The Crawford Fund*

My question is for Mike. In one of your slides you showed a linear progression from the producer through to the consumer when you were talking about the importance of the customer. But no feedback loop. It seems to me a MAD (mobile acquired data) function would be to collect data in much the same way as TripAdvisor does for travel, getting immediate feedback. It is more difficult of course with a diverse range of producers, but have you been thinking about that aspect of customer feedback?

A: Mike Briers

Yes. I'll apologise: that slide is meant more for illustrative purposes, to illustrate the various players in the market, rather than as any linear sort of pattern. But clearly when we talk about digital disruption and intermediation and so on, we are seeing that already. We are working with some interesting players: one example is HiveXchange, on projects in rural communities, where the aim is to reduce food miles. In the north of New South Wales for example, there's a situation where primary producers are sending their produce down to Sydney for sale, and then that food goes back to markets and restaurants in the northern region. New types of platforms are emerging in a number of different

spaces, in the beef industry, in the fresh food and vegetable industry now, that enable these sorts of markets to operate. Effectively they are cutting out the middle man or woman. We are seeing all sorts of very interesting models of aggregating, where we're aggregating demand just in the mediation going on and we want to support that. Also I think there is really interesting tension between trying to produce more and focus on yield, and the conversation now about Australia being the delicatessen of Asia rather than its food bowl. How do we promote and build systems that support the types of decisions that primary producers and others make, in terms of value-adding to their product?

Q: Petra Tschakert, *The University of Western Australia*

My question is for Pham. Thank you for your presentation and thank you for showing us women in agriculture. In your experience has the introduction of data in the sale of vegetables increased or decreased gender equality in Vietnam among the smallholders?

A: Pham Thi Sen

Actually in Vietnam, we have an assumption that there is gender inequality. But so far, in our project area, we have not done any research on that and I cannot say if there is real inequality or not. However, we also intend to analyse the impact of our project on gender. Obviously now, with our support, farmers involved in the supply chain of vegetables from Moc Chau to Ha Noi earn much higher benefit. It can be 50–150% higher than when they grow other crops such as rice or maize. We would like to know, when they earn better income, does that income benefit both men or women, or does it only go to the men or only to the women? And are we creating a bigger workload for the men or for the women? Traditionally in Vietnam, women are more in charge of vegetable production, and thus we would like to see how our project affects the balance of use of labour between men and women. But I cannot say yet if there is inequality or not, nor how we will increase or reduce inequality.

Q: John Radcliffe, *The Crawford Fund South Australia*

I have a question for Dr Sen. You have demonstrated your QR codes, which provide a detailed listing of the input components of the production system for your safe vegetables at Moc Chau. But do you have an independent testing or evaluation or monitoring service that checks the credibility of that data, and do you also check the bacteriological status of the safe vegetables, particularly if they may have been grown with, say, untreated wastewater?

A: Pham Thi Sen

Yes, before we got the Certification trademark for safe vegetables from Moc Chau we had to do all the tests you mention, for chemical and for biological contamination residues in the vegetables. We also had to test for contamination in water and land areas where the vegetables are produced. But you know, because nobody can do the test for all kinds of vegetables, we have to rely on the control system for controlling the quality of agriculture, forestry and aquaculture products. We work together with them, and they come frequently or at random, to take vegetable samples to do the tests. Also, in Vietnam now there is much increased attention to food safety, and some consumers and

retailers have their own ways of testing produce. Some of them have their own way to test the quality of vegetables, and if they see any problem with chemical residues or microbial contaminants, they report back to us. Then we trace back to see from which household those vegetables came. Then we try to see where and why the contamination or the residue came about, and we solve the problem. And if the farmer doesn't want to change, to improve, then she or he can no longer belong to the group and be involved in the chain. Also, the farmer groups have their own system of internal control.

Q: Ernest Bethe, *International Finance Corporation*

I have two short questions, for Dr Sen and Professor Sukkarieh. Dr Sen, I work in countries – and I think you may be in a country like this – where there's quite a lot of fraud, food fraud, things like that. Have you begun to see anybody manipulating the QR codes? I mean are you finding that fake QR codes are going on products that are being sold to consumers? And if so, what are you doing about that?

And Professor Sukkarieh, we work with companies, large companies, that are quite concerned about the availability of agricultural labour. There are two aspects to that: one aspect is the robotics that you're talking about, and I take your point that it's not displacing any labour. The other aspect, really interesting to me, is the training that you're giving in the schools, and getting people in secondary schools more professional. That is of interest to a lot of the companies we work with – professionalising agricultural labour in a lot of these markets. Have you taken that model to developing countries? You've worked in Indonesia I know on the first part of it, the robotics, but are you also bringing the training within the schools into Indonesia, and will you take it into the Pacific, like you've done here in Australia?

A: Pham Thi Sen

We've just started to use the QR codes very recently. In Vietnam, QR codes were introduced in the end of 2016 and our farmers are among the first ones to test them. They got support from our project and they also got support from a local program for quality vegetable production of Son La province to use QR codes for their vegetables. Son La Province has a program to develop Moc Chau as a high quality vegetable production area, and our project is only working as a facilitator, supporting them to implement their own programs.

A: Salah Sukkarieh

There are a couple of things here. Industries around agriculture are going through digitisation phases. Agriculture can't afford to have people to come across from fintech, and that's really what the issue is. So from the rural schools' perspective, one reason why we're doing that in schools is that we are trying to encourage some of those children to say: "I want to stay in food production, because I find this really enjoyable with the digitisation process in there". The second reason is to introduce digital technologies into the schools and have them learn how to code, because that can affect what happens to the surrounding communities, around the farms. There will be jobs lost – we've seen that in all other industries – and although jobs get created, there are never as many as the jobs that are lost. We're trying to look at the longer-term picture.

Yes, as part of the training program, we are thinking about and have already tried to engage with NGOs in the Pacific Islands. We know that we have to introduce the training program that we've tried to develop in Australia, into that region as well. Does it go into high schools or does it go into colleges? We're not too sure yet. There are obviously going to be language issues, and fundamental education issues as well that we have to work with, and so that becomes important. The question again is – and it's the same issue as with agriculture in general – do you develop technology that helps teach, or do you try and pull the curriculum around the technology itself? The technology's growing rapidly. If you look at how any of your kids or grandkids are learning maths and so forth online now, they are not just having information thrown at them. It's about learning from your mistakes, and then having questions thrown back at you that help you improve. Is that the right mechanism? These are things that we're still looking at.

Q: *University of New England*

I have a question for Dr Sen. Food safety is a hot topic in Vietnam at the moment, and I'm very happy to know that, as I have a project to support the development of safe vegetable products in Vietnam. Can you say more about the consumer demand for safe vegetable products in Vietnam at the moment, and how much difference there is between the prices of safe and normal vegetables? What do they cost?

A: Pham Thi Sen

Actually the consumers in Ha Noi are really concerned about the safety and quality of food, not just vegetables but also other foods such as meat – beef, pork, chicken and others. And they are now ready to pay a higher price for high quality products. How much higher, depends on the products and the seasons. You see in Moc Chau we have a very cold climate in the winter, and even in the summer it is very mild, so they can produce off-season temperate vegetables. In the off-season the price is much higher, but in the in-season the price is lower because other areas near Ha Noi can also produce temperate vegetables. Also, how much higher depends on the technology you use for vegetable production. The QR codes also specify which technology is used for cultivation, harvesting, packing and transportation. The technology can be VietGAP, or safe, or organic, or whatever. So, depending on the process farmers use to produce and supply the products, the price can be a bit higher, or very much higher. But the consumers really are ready to pay higher prices for quality products.

Q: Isaac Jones, *Western Sydney University*

Pham, with the amount of information that the consumer can get from the QR codes, right down to the name of the person who was transporting those goods, could that potentially put anyone in danger or is that an invasion of privacy do you think? And how could we make sure that people are safe?

A: Pham Thai Sen

So far we have not seen any danger. We keep all records from planting to harvesting to packaging and transportation to the retailers. We are the public owner of this information and at the moment we don't see any danger. I hope there is none.

Q: David Giles, *Deakin University*

This question is about the role of 'big data' in creating or mitigating externalities and waste. It's probably mainly for Mike but perhaps for all of you. We've talked a lot today about value capture and value added. But Mike said that we can measure and record and archive more information than ever before. I'm wondering if there might be added costs involved in that, or if we're factoring in new value? Are there ways we might be factoring in new costs as well? How does it change the value or the cost of the final product? Because after all a banana is a banana is a banana, I think, but maybe 'big data' changes that? I don't know.

A: Mike Briers

Typically what we're seeing is that some of our partners, like Bosch for example, are in pretty much everything. They've got a device in every single car on the planet, and they've strategically globally said that they're going to make everything connectable to the Internet in the future. This indicates an explosion of measurement devices at one end. But at the other end of that, like so many things in tech space, the costs are reducing. And it turns out that the costs of the devices are going down, and that's really the trend: to push the cost of the actual measurement device down. The connectivity doesn't really change, because we've got different protocols now. And a lot of the data in the compute is at the edge, in the sense that it's not in the cloud which can be expensive. So I can only see that costs are going down, rapidly, and all I can see is a world full of sensors measuring attributes of the environment that we've never been able to measure before. In fact, for the decisions that matter, like disease prediction, we can actually get down to measuring exactly the attributes that we need to measure in order to predict something. And I think the value of that and having a reliable decision-support system that accurately predicts a disease outbreak on this side of the hill, that's hugely valuable.

A: Salah Sukkarieh

I have a problem with the term 'big data'. Agriculture doesn't have 'big data' compared to other industries; not yet, anyway. It may, but it doesn't have it yet. So I think we should not get side-tracked by that term. I think there's a lot of hype out there and if this was an industry conference we could talk about it as much as you want, because I know there are a lot of scientists here. What I will say is that the way machine learning and 'big data' are used, you don't worry about the hypothesis or science question up front. Instead, you see what the data tells you and then you try and evaluate something. And from my experience, what you really ought to do is to bring the two together. You still need the biophysical knowledge and then to use the data to try and capture that. So don't let go of all those methods. Otherwise, it can be garbage in, garbage out. That's what you've got to be careful about.

Chair

Thank you to all speakers in this session.