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## SESSION 3: ICT ADDING VALUE FOR SMALLHOLDERS

### *Overview: Unlocking the power of digital agriculture*

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#### Abstract



Digital agriculture encompasses a value chain framework that supports smallholder farmers' access to services, knowledge and markets. This helps to unlock the economic potential of agriculture, preserve natural resources and accelerate equitable economic growth in rural communities. Digital agriculture is already the nerve centre for modern food systems. It enables democratisation of information

and distillation of big data analytics to provide timely and targeted insight for farmers, input suppliers, aggregators, processors and consumers. These insights are now delivered to the location of a decision (e.g. a farmer's field on a smart phone) on how to optimise profitability, increase value chain efficiency and support consumer awareness on food and its impact on their nutrition, the rural economy and the environmental footprint of agriculture. Digital tools have the potential to compress value chains and reduce transaction costs, thus moving more value to the farmers' end for improving incomes and livelihoods. Through 'big data' and systems biology, the nutritional quality of crops can be improved by gaining a deeper understanding of the interaction of food, nutrition and human health. Spatial Data Infrastructure combined with unique digital identification can support an ecosystem of integrated services to better serve the needs of farmers – whether it be access to inputs, credit, insurance or markets. Downscaled observed weather data are critically important to support all actors along the value chain, given that agriculture is a solar- and water-driven industry. Maintaining the trust of farmers and consumers is vitally important, so policies to manage personal identification information are essential. However, data also needs to be granular to support precision agriculture practices. An ecosystem of different tools and platforms supported by pragmatic and visionary policies and institutions will position countries to uniquely unlock the power of digital technology to accelerate agricultural development and ultimately enable us to deliver on the Sustainable Development Goals – one country at a time.

What a privilege it is to be here and especially speaking on this topic of how to leverage 'information & communications technology', ICT, to support smallholder farmers. In essence, what we are talking about is how to make agriculture economically remunerative for smallholder farmers, and help them manage both market and production risks; to help them not only to realise

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This paper has been prepared from a transcript and the Powerpoint slides of the presentation.

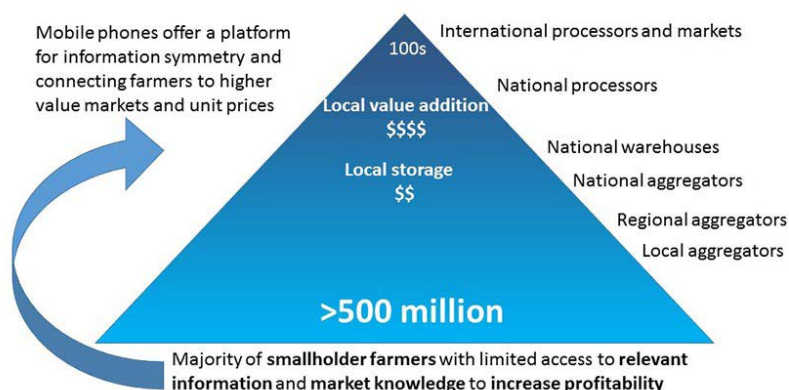


Figure 1. The pyramid of economic opportunity.

their full economic potential (Figure 1) but also to serve society through better nutrition – which is emerging as a theme from this conference. For the world’s 500 million smallholder farmers, the challenge is information asymmetry, and our conversation here today is about how to leverage ‘big data’ and technology to address that constraint.

In fact, mobile phones have the power to bridge inefficient value chains that smallholder farmers are exposed to. How can we apply ICT to create opportunities for value-adding, for better market integration for smallholder farmers and, ultimately, to reduce the post-harvest losses that some farm sectors are experiencing? ICT can help improve the efficiency of value chains and create consumer awareness around post-harvest losses.

Digital agriculture can harvest this ‘ecosystem’ of new technologies that we have available, which includes:

- spatial data infrastructure;
- cloud computing;
- mobile phones;
- the ‘internet of things’ and sensor technology, which are evolving very rapidly, with graphene making that technology very compact and affordable;
- unmanned aerial vehicles (UAVs) or drones that are changing how we collect data (and I saw at CSIRO yesterday some of the fantastic advances that Australia has been making in this domain);
- image processing, as mentioned in all the previous talks this morning;
- advanced analytics and machine learning, as well as the analytical power we require and, importantly, the insights that we can gain through integrating maps or geospatial tools;
- unique identifiers – a very important issue – especially as they relate to the farmers that we are serving; these affect both our ability to deliver timely, tailored and targeted information and services, and also our responsibility around data governance and making sure that we do not betray the trust

of farmers in using that data; it is a challenge for the whole community to accept, to agree on guiding principles that make sure we use that data responsibly to serve society; and

- massive online open courses (MOOCs), with which potentially we could bring cutting-edge knowledge to millions of farmers, and create awareness around products and services to enable them to realise their full economic potential.

ICT will be the major conduit for delivering timely, targeted and tailored products, services and knowledge to increase rural incomes, improve nutrition, reduce risk and support sustainable agri-food systems.

ICT also has a role in the reconnaissance we need so as to understand the priorities of farmers, their needs, aspirations and how our science can serve them in order to develop sustainable agri-food systems for all of us.

Our challenge is to adapt these technologies for the developing world.

### Competition

Another point I would like to highlight is that agriculture, or food production, is in competition with other sectors. Farmers need to think through this to create economic opportunity and also sustainability.

Consider Figure 2, linking the Sustainable Development Goals 2 (Zero hunger), 6 (Clean water and sanitation) and 7 (Affordable and clean energy). As we know, 70% of fresh water is used for food production across the world. In some countries it is far more than that, such as in India. Agriculture is going to be in competition with industry and urbanisation for those water resources. Think about energy: how is water used to produce energy, especially when we get into the bio-economy and second generation biofuels. All these variables need to be considered, and from the perspective of farmers who must look through the lens of economic opportunity and risk management, if the world is to achieve SDG 1, 'No poverty'.

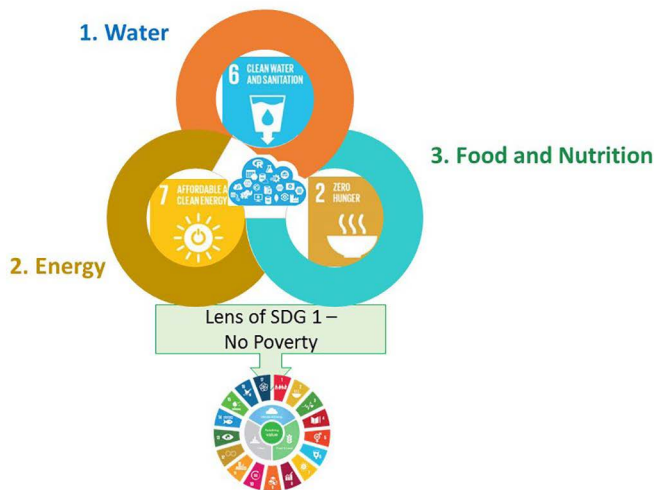


Figure 2. ICT to help manage the nexus of water–energy–food.

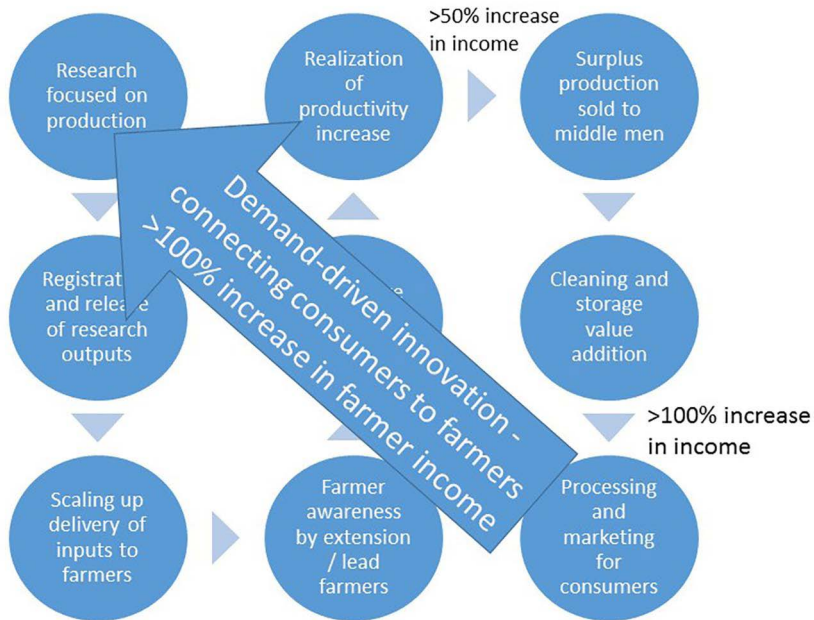


Figure 3. Compressing long and slow impact pathways.

### How ICT can help farmers

Currently we have very long and slow impact pathways as we translate science into impacts (Figure 3). That chain can be anywhere from 15 years to 40 years in some developing countries. This chain in agricultural research has largely focused on increasing productivity, but increasingly we realise that it goes beyond that – as we heard in the Sir John Crawford Memorial Address last evening. We have to think about nutritional security, and that means thinking about processing and marketing, and creating awareness amongst consumers about better nutrition. It is there that a lot of the value has not been captured by smallholder farmers: in that processing-to-consumer segment of the value chain.

Demand-driven innovation can be enabled by ICT to help farmers understand where the market is going and how they can position themselves to capture the opportunities. There are opportunities not just in the production of food but also in early-stage processing that allows farmers to increase their unit price and allows that food to be more accessible and convenient for their own consumption, especially when it comes to nutritious crops.

To make all this happen, though, we have to connect the ‘dots’ (Figure 4).

Today’s first presentation was on GODAN, the Global Open Data for Agriculture and Nutrition. That Spatial Data Infrastructure sits at the centre of Figure 4. How do we unlock the power of data to serve society? Agricultural innovation is going to draw heavily on this infrastructure especially as we go beyond the public-private partnership model (Figure 4) to include producers and the whole value chain.

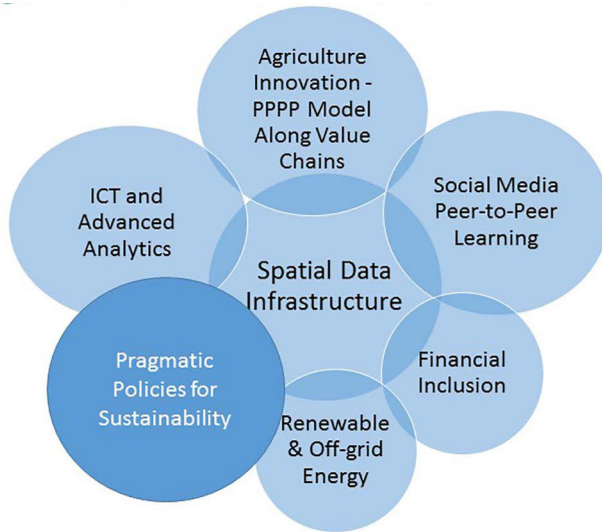


Figure 4. Intersecting domains for inclusive development.

Social media (Figure 4) is going to be critically important as we create awareness, among consumers, policy makers and other value chain actors, about the environmental impact of agriculture as a key driver to addressing climate change. Agriculture must not only adapt to climate change but also help mitigate it, through carbon capture and other interventions.

Financial inclusion (Figure 4) is not just about agriculture but also about how we stitch together research and financial instruments, and link the medical field with nutrition.

I mentioned solar energy already, for its use in pumping water and because farmers are selling energy back into the grid. For example, in India, electricity from solar panels is being fed back into the grid, and farmers are also making strategic choices around water use based on an economic model. ICT enables all this.

Also in Figure 4, high-end advanced analytics, cloud-based, allow us to consume all this 'big data' and deliver very simple accessible solutions to smallholder farmers ... but of course that requires pragmatic policies.

What policies need to be put in place to make this a reality? When we talk about 'big data', how do we ensure we protect personal identification so as not to betray the trust of the consumer? How do we put in place the incentives to drive sustainable agriculture, so that humanity lives within the ecological boundaries of the planet, one farmer at a time? All these considerations need to be thought about in designing ICT solutions.

### **Fostering youth involvement and effective communication**

ICT is a powerful vehicle to bring youth back into agriculture. At ICRISAT we have converted our library into an agribusiness incubator to integrate agriculture

## Fostering Innovation and Attracting Youth to Agri-business Sector



### Agri-entrepreneurship can :

- Unlock the inherent economic potential of agriculture
- Attract youth to agriculture
- Foster entrepreneurship spirit and help increase incomes

Beyond ICRISAT, "i" stands for:

- |               |               |
|---------------|---------------|
| • Innovation  | • Inspiration |
| • Integration | • Impact      |

- ihub launched on 13 Feb 2017 to accelerate opportunities for agri-preneurs in India
- Exploring partnerships in Africa



Figure 5. ihub – an ICRISAT initiative linking youth and agri-business.

with science, with financial services and off-grid energy, to create sustainable business solutions for smallholder farmers (Figure 5). We are finding that is attracting a young energetic population of scientists and entrepreneurs to come together to deliver these solutions and to serve those that have been underserved in the past with traditional models, including extension, market integration and value addition.

I want to end this overview by commenting on how we are communicating science. We have to do a much better job. Although overall the science community can be a little introverted, that should not stop us from reaching out to society to communicate our science at all levels, for example via:

- infographics that can influence and inform policy makers so that they make science-based decisions;
- interacting with our colleagues within the science community;
- interacting with farmers through peer-to-peer learning. Increasingly, in the United States and in Australia, farmers are learning from other farmers as trusted sources of information for practical solutions to real problems.
- engaging with the general community. We need to be at the forefront of communicating the value of the new technologies to serve society or we may find ourselves in a debate (like that over genetic modification) about whether the technologies are good or bad. Let us educate society on how we are using science responsibly to serve society and address the Sustainable Development Goals.

By communicating science we can:

- foster collaboration and innovation;
- enhance knowledge and career prospects;
- convey the importance of agriculture in eliminating poverty and malnutrition;
- make data-driven decisions for a better world.

We all need to make data-driven decisions, whether we are smallholder farmers deciding on the optimal mix of crops to deliver diversified nutrition and manage market and production risks, or whether we are policy makers deciding on budget allocations and on policies that can create either an enabling or a sometimes disabling environment for innovation to serve society.

In conclusion, I think the urgency of the agenda is critical, that agriculture touches on all 17 of the Sustainable Development Goals in some shape or form, and that we really need to come together as a community to build partnerships to accelerate the delivery of our science to serve society.

David Bergvinson joined ICRISAT in January 2015 to lead its strategy development to ensure science, demand-driven innovation and strategic partnerships come together to translate science into prosperity for rural families in the dryland tropics of Asia and sub-Saharan Africa. Prior to joining ICRISAT, David worked on the Agriculture Development team at the Bill & Melinda Gates Foundation and led their Digital Agriculture initiative. As Director General of ICRISAT, David continues to build partnerships that leverage the power of digital technology to accelerate the development and delivery of farmer-preferred products and services. To this end, ICRISAT is working closely with national partners along value chains of ICRISAT's mandate crops (sorghum, pearl and finger millet, chickpea, pigeonpea and groundnut) to ensure our science improves the lives of farmers and nutrition for all consumers. ICRISAT refers to these crops as 'Smart Food – Good for consumers nutritionally, Good for the planet by diversifying farms and Good for smallholder farmers by increasing their resilience and offering diverse market opportunities'. David is a Canadian national who has worked in international agriculture research for development for over 25 years.