



THE CRAWFORD FUND  
*For a Food Secure World*

# RESHAPING AGRICULTURE FOR BETTER NUTRITION

THE AGRICULTURE, FOOD, NUTRITION, HEALTH NEXUS

**The Crawford Fund**  
**2018 ANNUAL CONFERENCE**

Parliament House, Canberra ACT, Australia, 13–14 August 2018

*Editor: A. Milligan*





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The agriculture, food, nutrition, health nexus

**The Crawford Fund  
2018 Annual Conference**

**Parliament House, Canberra ACT, Australia  
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## The Crawford Fund

The Australian Academy of Technology and Engineering established the Crawford Fund in June 1987. Named in honour of the late Sir John Crawford, the Fund commemorates his outstanding services to international agricultural research.

The Crawford Fund is a non-profit, non-government organisation, dedicated to raising awareness of the benefits – to developing countries and to Australia – of international agricultural research. The Fund depends on grants and donations from governments, private companies, corporations, charitable trusts and individual Australians. It also welcomes partnerships with agencies and organisations in Australia and overseas.

The Fund promotes and supports international R&D activities in which Australian research organisations and companies are active participants. It supports the work of the Australian Government's aid program, particularly with the Australian Centre for International Agricultural Research (ACIAR), the CGIAR Consortium, and other international research centres. The Crawford Fund also runs training programs that fill a niche by offering practical, highly focused non-degree instruction to women and men engaged in agricultural research and management in developing countries.

We also support and encourage the next generation in their study and careers in international agricultural research, through our international agricultural student awards and our Crawford Fund Conference scholarships and related activities, and by providing volunteering opportunities in our mentoring program.

The annual Conference is a key part of the Fund's public awareness campaign to increase understanding of key food and nutrition security issues and the importance and potential of international agricultural research.

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For the **Summary of the 2018 conference by the RAID Listeners**

see <https://www.crawfordfund.org/news/news-2018-crawford-fund-annual-conference-keynote-listeners-report-august-2018/>.



Conference scholars with Board, Coordinators and staff of the Crawford Fund  
August 2018

# Acknowledgements

**The Crawford Fund wishes to thank the Chairs of the conference sessions,  
and the sponsors and supporters of this year's conference and scholar program**

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In addition to the conference scholars supported by our State and Territory Committees and some individual donors, the following have supported conference scholars this year:

Australasian Agricultural & Resource Economics Society (AARES) Queensland Branch,  
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Centre for Nutrition and Food Sciences, QAAFI (Queensland Alliance for Agriculture  
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Marcus Oldham College

Plant Health Australia

School of Agriculture and Food Sciences, The University of Queensland

University of New England

University of the Sunshine Coast, Forest Industries Research Centre.



## Foreword

Each year, the Crawford Fund board considers potential topics for the annual conference, from across a range of agricultural disciplines. This year we opted for the food, nutrition and health nexus, because this topic is of major concern to the developing world these days, and because we now face both under-nutrition and over-nutrition almost side by side in many countries, including Australia where overweight and obesity issues are putting an increased strain on our health facilities and budgets.

The Green Revolution of the 1950s to 1970s and the follow-up work to increase crop yields were incredibly successful, allowing a rapidly increasing population to be fed, globally, in a way that even Sir John Crawford would hardly have believed possible. Arguably, the world can produce enough food to feed everyone, but economic, political and distributional issues as well as wars and various sorts of distress mean that people still go hungry. Hunger and malnutrition account for 1.5 times more deaths now than disease and natural disasters, and it would appear that around 800 million people are chronically under-nourished. That figure has increased by 38 million since 2015, and yet it is probably dwarfed by the number of people now overweight, over-nourished or obese.

Growth in individual wealth across the world has led many people to change their dietary preferences to Western-style diets, high in proteins (meat and dairy products), lower in whole grain (cereals, fruit and vegetables), high in processed food, rich in sugar and salt. As a result over 2 billion people are over-nourished.

Compounded in this is the deeply disturbing matter of food waste in western societies. In Australia, food waste accounts for between 30% and 45% of food produced in this country in our domestic markets. We addressed the topic in the Crawford Fund's 2016 conference, and it remains of great concern.

To produce the right food and the right quantities to satisfy diets globally will require a great deal of effort. That stress on land, on water, on other resources including fertilisers and energy places further strain on the natural environment. However, Australia is a sophisticated and well-to-do country that has enormous expertise in agricultural science and agricultural know-how. Australians can 'punch well above our weight' in these fields. In agriculture, food, nutrition and health, Australia can have a very large positive impact.

The challenges posed by these complex issues set the scene for the speakers at today's conference. If we have the will, there will be a way through these issues.

This year's conference delegates (pp. 137–142) include 44 young scholars – young scientists with genuine interest in international agricultural development. They can and must be the heroes of tomorrow, committed to seeking out the evidence and to drawing knowledge from the evidence. The Crawford Fund would like to acknowledge the supporters (listed above) who, with the Fund's State and Territory Committees, have guaranteed those scholars this opportunity to take part in today's agriculture, food, nutrition and health discussions. The scholars' names and supporters are also listed on the Crawford Fund website.



The conference delegates also include members of Researchers in Agriculture for International Development – RAID. The Crawford Fund’s support for RAID is another part of our commitment to the next generation, encouraging young people’s enthusiastic embracing of what we do. RAID members again this year summarise the whole conference in a short paper published online at the Crawford Fund website.

Finally, the Crawford Fund gratefully acknowledges the contributions of the Chairpersons of this year’s sessions, and the sponsors who have supported this conference, and Ms Cathy Reade and her team without whom the conference would not take place.

A handwritten signature in blue ink, appearing to read 'John Anderson', with a long horizontal stroke extending to the right.

The Hon. John Anderson AO  
Chair, The Crawford Fund

# 2018 SIR JOHN CRAWFORD MEMORIAL ADDRESS

## Food, climate change and national security

Frances Adamson

Secretary of the Department of Foreign Affairs and Trade (DFAT),



Let me first acknowledge the traditional custodians of the land on which we meet, the Ngunnawal people, and pay my respects to their Elders past, present and emerging.

I also acknowledge Patrons of the Crawford Fund here tonight, including the Hon. John Kerin AO, the Hon. Neil Andrew AO and the Hon. Tim Fisher AC; members of the Crawford Fund Board, including the Hon. John Anderson AO (Chair of the Board) and Dr Colin Chartres (CEO), Mr Bob McMullan and the Hon. Margaret Reid AO; the CEO of the Australian Centre for International Agricultural Research, Professor Andrew Campbell; Crawford Fund Scholars, and Researchers in Agriculture for International Development.

I thank the Crawford Fund for inviting me to give the 2018 Sir John Crawford Memorial Address.

In doing so, I am deeply conscious of two things: firstly, the long history of high-quality work the Crawford Fund has driven or supported over the decades in agricultural research and development – few organisations can claim this sort of record. And secondly, the extremely high-quality of the speakers who have delivered this address over those years – Bob McNamara, Amartya Sen, Peter Doherty, Craig Venter, among a storied list – these are some big shoes.

Without question, Sir John Grenfell Crawford was a remarkable person.

One of the Australian public servants who exercised a profound influence behind the scenes on national policy in this country through the 20th Century, Sir John Crawford casts a long shadow on Australian agriculture and trade, over 30 years after his death. Presenting him with the Australian of the Year award in 1981, Sir Zelman Cowen described him as an ‘architect of Australia’s post-war growth’ – and I think that was no exaggeration.

In the CV he built up and left behind, I count Sir John as my predecessor not once but twice. In the 1950s, he was Secretary of the Department of Trade, which amalgamated in 1987 with the Department of Foreign Affairs to become the Department of Foreign Affairs and Trade (DFAT). And in the 1970s, he was

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The text of this address is online at <https://dfat.gov.au/news/speeches/Pages/food-climate-change-and-national-security.aspx>. For the video of the actual address, see <https://www.crawfordfund.org/news/news-the-2018-sir-john-crawford-memorial-address-august-2018/>.

a key figure in the formation of the Australian Development Assistance Agency, later AusAID, now – once again – integrated into the modern DFAT.

In the 1980s, he was also a driving force behind the formation of the Australian Centre for International Agricultural Research, ACIAR – now an independent agency within the foreign affairs and trade portfolio, and incidentally, the key financial support behind the Crawford Fund.

### **1961 Roy Milne Memorial Address**

In thinking about and preparing for the Sir John Crawford Memorial Lecture, I read a memorial lecture Sir John delivered himself in 1961. This 1961 lecture – the 12th Roy Milne Memorial Lecture, a series named for a prominent businessman in the interwar period – was a fascinating read, one that clearly set out Sir John’s deep professional obsession – there is no other word for it – with food security and agriculture.

Titled ‘International Aspects of Feeding Six Billion People’ and delivered at the University of Melbourne, Sir John’s lecture focused on the key challenge he saw lying in wait for the world in the last four decades of the 20th Century.

Apart from the spectre of nuclear war – a vivid and understandable fear only a decade and a half after the end of the Second World War – Sir John Crawford was most concerned by the challenge of feeding the booming world population, particularly in rapidly growing Asia; an Asia that was much poorer than today.

His projections of population growth, based on United Nations data, were strikingly accurate. Speaking in 1961, at a time when the global population was 3 billion, he projected the population in the year 2001 would be 6.28 billion. According to the UN Population Division, we reached the 6 billion mark in 1999 – so from a distance of 40 years, he got it pretty much exactly right.<sup>1</sup>

He was an optimist, in the end, about whether and how we would meet that challenge. Hunger [I quote] ‘is a threat we can defeat, if we are so minded, for technology is not our principal problem,’ he concluded.

Unsurprisingly, given his background and his work, he saw both aid and trade as necessary but not sufficient parts of a solution that would meet the vast nutritional and calorific needs of the growing human population.

He saw trade as playing only a fairly marginal role in food security, quoting data that showed only 7% of global grain production was exported in 1961.

In 2017, 15% of global grains were exported, many feeding into value chains around the world. Compare this with oil, where 9% of production was exported in 1965 and 71% in 2016.

In 1961, Sir John also put a heavy emphasis on the importance of the Asian countries, about which he was most concerned, solving much of the problem themselves through economic and agricultural development. As we know, and this is a complex story to cover in only a few words, he was by and large right

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<sup>1</sup> Source: United Nations World Population Prospects 2017 Database

in his analysis: the countries of what we now think of as the Indo-Pacific were transformed over that 40- or 50-year period, through economic growth and through development. International development assistance – including from Australia – played a role, and globalisation, investment and trade have been key parts of lifting economic performance and transforming those societies.

Thankfully, we've also managed to manage the threat of nuclear war that also weighed on Crawford's mind.

Today, as we consider the big questions of food and agriculture, we see a similar trajectory in front of us as the global population heads towards nine billion by mid-century – a tripling from the 1960s.

While populations in the Indo-Pacific and in most parts of the world are much wealthier than they were 60 years ago, what we now think of as food security is still a major issue. People still go to bed hungry, and in many places nutritional requirements are still not met – hence the second of the 17 global Sustainable Development Goals: 'Zero hunger'.

In 2016, around 815 million people – close to 10% of the global population – were considered undernourished.<sup>2</sup>

Sadly, the impacts of chronic hunger and malnourishment are always most severe on children. Globally, of the 667 million children aged five or under, almost a quarter (22.9%) are considered to have had their growth stunted.<sup>3</sup> The proportion is as high as 50% in our immediate neighbourhood, according to the World Health Organization's estimate. That tells us that the benefits of our global economy are still very unevenly spread.

### **Food and threats to national security**

Apart from its devastating and often life-long physical impacts, food insecurity – along with water security – also plays a key role in national security.

All nations and all national governments are sensitive to the importance of their capacity to ensure reliability in food supply, but it is a particularly important issue for developing countries – especially those whose geography, history or natural endowments do not lend themselves to reaching long-term food security goals.

It's a point that may be hard to imagine in a wealthy country like Australia, with a major agricultural industry that produces and exports much more food and fibre than our relatively small population can consume. As the Prime Minister said today in his Statement to Parliament, 'The National Farmers' Federation vision for a \$100 billion a year farm gate industry is undaunted by the drought'. In fact, our country exports around two-thirds of its agricultural production.<sup>4</sup>

But consider a country like China, whose progress has been far more hard won. It is an understatement of the highest order to say that in 1961, China was a

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<sup>2</sup> Source: Food and Agriculture Organization of the United Nations (FAO)

<sup>3</sup> Source: Food and Agriculture Organization of the United Nations (FAO)

<sup>4</sup> Source: World Trade Organization Agricultural trade

vastly different country to the global economic superpower we know today; a largely agricultural society focused on internal challenges. Even today, however, after its integration to the global economy and its rise to be rivalled by only the United States in economic scale, food security remains a vital issue at the heart of Chinese national identity.

In 1996, the Central Government produced a White Paper on ‘The Grain Issue in China’ which identified national food security, particularly in grains, as a high order priority.

Still today, in the many iterations of the Communist Party’s No. 1 Central Policy Document, questions of agricultural and rural development remain front and centre. ‘Ensuring long-term food supply [...] is a necessary and basic policy for governing the country,’ that document says, reflecting China’s history, but also the vitally important issue of maintaining social and national stability.

China is a large country, but that task is gargantuan. Today, China feeds one-fifth of the global population on one-fourteenth of the world’s farmlands. In the last few decades, agricultural productivity growth in China has run at a rate three times higher than the global average, resulting in a major surge in output. Chinese rice paddy yields are more than three times greater now than they were in 1961. Wheat yields have gone up nearly tenfold.

Nutrition has improved as a result, and the negative impacts of under-nourishment are slowly declining.

Now, more conscious of environmental issues, the Chinese Communist Party places heavy emphasis on addressing the environmental impacts that come hand in hand with decades of overuse of fertilisers and chemicals.

I know that ACIAR has been working for years alongside the Chinese Government on food security and agricultural sustainability issues, and has seen first-hand some examples of the hugely positive impact this has had, including in Tibet.

My colleague Andrew Campbell (CEO, ACIAR) has recently returned from there, reviewing grasslands management research critical not only to the local Tibetan population but to the management of 13 Asian river systems.

Together, these rivers sustain billions of people.

Food security is of paramount importance to many countries, of course. Consider the immense strategic and political challenge for the various governments that rely on the water in the Mekong River Basin.

A complex and competing range of factors come together in the Mekong – power generation, water for irrigation, farming and human consumption, transport, food security, economic livelihoods, and geostrategic interests. If a government builds a dam, it restricts or controls downstream water flows – with resulting impacts in neighbouring countries.

That water may be needed for seasonal cropping, or for flushing silt, or for sustaining populations of local fish – a key source of protein for millions of

people in the countries that stretch up and down the Mekong. It's an acute example of the trade-offs that govern this complex tangle of issues – and new risks continue to emerge, as we saw in the collapse of the Xepian-Xe Nam Noy dam in Laos last month.

There are examples in other parts of the world. In 2010, severe drought reduced grain production in both Australia and Russia. Farmers in both countries suffered greatly – losing large-scale wheat crops intended for export, and contributing to a global hike in bread prices.

In the new year, in an entirely different part of the world, protesters took to the streets. Masses protesting the inflation of food prices – the fact that they couldn't afford bread anymore. Today, that drought – the same one we saw right here in this country – is widely acknowledged as the first in a set of dominoes that brought down the Egyptian Government.

Sitting at the centre, of course, is a core universal need for food and water security.

We see a similar story today in Syria – a country that has seen dramatic changes to its rainfall patterns since the 1990s. With these critical water security issues came decline across rural farming communities – simply put, traditional income streams were not as reliable as they once were. The domino effect again – we saw Syrians forced out of their livelihoods and moving to major urban centres.

We saw more urban poverty as a result, greatly compounding the impact of other political and social issues that sparked protests and escalating violent responses.

Today, we see those changing rainfall patterns for what they really represented to the people of Syria – fuel to the disintegration of internal social and political cohesion. The conflict has in turn devastated already declining agricultural productivity, and has all but destroyed the food security landscape for the local population.

We in Australia – and especially at the moment in rural New South Wales – know all too well the impact of sustained drought, even in a politically and socially stable situation. In tough times and an unforgiving climate, we have developed expertise in water management and dryland farming, in developing drought-resistant strains of crops and stock.

This Australian knowledge can help to shore up food security, and so mitigate the suffering and the instability that food shortages can cause.

### **Climate change as a threat multiplier**

The urgency of this work has an added intensity because of an issue that Sir John did not have on his radar at all: climate change.

In 1961, climate change was not part of Sir John's vocabulary – but in Australia's Foreign Policy White Paper, released in November, 'climate' or 'climate change' is mentioned over 40 times. Climate change and food security are two inextricable issues for the modern international community.

The threats that Sir John worried about in 1961 are compounded by temperature change, unpredictable rainfall patterns, ocean acidification, sea-level rise, and increases in the frequency and intensity of extreme weather events. They multiply the risk of threats to both national and international security. At their extreme, they increase the risk of conflict.

In an era of increasing strategic competition in some parts of the world, there is a need to anticipate some large-scale possibilities.

- What happens as some areas become uninhabitable?
- What happens as systems of food and water start to fail?
- What happens as farmers increasingly struggle to produce their crops and people can no longer feed themselves?
- What happens as societies can no longer count on the agricultural productivity of a territory they have relied on for generations?
- What are the consequences to changing patterns of climate, environment and of migration, to systems of governance and social cohesion?

These were the kind of questions we asked ourselves last year in developing our Foreign Policy White Paper. We concluded that ‘climate change, environmental degradation and the demand for sustainable sources of food (and water) would be political, economic and security disrupters’.

One part of the world which has a particular focus on climate change is, of course, the Pacific – our neighbourhood and one of the White Paper’s five central foreign policy priorities. The political and strategic stability of the Pacific, interlinked with its economic viability, is without question an immediate issue for Australia’s own national security.

Climate change is particularly concerning for Pacific island countries who have said it is the greatest threat to the livelihoods, security and wellbeing of their people. It will impact on food and water security, ocean health and fish stocks. Health risks, such as vector-borne diseases, will increase. In the long term, it poses an existential threat to some countries and low lying islands.

Today, there is no denying the rising frequency of extreme weather events – economically and emotionally devastating at both a personal and national level.

Large-scale migration looms as a growing risk in the years ahead.

Whether in the Pacific or beyond, the White Paper clearly concludes that these challenges will undermine stability, and could well contribute to conflict and irregular migration.

Whether or not conflict is the result, though, is only half the point. What we know for sure is that a changing climate will increase the risk of natural disasters, economic shocks and disagreement between and within countries – including right here in the Indo-Pacific. These are the interwoven, inextricable threats – inherently issues that require a committed, coordinated effort, based on good science, by governments the world over.

It cannot be done by anyone alone. The big question though is whether we have the wherewithal to do it together.



The complex nexus between food, climate change and national security adds urgency to the need for global cooperation. Yet here, in the halls of multilateral diplomacy, we encounter another set of difficulties.

A more recent predecessor of mine as Secretary of DFAT, Peter Varghese, set out some of the factors that have made multilateral diplomacy challenging in recent times, and continue to challenge us today. First, the United Nations had 51 members in 1945; it has 193 today. I don't know whether anyone here has ever tried to reach agreement between 193 parties on complex issues with vital interests at stake, but I can assure you it's not easy.

Secondly, many of our multilateral institutions were designed for that post-war world, a world we just don't live in any more. In some respects, international institutions have not kept pace with the changes in the distribution of power across the globe, and are under strain.

A third challenge we face in multilateral diplomacy is that in recent years a range of countries has shown a willingness to challenge the rules that help to preserve and progress international order. This distracts attention from common challenges, and undermines trust.

At the same time, traditional powers like the United States and Europe, which have played a prominent role in making international institutions work, are going through major challenges of their own. The United States is reassessing the way it exercises global leadership. In recent times it has preferred unilateral approaches to international problems. The United States has said it will withdraw from the Paris Agreement. It has shown a troubling willingness to engage in trade disputes as a first resort to achieve its economic priorities. Already, agriculture and the food sector are being affected by new US subsidies to American farmers impacted by China's retaliatory tariffs.

This unilateralism runs counter to the spirit of cooperation that is vital in reaching international agreement. In an interconnected and interdependent world many major challenges can only be solved by collective action.

Nations, including Australia, understandably will have an eye to their own national interests. We should not expect it to be otherwise. But managing the challenges of globalisation also requires a bit of give and take. We can't meet these challenges by applying only the narrowest conceptions of national interest. The cooperative approach – though never easy – has allowed us to deal with big global issues, like our collective efforts in the 1970s and '80s to agree UNCLOS, the United Nations Convention on the Law of the Sea. If we lose that spirit of cooperation in this increasingly contested global environment, climate change could continue unabated, and food security challenges could very well intensify.

It's a problem with no easy solution; a subject touched upon in the recent Senate Inquiry into the implications of climate change for Australia's national security (final report released May 2018). Reading the written submissions from across Australia, it's clear that many people understand that climate change affects the availability of food and water, and that that in turn has national security implications.

## **Australia's contribution to the global effort**

As a nation, we are relatively well placed to handle those threats. However, the issue of food and water security – burdened with population growth and with increasing climate pressures – will without question weigh on us as well.

In 1961, Sir John spoke bluntly when he said: 'I personally doubt whether we are yet pulling our full weight and doubt whether we yet realise the magnitude of the task ahead.' Those words continue to have a ring of truth. However, we are nonetheless making headway through our trade agenda and our development program.

We have counted some remarkable agricultural achievements since 1961, helping to feed millions and to raise productivity and agricultural yields around the world. As Australians, we add value through world class research and innovation. Sir John recognised this 57 years ago, calling it our 'imaginative invention!'.

It's clear that in today's competitive agricultural world, Australia's 'imaginative invention' is delivering – whether through the transfer of new technologies or through the sharing of agricultural expertise. From a DFAT point of view, our partnerships with the private sector are indispensable. Many of our large agricultural development initiatives work directly with businesses to transform local agri-food market systems, and protect otherwise vulnerable smallholder farmers who play a vital role in food production across our region.

It is about making a practical contribution to achieve more productive, sustainable and climate-resilient agriculture in developing countries. We support, for example, CePaCT (Centre for Pacific Crops and Trees), an organisation that provides Pacific farmers with seed varieties tolerant to drought, salinity, cyclones, floods and frost. We are also broadening the trade story to distinguish necessary conversations around food security from protectionist rhetoric tied to food self-sufficiency.

We are attracting foreign investment to grow the Australian agricultural market and taking some of that experience back overseas; leveraging our natural strengths in agribusiness and in food. German company Bosch is investing, for example, in The Yield – a Tasmanian agritech start-up that measures and predicts weather data in real time, and pairs it with intelligence specific to the crop. It's valuable technology with benefits to both productivity and to the environment.

Domestically, this kind of innovative research is reflected in the wonderful work of ACIAR, another Crawford legacy. ACIAR has supported hundreds of projects in 35 countries in our region – smart phone apps, drone technology, agribusiness education and early warning for crop viruses – facilitating collaboration that transcends international borders and engages the most remote communities in the world. It is work that stems from our domestic experience; an understanding of our own food and water security.

To take one example from right here at home, our National Water Initiative is in so many ways a best practice blueprint for managing water resources across jurisdictional boundaries – analogous in some respects to the transnational

management issues we see in the Mekong and in so many other parts of the world. We have great insights into the practical challenges of cooperation where the stresses on shared resources are extreme and prolonged. This is, after all, not a theoretical exercise – and having built our expertise at home, we commit to sharing it internationally under the umbrella of the Australian Water Partnership.

So too does our work stem from our domestic understanding of gender bias – a factor that the Crawford Fund recognises as ‘a major inhibitor’ in improving agricultural outcomes.

As far as DFAT is concerned, gender equality and women’s empowerment are a core part of our diplomatic, trade and development work. We focus on improving education for women and girls, on opening up community participation, on allowing for engagement in decision-making. For instance, DFAT trains Pacific women to participate at the table as negotiators in major international climate change talks. The evidence is clear – these kind of efforts improve outcomes in community nutrition, they slow down population growth, and they strengthen resilience in the face of climate change.

It’s an issue that requires broad engagement between people, just as much as it does between states – and on both counts, we must do what we can to ensure that happens.

## Conclusion

Times have certainly changed since 1961 – and yet, Sir John’s words then are a salient reminder of how universal they are, these basic human needs. Sir John was concerned with how the world would feed a population increase of 3 billion people that the demographers of his day were projecting, out to 2001. Today, we too should be concerned with how the world will feed the population increase of a further 3 billion people that demographers of our day are projecting for 2050.<sup>5</sup>

Climate change is an exacerbating factor that Sir John did not have to contend with but that we can no longer ignore. It will not change the extra 3 billion people that we have to feed, but it will exacerbate the challenge of feeding them. It will exacerbate the risk that territories in some parts of the world will no longer be able to support the people who live on them. It will exacerbate the risks of resource competition, of health challenges, of economic prosperity, of humanitarian disaster. It will exacerbate the risks of state fragility, of mass migration, of internal and of international conflict.

A different Sir John – Sir John Beddington, former Chief Scientist of the United Kingdom – once called it ‘a perfect storm.’

Australia is doing a great deal to combat this perfect storm, this great knot of interlinked issues – it is a complex problem, but not an impossible one. Yet in 2018, in the very pragmatic and introspective shadow of Sir John Crawford, it is time to ask ourselves again, whether we, too, need to be doing much more.

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<sup>5</sup> Source: United Nations, Department of Economic and Social Affairs, Population Division

## Further reading

Australian Government 2017 Foreign Policy White Paper.

<https://www.fpwhitepaper.gov.au/>

Senate Foreign Affairs, Defence and Trade References Committee, Parliament of Australia (2018) Implications of climate change for Australia's national security.

[https://www.aph.gov.au/Parliamentary\\_Business/Committees/Senate/Foreign\\_Affairs\\_Defence\\_and\\_Trade/Nationalsecurity/Final\\_Report](https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/Nationalsecurity/Final_Report)

United Nations World Population Prospects 2017 Database.

<https://population.un.org/wpp>

World Trade Organization Agricultural trade.

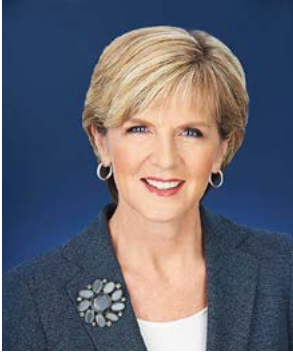
<https://dfat.gov.au/trade/organisations/wto/Pages/agricultural-trade.aspx>

Frances Adamson has led the Department of Foreign Affairs and Trade as Secretary since 25 August 2016. Prior to her appointment as Secretary, Ms Adamson was International Adviser to the Prime Minister the Hon. Malcolm Turnbull MP from November 2015. From 2011 to 2015, Ms Adamson was Ambassador to the People's Republic of China. She served in the Australian Consulate-General in Hong Kong in the late 1980s during the early years of China's reform and opening. From 2001 to 2005, she was seconded as Representative to the Australian Commerce and Industry Office in Taipei. Ms Adamson has twice served in the Australian High Commission in London, as Deputy High Commissioner from 2005 to 2008 and as Political Counsellor from 1993 to 1997. She was Chief of Staff to the Minister for Foreign Affairs and then the Minister for Defence from 2009 to 2010. Ms Adamson is President of the Institute of Public Administration Australia ACT Division. She is a member of the Efic Board, the Advisory Board of the Australian National University's National Security College and the Asia Society Australia Advisory Council. Ms Adamson is a Special Adviser to the Male Champions of Change and a member of Chief Executive Women. She was awarded a Sir James Wolfensohn Public Service Scholarship in 2015. Ms Adamson has a Bachelor of Economics from the University of Adelaide and was a recipient of a 2014 Distinguished Alumni Award. She joined the then Department of Foreign Affairs in 1985. She is married with four children.

## Ministerial address

The Hon. Julie Bishop MP

Minister for Foreign Affairs



I am very pleased to address this conference, because you are focusing on one of the global challenges that we identified in our Foreign Policy White Paper that was released last November.

That was designed to put out a framework of our foreign policy priorities and interests for the next 10 years or more. While we can't predict the future, we can certainly focus on our values as a nation: open liberal democracy committed to the rule of law, democratic institutions, human rights, an open export-oriented market economy – this

standard of living depends upon our ability to sell our goods and services around the world.

I am particularly pleased to be here because I want to pay tribute to the Crawford Fund for supporting agricultural research internationally, but also raising awareness of the benefits of such research – not only to Australia and to our region but internationally – and research leading to increasing productivity which provides benefits for all.

The National Farmers' Federation tells us that Australia's farmers each feed 600 people: 150 people at home and 450 people overseas. That is a remarkable statistic, showing enormous productivity on the part of our farmers. It is due to their hard work and enterprise but also to the agricultural research that enables them to embrace new techniques, and to innovate and to represent world's best practice in so many areas.

I want to take a moment to pay tribute to Australia's farmers, for many of them are struggling through one of the worst droughts on record. That's why the Turnbull Government has responded with a package of measures to support them at this time.

You'll be aware that the Farm Household Assistance Scheme introduced in 2014 is already providing about 8000 farmers with support of about \$550 per fortnight. We have now announced two further supplements to that assistance, and this package of about \$190 million is on top of the \$386 million in drought relief. It also provides concessional loans. So we take a moment to think of how our farmers are doing it tough at present.

Of course, no-one controls the rain, and that's why Australian farmers have so regularly confronted drought, and so regularly come up with innovative ideas for drought resistance, for water management, and we really do lead the world in many of these areas. Yes, there are huge global challenges, but we in Australia

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Prepared from a transcript of the Minister's address to the conference during the afternoon.

have a great deal to offer through our own experience, as tough as it can be, but also through our inquiring creative innovative minds, always prepared to take risks, push the envelope.

There is a huge global challenge ahead of us because of the increasing pressures on agricultural land around the world, and that has come about through growing populations, through unprecedented levels of urbanisation and also through growing prosperity. Growing prosperity means a greater demand for food and water.

In fact, we have seen the greatest reduction in poverty in human history: hundreds of millions of people have been lifted out of poverty since the Second World War. That's a great news story, but it does have big challenges, including in relation to agricultural land.

One challenge for us is that our high-quality food is very much in demand overseas. The challenge is we have to ensure that we have access to established and new markets – preferential access for our agricultural exporters so that we can compete on a level playing field. That's why the Government has pursued a very ambitious free trade agenda. Our Free Trade Agreements with China, Japan and Korea always take the headlines, but we are pursuing free trade agreements wherever we see benefit for Australian exporters. And given that we export two-thirds of our agricultural production, this is a vital underpinning for the Australian economy.

We should also note that much of our agricultural export is into developing countries, and trade is a key element of food security in developing countries. There was research last year – the ANU\* Development Policy Centre showed that for every dollar Australia invests in foreign aid, we receive back from that recipient developing country \$7 through our increase in exports. I think that is a figure worth recalling.

Another significant challenge, paradoxically, is malnutrition amongst agricultural sectors across the world. There are about 525 million farmers around the world; 475 million are considered to be smallholder farmers. Paradoxically, it is estimated that about half of them are suffering from malnutrition. Three million children die each year of malnutrition. Many others are suffering from stunting, from decreased learning abilities, from a decreased level of immunity to disease. These are challenges that no one country can face alone, and it is why we focus so heavily on partnerships – working in partnership with other governments, with the private sector, with civil society – to ensure that we can assist, given our expertise and our level of agricultural production.

Our aid program includes a significant element of agricultural research. It is targeted to our region, the Indo-Pacific: it is specifically targeted to the Pacific. This is our part of the world. This is where we have a responsibility to build safe and secure and prosperous communities and societies, specifically within the Pacific but broadly across the Indo-Pacific where, coincidentally, our major trading partners are located.

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\* ANU = The Australian National University

This morning you heard stories of work we are doing in Timor-Leste. I was in Timor-Leste about 10 days ago, in Dili, and I know that the Australian Government is working with Timor-Leste to help farmers access markets. For a country of Timor-Leste's size, with the economic and social profile that it has, it is extremely difficult for farmers to access markets, so we partner with them. It is in our interests as well as in the interests of the people of Timor-Leste to ensure that their farmers can grow crops that can be marketed, and that they can have access to markets and take part in the regional supply chains. The work we are doing in Timor-Leste is making a huge difference.

I also came across a great initiative, supported by the Australian Government. If you are in Dili, please go to Agora Food Studio. It is run by two Aussies, and its mission is to produce clean, quality food that is fair to the producers and consumers and the population at large. They run a restaurant café and they source 90% of the food – their ingredients – from smallholder farmers in Timor-Leste. They focus on uniquely Timorese herbs and spices and fruits and nuts – things I'd never heard of – and they turn them into the most extraordinary gastronomic delights. They are training young Timorese in the arts of culinary delights, of being chefs and apprentices in the kitchens. They are also training baristas – in fact, one of their baristas is coming to Sydney for the international barista competition. They are working with Australia to support their producers to provide their ingredients, with better strains of cocoa and coffee, and they are branding Timor-Leste produce. It is giving livelihoods, it is providing nutrition, interesting food, jobs for local people, and I could not think of a better investment of the Australian dollar than supporting these young people to do such amazing things.

The focus of today's conference is about better and more food, with constrained resources, and we certainly see that across our region. That is why I want to pay tribute to the Australian Centre for International Agricultural Research (ACIAR) to the work that it does as an integral part of our foreign aid program. ACIAR is a quiet achiever in the Department of Foreign Affairs and Trade – not to suggest that everybody else is a loud achiever – but ACIAR gets on with some remarkable work and produces some remarkable results. Every time I read one of \*Andrew Campbell's reports – and he gives them to me regularly – on the work we are doing, Australians would be proud to see the difference we are making.

Of course, the research that we undertake has an impact here in Australia. We all benefit from this research.

A couple of examples: in Papua New Guinea (PNG) last March, we went to Nago Island in New Ireland Province, and there ACIAR is working in what was a Japanese tuna canning factory that was discarded a long time ago. And through research, we are working with local people to produce sea cucumbers and creating a business in exporting sea cucumbers particularly to China. They are also doing a side business of ornamental fish, like the little striped clown fish 'Nemo', and selling these little ornamental fish into the US market. Again, wonderful research; and training up young people and giving livelihoods.

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\*Andrew Campbell is CEO of ACIAR



I know that ACIAR is also involved in developing aquaculture farms in PNG – there are now something like 16,000 aquaculture farms – and what we learn from our research in assisting PNG we can equally apply here in Australia.

You also heard this morning about the Smart Food initiative. This is something that we are doing with our innovationXchange – another quiet achiever in the Department of Foreign Affairs and Trade.

Some years ago, about three and a half years ago, I was concerned that while we had targeted our aid program and it was focused on effective efficient outcomes, nevertheless some countries in our region, particularly countries where we have a special responsibility to support them – PNG – were going backwards on some of the key socio-economic indicators. How could this be? It clearly wasn't a question of money. It was a question of how we were investing our aid dollars.

So we set up an ideas hub, the innovationXchange. If you have not visited it, please do. It is in a building opposite the imposing R.G. Casey building, and it looks like an ideas hub, which is what it is. I asked the people – we selected people from across the public service; from the private sector; we had people from the United States come into it from Google; from PWC – I asked them to focus on some of the intractable development issues in our region, but to forget what we have always done, and start with a fresh piece of paper and do something completely new and see if they could come up with an answer – using technology, using different ways of thinking. Just being creative.

And as a result of our ideas hub, the innovationXchange, we now have 102 projects that have been selected on their level of creativity and their effectiveness across 32 countries in the Indo-Pacific. We are truly making a difference: things like using drones for identifying areas of need after a natural disaster, or using drones to deliver pharmaceuticals.

In the agricultural area we have had some really exciting breakthroughs. One of them was the Smart Food initiative you heard about today, which was one of our finalists in the LAUNCH Food challenge that the innovationXchange launched: that is, we came up with some seed funding, we came up with an issue – that is, agricultural yields, how to increase productivity in developing countries – and we asked for ideas from consortiums and individuals around the world, and Smart Food was one of them. They are focusing on types of grain that are resistant or adapted to climate extremes.

This kind of innovation does transform societies.

Something else that we have to offer the world is our expertise in water management. This is a real issue in terms of global and regional security. Half the world's cities and about 75% of irrigated farms around the world are facing water scarcity. There have been more fights over water in the history of mankind than over religion, I dare to suggest.

Australia has particular expertise in water management, and we are offering that expertise to others in partnerships. We are doing fantastic work in the Lower Mekong, in India, in countries where irrigation, water management, water scarcity really do lead to security issues.

Partnerships are the key. That is the way we have to do it: leverage the private sector; make sure the private sector is involved; work with other governments; work with civil society. A great partnership that has just been announced is that the Melbourne-based company Rubicon Water has entered into a joint venture in China to deliver irrigated water systems. That is another example of a great partnership.

Ladies and gentlemen, all the very best for your conference. I am about to go and vote. This is democracy in action!

Julie Bishop is the Minister for Foreign Affairs in Australia's Federal Coalition Government. She is also the Deputy Leader of the Liberal Party and has served as the Member for Curtin in the House of Representatives since 1998. Minister Bishop was sworn in as Australia's first female Foreign Minister on 18 September 2013 following four years in the role of Shadow Minister for Foreign Affairs and Trade. As Minister for Foreign Affairs, Minister Bishop led the development of the 2017 Australian Foreign Policy White Paper – the first review of Australia's international engagement for 14 years. The Foreign Policy White Paper sets out a comprehensive policy framework to ensure Australia's prosperity and security over the next decade and beyond. Minister Bishop has overseen the single largest expansion of Australia's overseas diplomatic presence in 40 years, introduced the New Colombo Plan to support Australian undergraduate students to study and undertake internships in the Indo-Pacific region, and established the innovationXchange within the Department of Foreign Affairs and Trade to develop bold and creative solutions to long-standing development challenges. She has strengthened Australia's key strategic and economic relationships and enhanced Australia's engagement with Pacific Island countries, including normalising relations with Fiji, leading international recovery and reconstruction efforts in Vanuatu and establishing a school of government in Papua New Guinea. Minister Bishop promoted Australia's interests at the United Nations Security Council, playing a lead role in the international response to the downing of Malaysian Airlines flight MH17 over Ukraine for which she was awarded the Commander of the Order of Merit of the Netherlands Ministry of Foreign Affairs, in 2014. She previously served as a Cabinet Minister in the Howard Government as Minister for Education, Science and Training and as the Minister Assisting the Prime Minister for Women's Issues. Prior to this, Minister Bishop was Minister for Ageing. Minister Bishop has also served on a number of parliamentary and policy committees including as Chair of the Joint Standing Committee on Treaties. Before entering Parliament Minister Bishop was a commercial litigation lawyer at Perth firm Clayton Utz, becoming a partner in 1985, and managing partner in 1994. Minister Bishop graduated with a Bachelor of Laws from the University of Adelaide in 1978 and attended Harvard Business School in Boston in 1996, completing the Advanced Management Program for Senior Managers. In 2017, the University of Adelaide awarded Minister Bishop the Honorary Degree of Doctor of the University for her contribution to Australian parliamentary service.

# Feeding a growing global population with healthy food from a sustainable planet

Dr Alessandro Demaio

EAT

## Abstract



Food is fuelling several of the major global challenges of our time. Current food systems fail one in two people worldwide and poor diets are now the leading risk factor for disease, globally. Food systems also represent a significant driver of environmental degradation. Yet because food cross-cuts the major health, environmental and sustainable development challenges of today, bending the curve of unhealthy, unsustainable food provides one of the greatest

opportunities to achieve our Global Goals. Mounting research demonstrates the benefits of transforming our food systems, but a crucial next step is translating this research into action. This talk outlines some of the major linkages between food, people and the planet, and presents the coming EAT–Lancet Commission on Healthy Diets from Sustainable Food Systems as well as the *Lancet* Series on the Double Burden of Malnutrition. The former will synthesise the best available science to define what constitutes a healthy diet globally and what sustainable food production looks like that preserves functional ecosystems, and the latter outlines the important opportunities for integrated action on malnutrition in all its forms.

Healthy people from a healthy planet is my topic, and it is important to start by acknowledging some great successes that have resulted from our food systems over the last 100 years. There is some doom and gloom to come, but the take-home message of the last two centuries has been one of positive success.

- Since 1900, global average life expectancies have more than doubled across the planet, and to a large degree that has been because of our food systems and the food that they deliver.
- The proportion of people that go hungry every night has halved since 1969 alone; and
- Generation after generation we have seen incremental intergenerational increases in life expectancy, height and, of course, health.

We have had a food system that was largely focused on security and quantity. Now we are starting to transition to ask questions about quality. This is the next phase, because we are starting to look at the global burden of malnutrition currently across the planet. I have just finished three years with the World Health Organization (WHO) in Geneva, and I am very focused on addressing the global burden of malnutrition.

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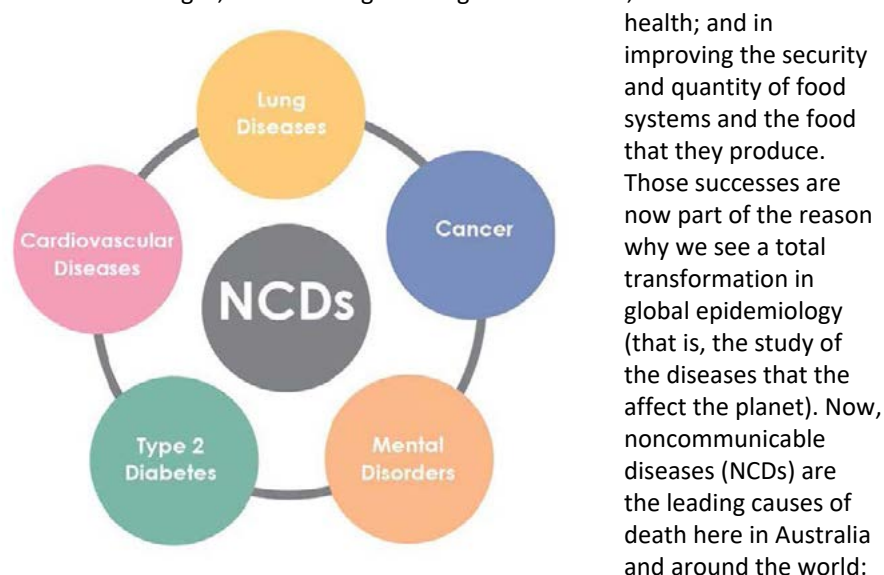
This paper has been prepared from a transcript and the illustrative slides of the presentation.

Food has been a great factor in extending life expectancies and improving qualities of life, and a major driver of economic and social development around the world. However, food also presents a major challenge.

- Two billion humans across the planet today are deficient in key vitamins and minerals, essential for their daily health.
- At the same time, more than two billion adults wake up every morning overweight or obese: around 600 million of them are obese.
- More than 800 million people go to bed every night hungry. Alarming the number that are hungry is once again rising, after decades of decreases. This rise is due largely to conflict and climate change.
- We know that 50 million children are wasted – that is, they are short, acutely hungry and thin for their age.
- Around 150 million children continue to be chronically undernourished, to the point that it permanently impairs their intellectual, social, biological and wider economic development. We know that a stunted child will expect to have an income that is roughly 20% less than that of their non-stunted counterparts by their second or third decade of life.
- And still 40 million children are overweight or obese and that number is increasing in almost every country across the planet and has no sign of reversing, let alone decreasing.

All in all, if you add that up, approximately half the planet is currently malnourished in some way, with 88% of countries facing a serious burden of either two or three forms of malnutrition. In summary, according to a 2017 Global Nutrition Report, the world is off-track to meet all its global nutrition targets.

In the 20th Century there were successes in eradicating many of the major infectious scourges; in addressing challenges to maternal, child and adolescent



(University College London 2014).

health; and in improving the security and quantity of food systems and the food that they produce. Those successes are now part of the reason why we see a total transformation in global epidemiology (that is, the study of the diseases that affect the planet). Now, noncommunicable diseases (NCDs) are the leading causes of death here in Australia and around the world:

diabetes, heart disease, cancer and chronic lung conditions, with mental illness as the often forgotten fifth. The United Nations is reconvening in September 2018 in New York for a High-Level Meeting to try and address this urgent and often overlooked – even ignored – global epidemic that causes seven in ten deaths in Australia.

We know that 80% of global diabetes and heart disease and a third of cancers are significantly delayable, to the point that we call them preventable.

### **Multiplying the burden**

The global burden of malnutrition is made even more complicated by what is called a double burden of malnutrition (or sometimes a triple or multiple burden): that is, a coexistence of multiple forms of malnutrition in an individual, either at the same point in life, or across the life course.

For instance, a young child who is born into an environment, a country, a society where food is scarce, may actually be hungry for such a long period that it permanently hinders their physical, biological, economic and social development and, of course, their growth, through stunting. Then by their second or third decade of life they are living in an environment that looks more like ours – so called ‘obesogenic’: that is, Westernised food systems with prevalent junk foods and a food system that is delivering largely calorie-dense, nutrient-poor foods, from which obesity ensues, overlain on a short individual with underdeveloped organs that are at a greater risk of chronic disease.

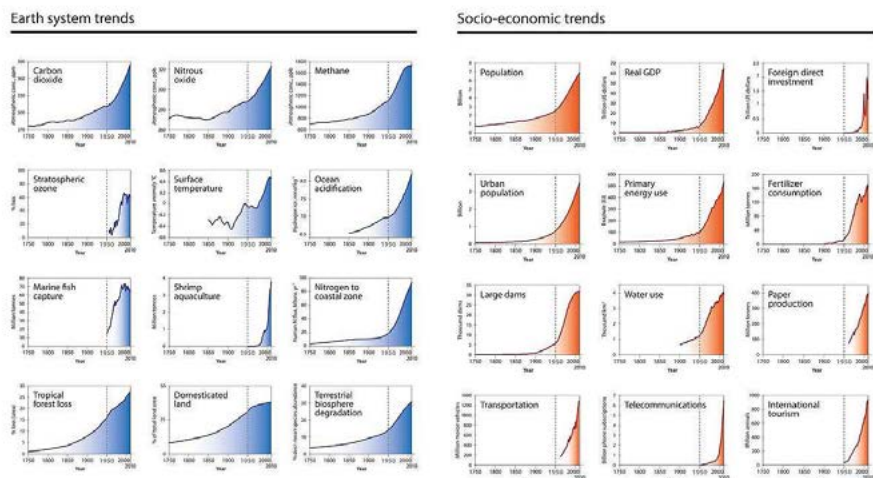
Another major example, of course, is obesity coexisting with micronutrient deficiencies – a sad reflection of the global epidemic of nutrient-poor calorie-dense junk foods and the globalisation, commodification and Westernisation of our food systems and the food they supply.

At the same time our planet is also going through a major transformation. We are leaving the Holocene era in which humanity has thrived, and entering a new stage known as the Anthropocene. In this new epoch of history, humans exist at such a planetary scale that we are influencing the climate and the way the Earth’s systems function. We see this not just in scientific journals but also reflected as a major economic threat to our planet going forward as well.

Since about 1950 we have seen an unprecedented rise in human enterprise and socio-economic trends that are synchronous with an acceleration in the impact on the Earth’s systems (Figure 1). Not only are there increasing emissions (left side of Figure 1), there is also increasing deforestation, biosphere degradation, ocean acidification and many other impacts. As a human race, we are clearly making a major mark on the planet around us, and it is not always favourable.

### **The role of food**

Over the last million years food has allowed us to grow larger brains and to develop more sophisticated cultures and, of course, come out of the caves. In the 20th Century food brought gains to life expectancies. We are now at a point in history where food is the single greatest threat to human health. Poor diets, globally and in Australia, are the single greatest risk factor for poor health and disease.

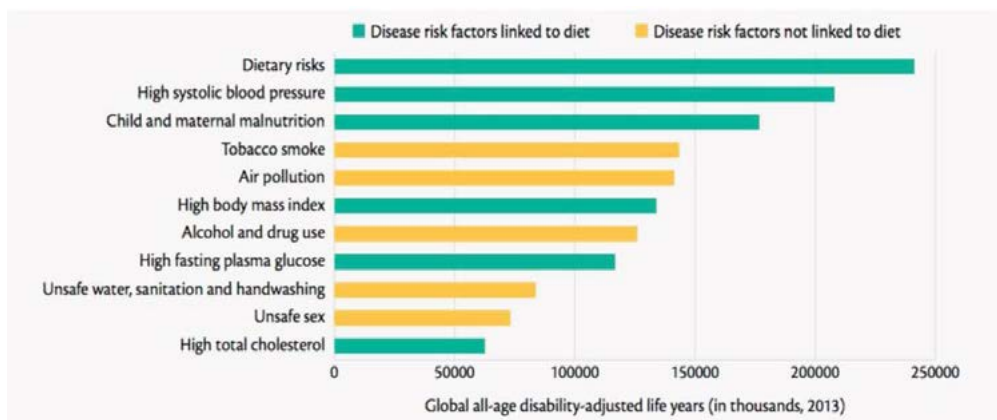


**Figure 1.** Earth-system & socio-economic trends in the Anthropocene (Steffen *et al.* 2015).

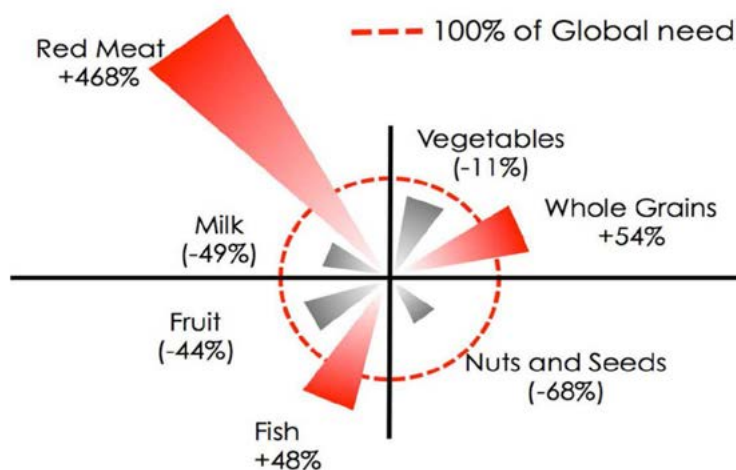
If we add up all the different risk factors, directly and indirectly affected by health in studies of the global burden of disease (e.g. Figure 2), we find that six of the top 11 risk factors are related to what we do, or do not, eat.

Although we understand what the world's people should be eating, how we get people to *do* that is a completely different story and much more complicated. However, understanding what we *should* be eating is a great starting point. The World Health Organization (WHO) guidelines recommend:

- balanced energy intake;
- a diet rich in fruit, vegetables, legumes, nuts, whole grains;
- healthy fats, unsaturated fats, lower levels of saturated fat;
- eliminating trans fats, particularly processed trans fat, from the food system;



**Figure 2.** Food fails health. Global life years, disability-adjusted (DALYs) attributed to level 2 risk factors in 2013, both sexes combined (Global Burden of Disease Study 2013 Collaborators 2015).



**Figure 3.** What we are producing (adapted from Murray (EAT 2014)).

- limiting our total free sugars to 10% or preferably 5%;
- reducing salt intake to less than 5 g/day.

Is this reflected in the food that we are actually producing? The short answer is, 'No' (Figure 3).

We are producing far more meat than the planet needs, with major ecological consequences. At the same time, the evidence suggests that we are producing far less fruit and vegetables than we need. Billions of people need to be eating more animal-source proteins, but much of the rich world needs to eat much, much less. How can we balance these two? How do we close this important gap?

Food systems are not just responsible for health challenges. Our food sector is the single greatest contributor to global greenhouse-gas-related emissions: more than 25% or almost 30% of human-produced greenhouse gases now come from our food systems. Our food systems are a major cause of disruption of flows of nutrients, including nitrogen and phosphorus which are very important in Australia in relation to total pollution. And food systems use 70% of fresh water and affect biodiversity loss and land degradation.

Although it is a great challenge for humanity to get our food systems aligned with people's priorities and long-term planetary health, food also offers incredible opportunity. Food is so central to today's major health, environmental and developmental challenges that we have a great opportunity to bring humanity back on track towards meeting the global development targets, the Sustainable Development Goals (SDGs), by 2030. Recent evidence suggests how this can be done.

### **Food can fix it**

Changing meat consumption and changing production practices are probably the best levers we can use to reverse or avoid the health and environmental effects of consumption (e.g. Poore & Nemecek 2018).



At the same time, while there is a fixation on reducing consumption of a handful of species, we often fail to recognise the thousands of edible plants and animal species that could be included in a plant-forward future. Including such species would also be a pathway to protecting biodiversity and the richness of our ecosystems.

We also see that food is an incredible opportunity for win–wins across that double burden of malnutrition.

- We know that early nutrition and food in the first thousand days of life are critical to long-term health, to setting a child and an adult up for health across their life course.
- We know that breastfeeding and protecting and promoting exclusive breastfeeding and appropriate complementary feeding are probably the two most critical things that we can do to allow an individual the healthiest life possible.
- We know we should be promoting a healthy diet that is based as much on quality as it is on quantity.

The SDGs that were outlined in 2015 are comprehensive and complicated to the point that they often seem paralysing. But food systems also offer great opportunities for integrating actions, for integrating impact across the full spectrum of the goals and the many sub-targets. Whether it is ocean sustainability, whether it is partnerships for the global goals, whether it is poverty or hunger or wellbeing and health, food is critical to all of those. Food is a great driver for achieving multiple global targets all at once.

With less than 13 years to achieve the SDGs, for most countries food and food systems provide unprecedented opportunities for achieving win–win outcomes.

### Major scientific outputs imminent

I want to draw attention to two major scientific outputs that we can expect to see in early 2019 that EAT is involved in. **The first output** (box below) is a *Lancet* series on the double burden of malnutrition, co-hosted by the WHO and our colleagues at the Food & Agriculture Organization of the United Nations (FAO).

This will focus on four papers and really try to clarify, in a confusing landscape of multiple forms of malnutrition, the opportunities that lie in addressing the double burden of malnutrition.

#### *Lancet* series on the double burden

**Paper 1:** Global nutrition transitions and the double burden (epidemiological).

**Paper 2:** New biological pathways in malnutrition (biological).

**Paper 3:** Double-duty actions for nutrition (policy).

**Paper 4:** Economics of inaction in the double burden of malnutrition (economic).

There are opportunities for using so-called ‘double duty actions’ to address forms of undernutrition at the same time as addressing overweight and obesity. Some of these are well known, such as breastfeeding, and some involve integrating other forms of malnutrition into the work that we are already doing.

For instance, we worked with the World Food Programme, delivering breakfasts to millions of children every day. Of course, that breakfast very often was a juice box and a muffin or bread roll. Integrating a healthy diet into humanitarian responses is a great example of retrofitting an existing opportunity for a double duty action on nutrition.

We are going to need to develop new types of responses: new opportunities, new initiatives that, at their outset, acknowledge that we live in this very complicated age where hunger can coexist with obesity in the same household, in the same community, in the same country. We need solutions for policy makers that will address both – and quickly.

**The second major output** is the EAT–*Lancet* Commission. It is led by the organisation I lead in Norway. Many of the Commissioners are in this audience today, and I feel a bit cheeky speaking about it when two of our Commissioners are also among today’s speakers.

The EAT–*Lancet* Commission brought together 30 world experts from across the spectrum of science, multilateral systems, environment and health. The core question was: How do we feed nearly 10 billion people by mid-century with a healthy diet that is produced sustainably? The Commission was co-chaired by the two gentlemen in the photo below: Professor Walter Willard of the Harvard School of Public Health and Johan Rockström of the Stockholm Resilience Centre.



Professor Walter Willard  
and Johan Rockström.

The discussion took in two non-negotiable hard biophysical boundaries (Figure 4). On the one hand, environmental targets were developed taking an Earth’s system approach and looking at global regulatory flows that are impacted by food production.

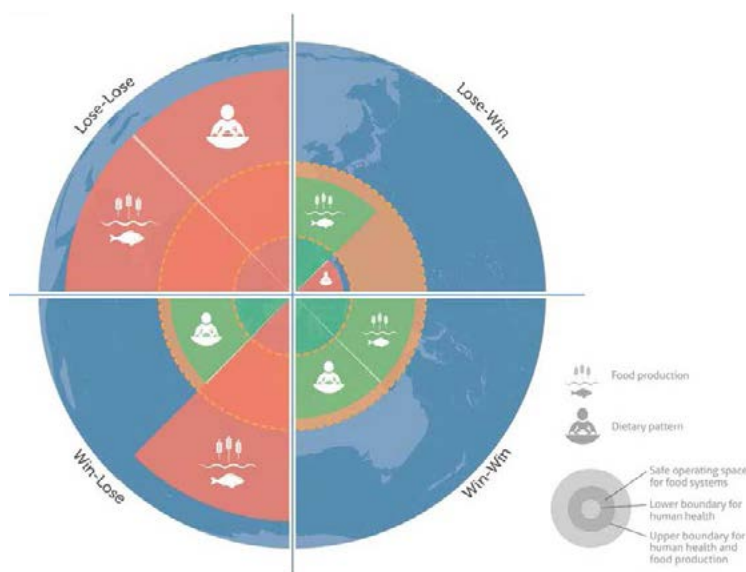
On the other hand, for health targets defined by healthy eating patterns, the Commission took a nutrient-based and food-based approach. It uses recommended ranges of intakes as well as recommendations for the food system that will provide it. Here, the *right diet* emphasises ‘not too little, not too much’ and, of course, ‘the right quality and just enough calories to protect human health’.



**Figure 4.** A safe operating space for food.

Although we have these two hard boundaries – human dietary requirements and planetary boundaries – there is a lot that can be done in the middle, and that is where the Commission mainly focused. For example: What can be done to reduce waste; to intensify agriculture sustainably; to protect and safeguard our oceans and our soil; and to shift populations to healthy diets?

We know that many diets transgress both boundaries: the so-called lose–lose diets. Other diets might be healthy but not sustainable, or sustainable but not healthy. We need to have diets in the safe operating space, meaning that they are a win–win diet for people and the planet: that is, in the bottom right part of Figure 5.



**Figure 5.** Achieving win–win diets.

In addition, the EAT–*Lancet* Commission will identify five key strategies that will help create this transition to win–win diets. These are to:

- shift a population to healthy, tasty and sustainable diets;
- realign food system priorities for people and planet;
- produce more food from less;
- safeguard our land and oceans; and
- radically reduce food loss and waste by 50% by mid-century.

Of course, the Commission is going to generate more questions than answers and this is what we would expect. So the next step for us at *this* conference today, and for the global community, and for us at EAT, is to tackle the following tough questions:

- How can trade contribute to continue healthy, sustainable and prosperous food systems?
- How do you engage people and companies in change when it means eating new foods, producing new outputs and adopting new business models?
- How do we navigate, understand and manage the fact that there will be trade-offs – that there will be those that lose in some way from this new future where planet and people are in fact protected?
- How do we use food systems change to empower women and drive gender equality?
- How do we use food systems to achieve our 2030 goal of leaving no one behind?

This last question is very important because, as I said at the beginning, our current food systems result in half the planet being malnourished, and if we are going to get anywhere close to achieving the SDGs by 2030, with a prosperous planet and population living on it, we need to get to a point where our food systems are providing diets that, indeed, leave no-one behind.

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Sandro trained and worked as a medical doctor at The Alfred Hospital in Australia. While practising as a doctor he completed a Master in Public Health including fieldwork in Cambodia. In 2010, he relocated to Denmark where he completed a PhD with the University of Copenhagen, focusing on noncommunicable diseases. His doctoral research was based in Mongolia, working with the Ministry of Health. He designed, led and reported a national epidemiological survey, sampling more than 3500 households. Sandro held a Postdoctoral Fellowship at Harvard Medical School from 2013 to 2015, and was assistant professor and course director in global health at the Copenhagen School of Global Health in Denmark. He also established and led the *PLOS* blog 'Global Health'. From November 2015 until April 2018, Sandro was Medical Officer for noncommunicable conditions and nutrition with the Department of Nutrition for Health and Development at the global headquarters of the World Health Organization. In April 2018, Sandro became Chief Executive Officer of EAT: the science-based, global platform for food systems transformation. In his pro bono work, Dr Demaio co-founded NCDFREE, a global social movement against noncommunicable diseases using social media, short film and leadership events – reaching more than 2.5 million people in its first 18 months. In 2015, he founded 'festival21', assembling and leading a team of knowledge leaders in staging a massive and unprecedented free celebration of community, food, culture and future in his hometown Melbourne. Then in 2018 and funded through his media work with ABC TV and Pan MacMillan publishers, Sandro established an independent, not-for-profit foundation focused on improving the health and nutrition of Australians. Dr Demaio currently co-hosts the ABC television show *Ask the Doctor* – an innovative and exploratory factual medical series broadcasting weekly across Australia. To date, he has published 30 scientific papers and more than 90 articles. He is also the author of *The Doctor's Diet*, a cookbook based on science and inspired by a love of good food. Sandro is fascinated by systems-innovation and leadership; impact in a post-democracy; and externality-driven disease.

## Challenges and impacts of poor nutrition

Dr Jessica Fanzo

United Nations Food & Agriculture Organization (FAO),  
and Johns Hopkins University

### Abstract



Never has there been a more urgent time to ensure that everyone has optimal nutrition. However, globally, that has not been realised. While some indicators of global health are improving, nutrition is not. Undernutrition is decreasing but way too slowly. Overweight and obesity are rising, rapidly. What we are left with is a massive, complex burden of multiple malnutrition outcomes, as a result of multiple drivers and causes. The consequences are staggering not only

for the health and wellbeing of individuals, but economically, socially and environmentally they are costly for society. Twenty-two per cent, or 150 million, children under the age of five are chronically undernourished, or stunted; 50 million children are wasted or acutely malnourished with high risk of mortality; and on the opposite side 38 million children are overweight. At this rate, global progress to reduce these forms of malnutrition is not rapid enough to meet internationally agreed global targets. Adult overweight and obesity prevalence is shocking. Over 2 billion people are overweight and obese and that number is rising in all countries from low- to high-income classifications. Obesity is a significant risk factor of diet-related noncommunicable diseases including diabetes, cardiovascular disease and some cancers. Many countries are grappling with multiple burdens of malnutrition. What actions do we need to take to address this massive burden and who should act? We have known for a long time that nutrition takes many sectors and disciplines to eradicate the multiple burdens. There is nothing new to this. What is new is how we can deliver on the 17 Sustainable Development Goals, the SDGs, which call on the world to approach development differently, through shared action. That is, to see development across the goals as part of an integrated whole and that each goal is essential for what we, as global citizens, would agree is a better, more equitable world. It is not just about what other sectors can do for us in the nutrition community to deliver our goals, but what we can do for them in delivering their goals. Food systems allow many points for intervention to improve nutrition – across the supply chain, within food environments and related to consumer behaviour. However, food systems are not static. They are rapidly transforming due to multiple drivers, including global dietary pattern shifts. With globalisation, urbanisation and income growth, people are experiencing new food environments, expanding their food choices and diversifying their dietary patterns in both positive and negative directions. Current food systems have dramatic effects on human and planetary health. They shape producers' decisions and consumers' food choices. Nevertheless, human decisions and choices

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

(whether individual or collective) regarding production and consumption can also influence food systems and improve their ability to deliver healthy and sustainable diets. The global community should embrace the SDGs as interlinked and address simultaneously all forms of malnutrition. This will require everyone who interacts with food systems and the food security mandate to act. Food supply chain and food environment actors, whether small or large, need to be valued and supported to shift towards nutrition-sensitive agriculture and food systems.

This paper gives an overview of how the world is progressing in tackling the malnutrition burden, the current state and the consequences of this burden, going a bit deeper than Sandro Demaio's paper.

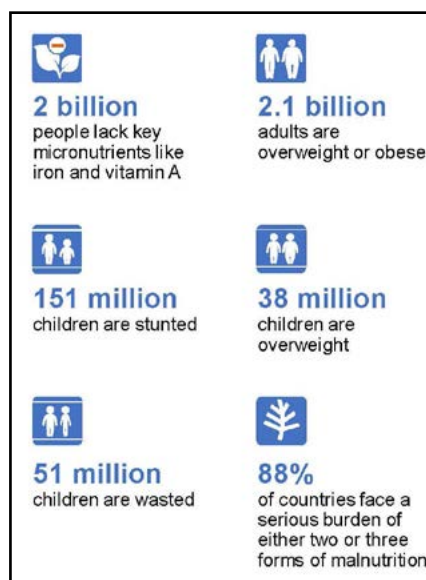
### The current burden of malnutrition

Figure 1 shows the latest statistics from the joint malnutrition estimates for the world, compiled largely by the UN. We are not doing very well. About 2 billion people are overweight or obese, 151 million, or 22% of the world's children, under five, are stunted in bodies and brains – that is a huge number of children! Numbers of wasted children, acutely malnourished due to food shortages, seasonal issues, infectious diseases, has not changed over the last decade.

The Asia-Pacific is a complex region where some countries are suffering from the highest burdens of stunting. Compared to a global average of ~22%, Papua New Guinea (PNG) has 50% stunting, Timor-Leste 50.2%, Laos 44%, Pakistan 45% – these are huge.

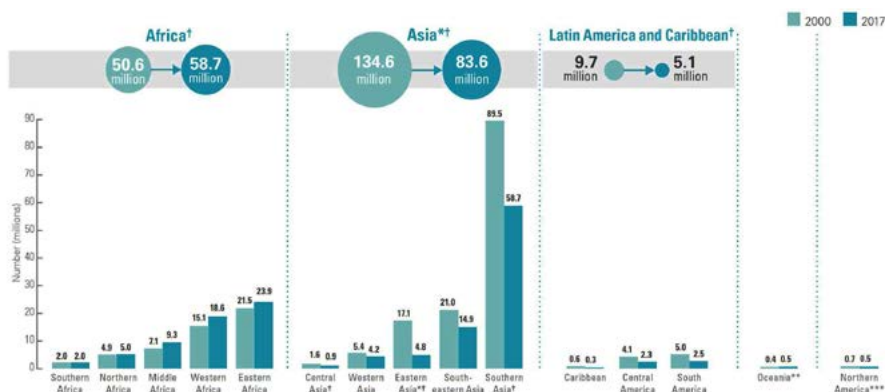
Globally, about 5.6% of children under five suffer overweight and obesity – too many – but again in this region the statistics are worse: in PNG 14% of children are overweight, so that nation is dealing with a serious double burden; Tonga 17% overweight; Indonesia 12%; Thailand 8%; Korea 7%; Australia 8%. These are big burdens to deal with.

Figure 2 shows the changing statistics of stunting over time, via subregional data, comparing the years 2000 in the light colour and 2017 in the dark colour. The proportions of stunting are coming down, so there is progress being made, but that is happening very much too slowly. The changes are happening in parts of Asia which have made big changes. China has made big improvements, and also Nepal and a number of low-income countries. However, stunting in Africa has increased from 50 million to 58 million.

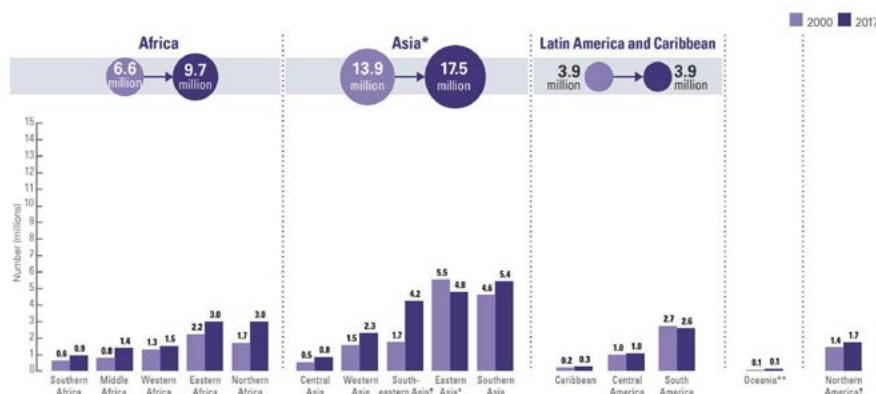


**Figure 1.** Malnutrition in all its forms is a large-scale and universal problem (*Joint Child Malnutrition Estimates 2018; Global Nutrition Report 2017; The Global Report on Food Crises 2018*).





**Figure 2.** Stunting trends in children under the age of five  
(*Joint Child Malnutrition Estimates 2018*).



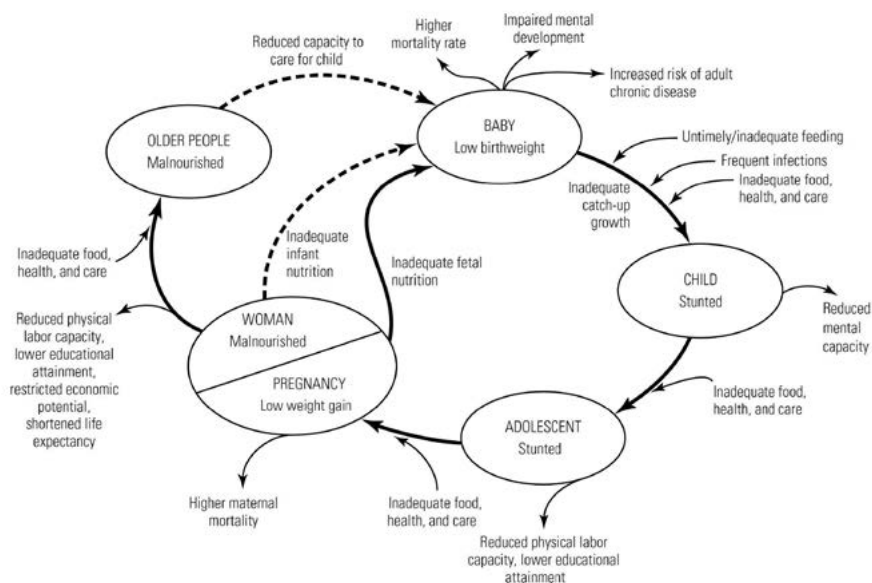
**Figure 3.** Overweight trends in children under the age of five.  
(*Joint Child Malnutrition Estimates 2018*).

If we look at overweight in children under five years of age (Figure 3), we see the opposite effect, with all the statistics going up, everywhere: Africa, Asia, Latin America. This is a big problem and a growing trend.

### The vulnerable

Every country is nutritionally vulnerable. According to the ‘2018 Global Nutrition Report’ (for release in November 2018), 41 countries suffer from a triple burden of obesity, stunting and anaemia; 54 countries suffer from overweight and anaemia; almost every country has some sort of burden, with some suffering between one and four burdens. This year’s report notes that an individual may have co-existing nutritional burdens: there can be stunting, overweight and micronutrient deficiencies in a single child. This is very complex to deal with.

The people most affected are women, young children and adolescents, with numbers of obese adolescents rising strongly. As Figure 4 shows, it is an



**Figure 4.** The cycle in women, children and adolescents.

intergenerational cycle. A woman who is undernourished, or overnourished (overweight or obese), puts her child at risk in different ways. If that child does not get adequate care and a healthy diet it will be stunted as an adolescent. The child's chances of going through school and education and fulfilment will be harder, and when the child becomes a woman, her children will then be stunted ... and this cycle just continues. The cycle can be perpetuated more strongly in places where there is conflict or lack of empowerment or disempowerment of women. Many issues feed this cycle.

The poor are nutritionally vulnerable on both sides. Among the 1.4 billion men, women and children who are the poorest 20% of the global population (the P20, living on less than \$1.90/day), most of them carry the burden of stunting. The people in the P20 are found in India, Nigeria, China, Indonesia – which will be the most populated countries by 2050.

We need to find a way to tackle the poverty issue. We know that in high income countries also, the people with obesity tend to be poorer, so this poverty situation exists at both ends of the spectrum. What are the consequences?

### Causes and consequences

The classic pathway shown in Figure 5 is called the UNICEF Causal Framework for Nutrition. Though developed in 1990 it is still functional, useful and holds true, and we still use it in the nutrition world. It shows the causes of malnutrition – both immediate and underlying – and the basic causes, and the consequences.

The causes are inadequate dietary intake and the burden of infectious disease, arising from several underlying causes: namely, food security, inadequate care in child-rearing practices, poor sanitation and hygiene, and lack of health

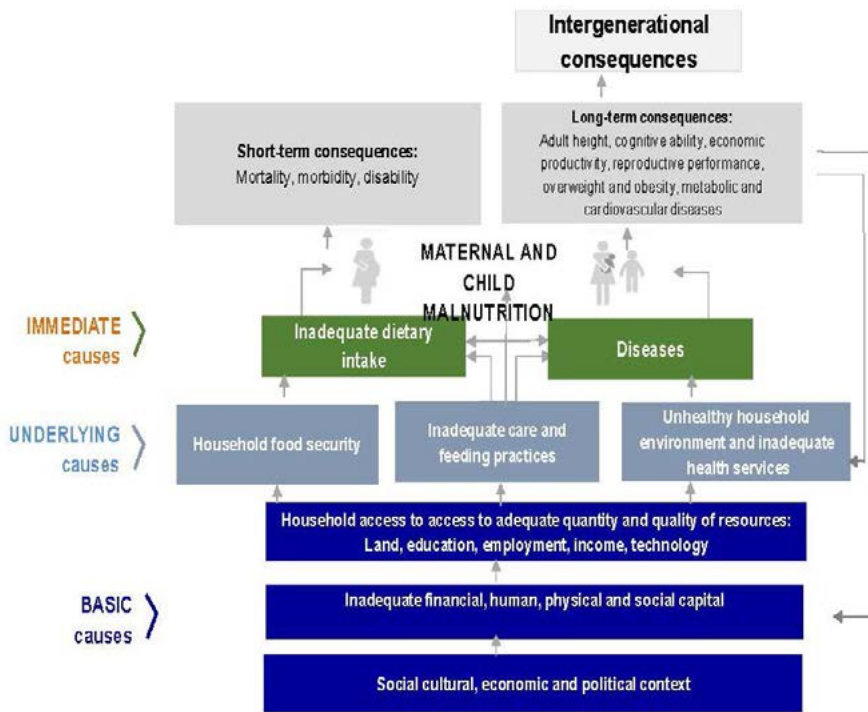


Figure 5. Causal pathway of malnutrition (UNICEF 1990, 2017).

services. In other words, it is not just food that is critical for nutrition, it is also that various sectors need to come together. And at the most basic level, Figure 5 shows the causes are governance, human capital, social capital, etcetera.

The consequences can be summed up at three different levels.

- (i) First, the health consequences: people who are overweight, obese and with inadequate nutrition have higher risk of morbidity, mortality, disability and quality of life. With undernutrition, particularly identified via stunting (as a proxy), people have a higher risk of lifelong cognitive impairments; they will never get on track. Brains develop largely in the first year of life, with some rational reasoning development continuing into the teenage years through puberty. Overall, the laying down of brain tissue happens very early in life, and if people miss out on the key nutrients to help form the brain they can expect difficulties for the rest of their lives. Undernutrition increases also the risk and pace of being obese and suffering from noncommunicable diseases (NCDs) into adulthood. Many epidemiological studies show this, and epigenetics shows that what happens early in life can have devastating consequences into adult life. In short, poor nutrition deals out a double fate.
- (ii) The social consequences: numerous studies have looked at lifetime earnings and shown that people with stunting have a 22–45% reduction in lifetime earnings. A 1% loss in adult height equates to a 1.4% loss in productivity.

Overweight, obesity and undernutrition also lead to higher lifetime health costs, for individuals and also for society.

(iii) The economic consequences: it is estimated that dealing with undernutrition can deplete national GDP (gross domestic product) by between 2% and 16% in the most-affected countries – a very debilitating impact on national development. Estimates of the cost of nourishing the 1 in 3 people who are currently malnourished include these by IFPRI\*:

- US\$7 – 265 billion annually, to 2030, to end hunger; and
- US\$7 billion annually, to 2025, to achieve the four World Health Assembly targets; namely, to reduce child stunting by 40%, halve the number of women suffering from anaemia, increase exclusive breastfeeding to 50%, and reduce child wasting to less than 5%. Also,
- global obesity is estimated to cost US\$2 trillion annually.

### **Are current actions effective?**

Are we improving these situations? Not really. Currently, most official development assistance (ODA) goes to humanitarian aid such as famine-relief in Yemen, in South Sudan and northern Nigeria. In comparison, ODA for undernutrition and long-term development is about 0.5%, which is too small to register, and ODA going towards overweight and obesity – which have a much higher burden – is 0.01%. Effectively, nutrition is not being funded.

Figure 6 shows how world food systems are changing, transitioning, shifting, and our diets are changing with them. Countries are moving from rural subsistence food systems (the left-hand block) to more modern systems (the right-hand block). Most of the world is currently described by the middle block.

On the left, there are still about a billion people going to bed hungry each day. They are smallholder farmers, subsistence farmers, still carrying high burdens of stunting and high mortality and morbidity of women and children.

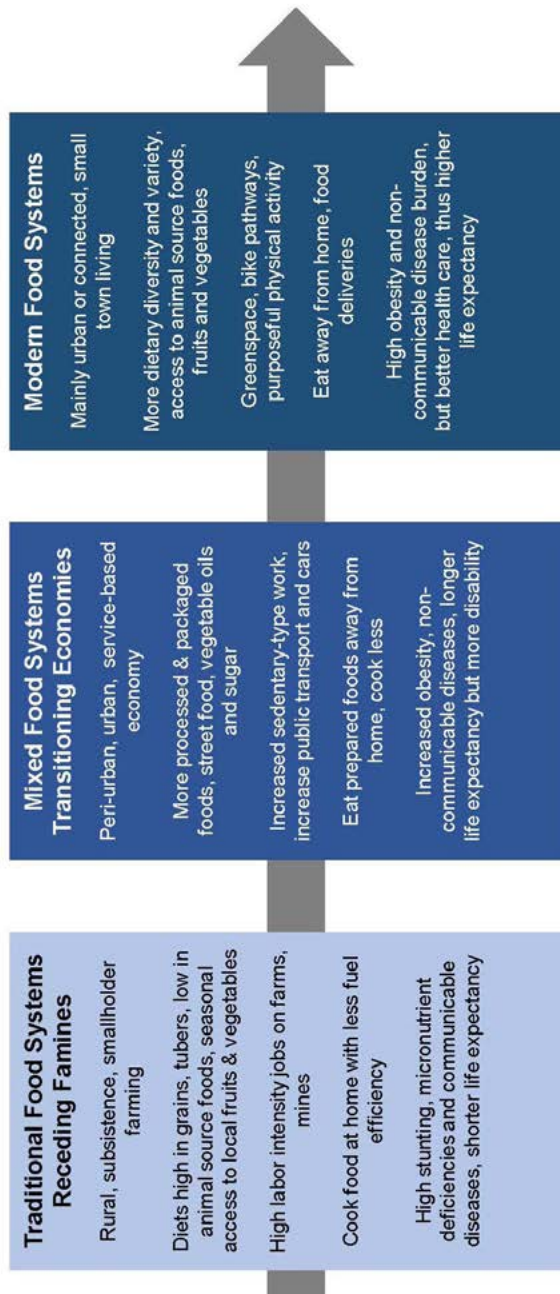
On the right, with modern food systems, people are educated – everyone at this conference, for example. We eat healthily, we purposefully exercise, we are willing to spend more money on food to be healthy.

The other 5 billion people's food systems are represented by the middle block: the processed food system. Their lifestyles are changing from rural to peri-urban; they are eating processed packaged foods; they are eating away from home, including street food. This is the population we *need* to focus on. However, that is not happening: the FAO for example focuses its work on the 1 billion hungry. It is the elite, all of us in this conference, who have the power to change things, and to care.

Sandro Demaio mentioned the Global Burden of Disease project. Diet is crucial. For example, fruits, nuts, vegetables – almost everyone, regardless of wealth, is eating too little of those foods. Very few people eat whole grains. On the other hand, people on high incomes eat too much red meat while those on low

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\* IFPRI = International Food Policy Research Institute.



**Figure 6.** Diets and food systems are transforming (adapted from Popkin & Drewnowski 1993).

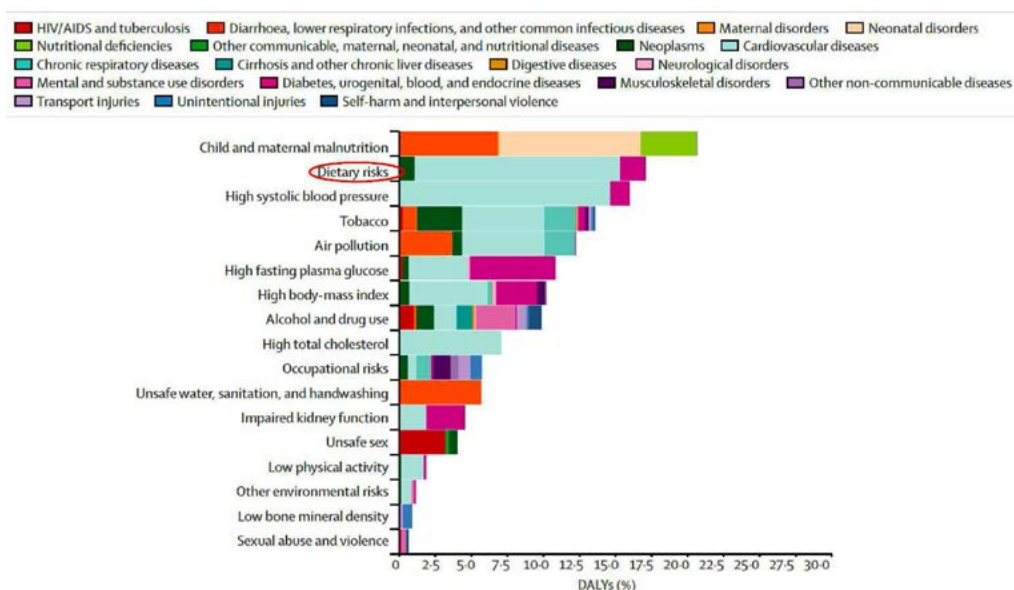
incomes get too little. Yet, every wealth group is consuming excessive sugar, sweet things and beverages, so while we could argue that wealth protects against dietary problems, sometimes that is not so. People can eat unhealthily whether they are wealthy or poor.

In Figure 7, the Global Burden of Disease chart recently published, diets (circled) are near the top of the risk factors for DALYs (disability-adjusted life years). They are second on the list (in Figure 7), largely due to cardiovascular disease (the long light blue part of the bar). The number one risk factor is still child malnutrition, for children dying of diarrhoeal disease or neonatal disease.

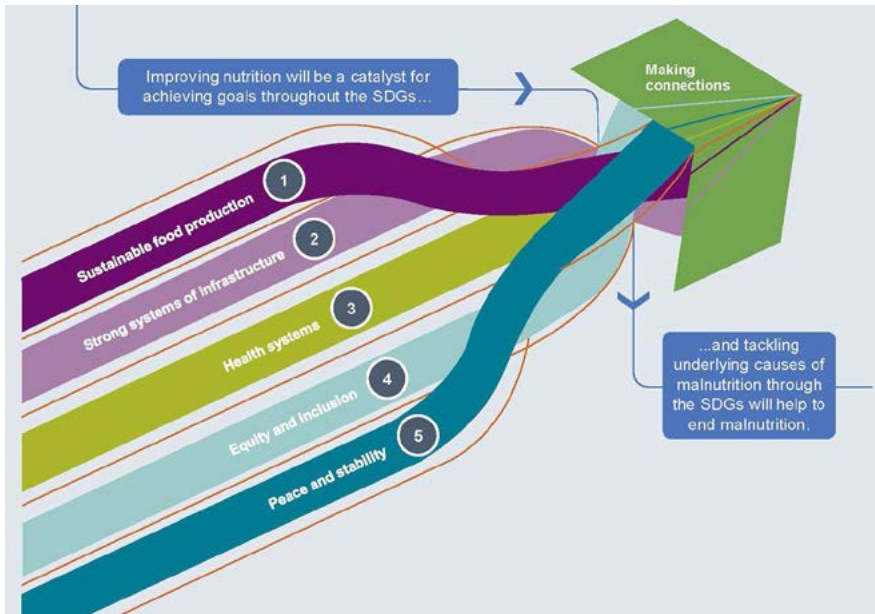
Separating this out into countries' income levels, in a low-income country children and women are still dying of undernutrition, with diet the second most important risk factor. But in high-income countries diet is the number one risk factor. Diet is the highest risk factor for morbidity and mortality in the world – more than smoking.

## Opportunities

We have an opportunity, such as by applying the Sustainable Development Goals (SDGs). I think they are important, although some people disagree. My reasons are that they are universal goals, and every country is supposed to adhere to them and try to achieve them, or strive to do so. They embrace sustainability in all of its forms, more than the Millennium Development Goals did. Many of the countries we (at this conference) work in are making plans to try and meet the SDGs, reformulating national strategies around the SDGs, or at least the ones they think are important for their country. In nutrition we are using the SDGs



**Figure 7.** Diets are a top risk factor of disease, measured as disability-adjusted life years (DALYs %) (GBD 2016 Risk Factors Collaborators 2017).



**Figure 8.** Integrating nutrition into the SDGs (Development Initiatives 2017).

as a ‘road map’. In last year’s Global Nutrition Report (Development Initiatives 2017) we created ‘building blocks’ representing what we thought was important to achieve the SDGs relating to food production and food systems; and also for infrastructure, building healthy cities, functional health systems, equity and inclusion and peace and stability (Figure 8). These are all important for nutrition. Food systems need this type of multi-sectoral sustainable-development-type approach.

The world is not on-track to meet the 2030 goals on nutrition. In an article very recently published by the Brookings Institution, Homi Kharas, John McArthur and Krista Rasmussen looked at the targets set for SDG 2 (Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture) and found that many of them will be off-track if countries apply the ‘business as usual’ approach. By 2030 there will still be a stunting burden, a wasting burden and (particularly) an overweight burden. This is a sad situation. The Global Burden of Disease project did a similar analysis in Africa, and found that probabilities of achieving the SDGs range from 5% for some African countries to 95% for others. There is a long way to go and we have to become more effective.

### Motivated?

I hope that the scale of malnutrition alarms everyone at this conference. We are all responsible – we probably have friends or colleagues dealing with malnutrition burdens; we all eat food; we all participate in the food system; we all need to do *something*. What are we going to do about it?



### **The motivation to act**

- The scale of malnutrition raises alarms.
- The societal costs of unhealthy diets and their health outcomes are considerable.
- Food systems face enormous challenges as well as opportunities.
- Solutions and evidence to act are available and leadership must come from governments and intergovernmental organisations.
- We need **disruptive change** and **action cannot wait**.
- Seize this moment to make the SDGs impactful.

There are big opportunities, so much we can do and so much evidence of how to act. We need leadership. Who owns the food system? Do governments own their country's food system? If not, how can we hold anyone accountable?

We need disruptive change, and action cannot wait.

I hope you all start from this moment to make your own changes and to act to make the SDGs impactful for nutrition.

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Jessica serves as the Senior Nutrition and Food Systems Officer in the Nutrition and Food Systems Division of the UN Food and Agriculture Organization. While at the UN, Jessica is taking a two-year leave of absence from her Bloomberg Distinguished Associate Professorship of Global Food and Agriculture Policy and Ethics at the Johns Hopkins University. She also serves as the Director of the Global Food Ethics and Policy Program at Hopkins. She is the Co-Chair of the Global Nutrition Report and was the team leader for the UN High Level Panel of Experts report on Food Systems and Nutrition. Before joining Johns Hopkins, Jessica held positions in the UN World Food Programme, Biodiversity International, the Earth Institute of Columbia University, and the Millennium Development Goal Centre at the World Agroforestry Center in Kenya. Jessica has a PhD in nutrition from the University of Arizona.

## Morning Keynote & Overview – Q&A

Panel: Dr Alessandro Demaio & Dr Jessica Fanzo

Chair: Dr Mario Herrero

**Q: Dr Peter Wynn, The University of Melbourne**

Thank you for those talks. I'm just interested, with 50 million children undernourished, how many of those are undernourished simply because of their political status either as refugees or as being politically discriminated against in societies that are suffering that imposition? How can we deal with some of the terrible stories that we hear? Particularly I instance Sudan and obviously Syria, but Sudan is a huge burden to our world society at the moment. How do we deal with those issues?

**A: Dr Jessica Fanzo**

Great question. In part of my life I work in places that are post-conflict and I think many of you have been to Timor-Leste which is a classic example of a post-conflict country with a massive burden where it is going to take decades, if not generations, to really see those numbers come down.

To answer the first part of your question, there are 150 million children stunted – that is, chronically undernourished – and 50 million who are wasted. Those numbers are calculated every couple of years through surveys; they call them Demographic and Health Surveys. They are different and distinct from the famine numbers (the IPC\*), or the food insecurity numbers. Right now, Yemen has about 10 million people who are extremely food insecure: Yemen tops the list. Afghanistan is second; South Sudan, Democratic Republic of the Congo, Central African Republic and some other countries are about third on the list, meaning they have between 5 million and 8 million people who are at extreme risk of very high levels of food insecurity. Those are different numbers from the 50 million from annual surveys. The 'wasting' number represents children suffering from an acute malnutrition episode; that survey is catching kids in a certain state due to seasonal hunger or diarrhoeal episodes. The crisis number is a very different number, and it seems to me that with climate change and geopolitics that number could potentially get worse before it gets better. The world's peaceful camaraderie is not improving either, and such tension really dismantles societies very quickly and puts people at very high risk of food insecurity quite fast.

To me it seems that the whole conflict issue is potentially worsening. The State of Food Insecurity report (SOFI), the flagship report put out by the UN FAO, reports on these undernourishment indicators every year. Last year (2017) was the first time, as Sandro said, that the hunger numbers went up, and FAO claims that was because of climate change and conflict. The SOFI 2018 report is not going to be a rosy picture. I have seen the numbers and they are worse, and again that is due to protracted crisis, conflicts, climate change.

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\* IPC = Integrated Food Security Phase Classification

**Q: Delegate from The University of Sydney**

I was just wondering, is it the government that is limiting this change, or is it the lack of people's knowledge? Who would you blame this on?

**A: Dr Alessandro Demaio**

It is a difficult situation. If we look at what has driven the major transformations over the last 100 or 150 years we think about the three great transitions: the nutrition transition; the epidemiological transition; and then the transition of globalisation and urbanisation. I wouldn't say the current situation has been, necessarily, the fault of any one group or individual. I think, as Jessica stated and the evidence would suggest, that the way we solve global malnutrition is by addressing food systems, and also food environments. To do that we need policy and population-based solutions, and in democratic societies like Australia and most parts of the world that comes back to collective action through governments.

In many parts of the world we don't see that type of collective action occurring at the rate that we would like, and then the question is: 'Why?'.

- Part of the answer is probably still, or increasingly, a disconnection from our food and food systems, particularly in our part of the world.
- Part of it is also because of active processes, driven by globalisation and the movement of people to cities. That is, our food systems have become more similar around the world, and they have also become more commodified. Food has become something you buy and sell, and with that has come an interest in buying and selling with efficiency, and with that has come the commodification of food systems and the concentration of power around large multinational companies. Then with that has come a transition of power, during the last 50 or 100 years, over who governs what we grow, manufacture and consume. And now there is a sort of dual or, we would like to think, tri-party responsibility across the private sector which has a very active hand in shaping the food systems that we all live in, increasingly, across the planet. I am referring to the 500 million or 600 million smallholder farmers, and also largely to the globalised, centralised food system that increasingly is reflected in many parts of the world.
- And third, as consumers, we all have a responsibility for what we ultimately buy and consume. But that is shaped by the food environment and the economies that underpin it, and by the policies that, in turn, shape those economies and are, in turn, shaped by those consumers and the market forces.

It is a complex interplay between all three, I think, and I am not avoiding answering the question but I think there is no simple answer.

Where the best opportunities for large-scale and rapid solutions lie, I believe, is with governments, and as Jessica pointed out – and this is one of the messages I will take from today – if governments don't own their food systems, then how do we have accountability for our food systems, and therefore how do we drive reductions in malnutrition and ensure that our food systems are actually serving people and the planet into the future? So I think it does rely largely

on governments to step up and take more responsibility for ensuring that the policies that are in place – around the private sector, and shaping our food systems, and informing our consumers – are those that are creating the right conditions for a pathway to sustainable food systems and healthy diets.

**A: Dr Jessica Fanzo**

I think also that governments prioritise – especially governments with limited resources. They have to make trade-offs. They are going to pick one thing over another: often economic growth over planetary health. When they are dealing with multiple burdens I think that often, particularly in countries that have an undernutrition burden, they have a moral pull to do something about that.

When you start to talk to governments that have this creeping obesity epidemic, and also a big undernutrition epidemic, they say: ‘Ah, don’t talk to me about the obesity. It’s immoral for us to have people hungry and starving in our country. Obesity is an individual choice; it relies on will-power; we can’t change people’s behaviours.’ You hear that a lot from government. So I think that sometimes they don’t face the obesity epidemic until it’s unavoidable and they realise the obesity epidemic has been silently creeping up in their country.

There is a lot of talk, even in the UN, about how we have a moral obligation to ensure that no-one goes to bed hungry but that obesity is different. You hear that often. Do you blame governments for that? No, I think they’re just prioritising, but I think they’re realising slowly the consequences of being an obese nation. I don’t know but it seems to me there are many times when governments have ten things on their plate and they can pick only one.

**Q: Dr Marco Wopereis, World Vegetable Center**

Thanks for great presentations. Last week I was in Manila in the Philippines and I was just flabbergasted by all the flashing billboards urging me to eat bad food. First of all, I wonder why that is still allowed. Second of all, is there a way that we can work with these fast food chains to turn this around, because that would be extremely powerful!

**A: Dr Jessica Fanzo**

Sandro will give the solutions; I’ll give the Doomsday answer. The thing is, with all these foods – and industry knows this and has capitalised on it because they have so much more research than we do about what drives consumer choice – they have tapped into taste, price and convenience, and they can advertise that, and make it very appealing and aspirational to want to consume those foods. I mean, why is Beyoncé doing Pepsi commercials? Are you going to drink a Pepsi and look like Beyoncé? I don’t think I am going to, as far as I know. I can try but I don’t think it is going to happen.

Taste, price and convenience are huge drivers for fast food, as opposed to vegetables, your ‘bread and butter’. Vegetables are a harder ‘sell’ ... ‘How do I prepare this food?’ ‘Is it convenient for me?’ ‘I don’t like broccoli, I don’t like the taste of it.’ ‘Do I have to steam it?’ It is a bit more complicated, and you have to make them taste good ... ‘Can I put mayonnaise on my broccoli and then will it taste better?’. This is a big problem. Our tastebuds crave this sugar, salt, fat. Last

night at the dinner, I was scoffing down those French fries. I don't know what any of you thought but I found them delicious, and that was because of their salt and fat! So, Sandro, how do we get over that? How do we get over this whole taste, price and convenience thing?

**A: Dr Alessandro Demaio**

I just have an anecdote. I live in Oslo and when I was working at the World Health Organization I had a conversation with a Minister for Health from the Nordic region. They have a total ban on advertising to children, and they also have a total ban on advertising alcohol, full stop, in society, because they believe that advertising is, basically, influencing what people want. It is inducing demand and if you are inducing demand for products that we know are associated with disease, that is not a very logical thing, particularly for governments that are then dealing with the outcomes and a major burden of obesity. That Nordic region has an obesity rate about one-third of the rate we have in Australia. You can connect those dots, and there are many other examples of things that would connect those dots.

I asked the Minister for Health: 'How did you get a total ban on advertising to children?', and he said, with a completely straight face, 'To be honest, Sandro, we don't understand how the rest of the world doesn't do it, if we have evidence that a six-month old can start to link advertising with products before they can speak; if we understand that advertising influences the behaviour of children; if we understand why they put cartoons on the packs of food that are high in salt, fat and sugar; if they put the product at the height in the supermarket that is perfect for a child either walking or in the trolley, and they advertise it on television.'

Australian television has some of the highest numbers of junk food advertisements anywhere in the world, so it's not just Manila. It is just as frightening here in Australia. There are solutions. There are other parts of the world where it is not appropriate to advertise unhealthy foods to kids who are still forming preferences, undermining the role of parents and influencing children: at best, making it harder for them to live a healthy life.

**A: Dr Jessica Fanzo**

Lots of things are being tried, like taxes on junk food, front-of-the-pack labelling. Lots happening to address unhealthy food environments.

**A: Dr Alessandro Demaio**

School-based programs, fiscal policies.

**Q: Hon. Gary Nairn AO, Mulloon Institute**

I am Chairman of the Mulloon Institute, an organisation doing landscape rehydration and repair, and proving that those works result in more productive and regenerative agriculture. That is a bit of background to my question.

The figures that you provide are pretty 'ordinary', obviously. However, there is a looming statistic that you really need to add to that, and that is, as I understand it, that by 2050 we can expect a global population of 9.7 billion, and by the same year we will have had to have increased our food production by 60%, doing that with, at the very least, the same footprint, but preferably a smaller one. How do

you see that challenge, on top of the existing challenge? Just having the existing challenge to deal with might be ‘nice’, but with that challenge on top of it ...?

**A: Dr Alessandro Demaio**

That is what the *Lancet* Commission focused on: a 2050 world of 9.6 billion people. We outlined lots of challenges but also lots of opportunities. One opportunity that we focused on is shifting a billion of the world’s wealthiest population worldwide to consume less and better quality meat, as a way of then also creating diets that are more sustainable and where we would be able to feed a growing population.

Another opportunity is around food waste. As was mentioned today, a third of food is wasted, approximately, worldwide. We know in countries like Australia that waste is mostly post-market. In low- and middle-income countries the food waste is still pre-market: that is, food being lost or spoiled before reaching the market. There is plenty that can be done to reduce food waste and it does not involve producing more food; it is more about not wasting the food that we do produce, or about eating less meat in high-income settings and therefore liberating those resources so they can be used to produce fruits and vegetables – the other things that we are not producing enough of.

A third area which I think is a big focus at the moment for the global community is our oceans. We know that 80% of global fish stocks are either out-fished or over-fished, but we also know that only 1% of global calories come from the ocean, which holds about 50% of global biodiversity. And we know that sustainable, probably land-based, aquaculture is going to have to be a huge part of feeding the future of the planet, and that protein from fish will be a big part of closing the protein gap that exists in many parts of the world still today, despite having said we need to reduce our meat consumption.

Those are three areas where I think there are huge opportunities, where we will see disruptive innovation that will drive huge progress on the same scale that we saw in the late 20th Century in Asia, I think. It will be on a different scale and in a different part of the world, but it will be around closing those gaps, as a way of then liberating more resources to feed a growing population.

**A: Dr Jessica Fanzo**

I agree with the questioner, in that we don’t see much family planning or reproductive health talks in presentations on food. We don’t really talk about it. The US just cut a lot of the family planning programs they were doing overseas. I think we are really at a crossroads. Around 350,000 babies – about the population of Canberra – are born every day, and many fewer people than that are dying.

I think it’s a huge challenge, and that as well as food systems transformations and some of the solutions Sandro just outlined, we also need massive transformations to happen across many systems.

We are at a crossroads with climate and population pressure and the migration issues. I always say I have a heavy heart, but I do think we have to be real in facing the challenges that we are up against. They are multiple, not just in the food system; also we need to come together on social and political challenges.

**Q:**

Sandro, you said yesterday that you really love the impatience of Millennials, but today you've said that government policy is the key mechanism for improving nutrition. Are there any other pathways that impatient Millennials can follow to improve nutrition and do you have any ideas for how we can follow them?

**A: Dr Alessandro Demaio**

Thanks for the great question!

I do think that Millennials are going to power much of the transformation that we are going to see over the next couple of decades. Not only because we will be the leaders in that future society, not only because we will inherit the mess that has been left and will need to leave the world in a much better state for future generations after us, but also because we have key comparative advantages that we talked about yesterday [at a pre-conference workshop], one of which is that we are more globally connected than any generation before us.

One of the things that I have been doing in Melbourne, through a small foundation, is establishing a festival to bring these discussions to the Melbourne community. It is a free festival. For the 2015 festival, 4000 people turned up to the Melbourne Convention Centre (we were donated the use of it). The festival will return in 2019. It is called 'festival21', and I invite everyone to join us next February (Saturday 2 February 2019, see [www.festival21.com.au](http://www.festival21.com.au)).

The objective is to drive these conversations. The festival is run by a team of 30 volunteer Millennials, with the aim of staging conversations and giving society an opportunity to come together, to reflect on who we are and where we are going, to reflect on whether that is the future we want – the answer is usually 'No' – and then to work out how we can achieve the future that we do want. I believe the biggest opportunity we have to do that is through our food.

This festival focuses on using food and food systems to achieve massive reductions in greenhouse gases; and on addressing climate change to take us to that safer climate future. It is a festival that looks at food as a way of improving health and human health and, particularly, reducing chronic disease, and it's a festival that looks at how food can be used to connect cultures and communities and create social trust and connectedness. Ironically, that is the very social trust and connectedness that we need if we are to solve the big two major challenges facing our community: climate change and obesity.

That's one example. As I said, it is now run completely by a group of volunteers. I invite you to either join the team or to join us at the festival in February in Melbourne.

## How does agriculture respond to the nutrition challenge?

Professor Andrew Campbell

Australian Centre for International Agricultural Research (ACIAR)

### Abstract



Good question! In the ‘good old days’ of agricultural research from the middle of last century, the objective was clear – increase food and fibre production to feed and clothe rapidly growing human populations. That is no longer the case. Agricultural research and policy now confront new challenges of unprecedented scale and complexity: climate change and nutrition. With fewer than one-third of the global population on a healthy diet, what is the role of agriculture? It is no longer

just about producing more food, more efficiently and more sustainably, but producing more and healthier food, efficiently and sustainably, and ensuring that it is distributed equitably. Systemically, agriculture is obviously part of the food system, but it is also central to the health system, with climate change as a risk multiplier for both. Agriculture and health have yet to come to grips with this 21st Century reality, in either science or policy. This brief overview presentation discusses this dilemma through the lens of agricultural research. We are still shaping the research agenda for nutrition in agriculture. It is clear that we will need to develop new platforms for collaboration across the food system, between the food and health systems, and between the public and private sectors. In doing so, the skills we have developed in brokering durable partnerships, the practice of involving end-users in the process of scientific inquiry, and the principle of developing enduring capabilities in science and policy in the countries with which we partner, remain more relevant than ever.

The title of my talk is a daunting question and my short answer is: ‘With difficulty!’. If this was straightforward we would have sorted it out by now. The context of the nutrition challenge has just been presented clearly by Sandro Demaio and Jessica Fanzo. My overview now zooms in on agricultural science and research.

We have seen the numbers in Figure 1 before. It does not matter how many times we see them, though, because we need to internalise them as some of the framing context for agricultural science this century. Suffice it to say that over the last 150 years or so agricultural science has shown that it can respond to very big challenges very effectively. We have done it before and I am sure we can do it again. But we are not going to succeed with the same paradigm that has brought us to where we are now.

Consider the differences between an agricultural production paradigm and a food systems paradigm: obviously there are very many more people involved

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



**Figure 1.** The nutrition challenge.



– upstream, the 570 million farmers, and downstream the 7.6 billion (rising to 9 billion) consumers.

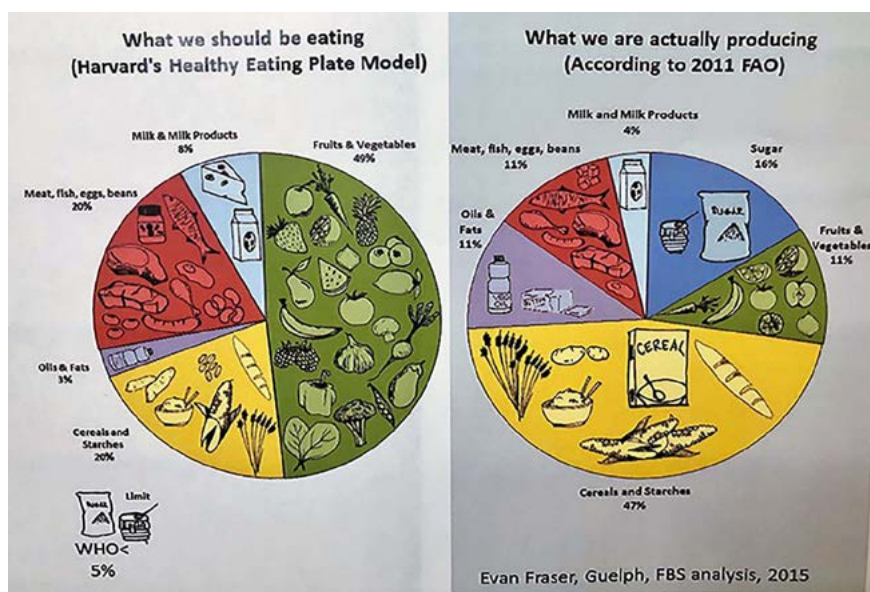
Humans now have geological-scale influence on the Earth. This epoch is therefore now known as the Anthropocene, but even in the Anthropocene the single biggest lever we have in our hands is agriculture. Agriculture employs more people than any other sector; it uses most of the world's water; it is on track to be the biggest global emitter of greenhouse gases (as a food system rather than just on-farm); it is certainly out of whack with the nitrogen cycle; it uses most of the land; it is the biggest driver of land-clearing; and so on. Agriculture is also easily the most effective way to lift people out of poverty, and that has been proven again and again. So agriculture has both the yin and the yang. It is a big powerful lever, with more power to do good than anything else.

### The pivotal role of agricultural research

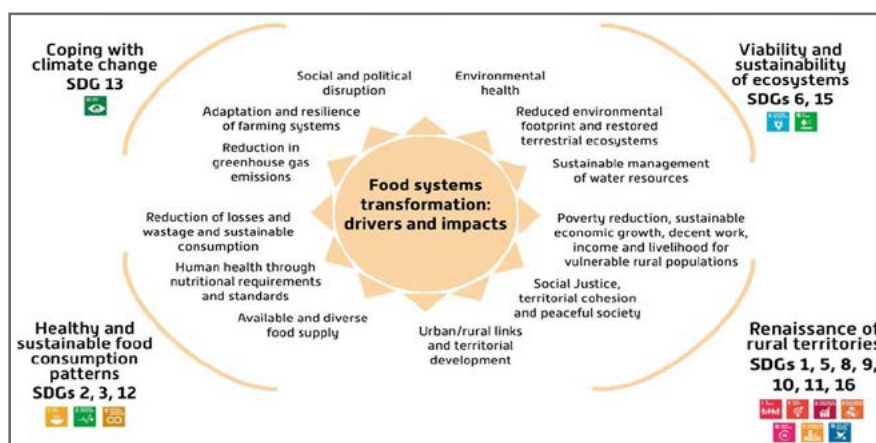
Nutrition has three dimensions: availability, access and utilisation. Agricultural science has clearly been making food 'available' for a long time and we have been spectacularly successful in terms of quantity. Nevertheless, as Fanzo and Demaio have already pointed out in this conference, there are some adjustments required on the quality side. There is already a 'menu' there – a research agenda – in each of those areas.

Agricultural science also has a very important role in improving access because, amazingly, many of those 570 million farmers do not have enough to eat, or they have an inappropriate diet. It seems crazy to think that the people producing our food are themselves often suffering from poor diets. As Jessica Fanzo said earlier, supply can shape demand, but in my opinion agriculture's role on the demand side of the equation is modest. However, we do need to be working closely with our colleagues in public health and similar disciplines.

Figure 2 is another way of looking at some of the information Sandro Demaio presented earlier today. It compares the Harvard Healthy Eating Plate model (left-hand side) with the proportions of food types being produced by agriculture, at least in 2011 (right-hand side). Clearly those two do not match: for example, humans should be eating about half our diet as fruits and vegetables, yet those commodities are about 10% of what agriculture is producing.

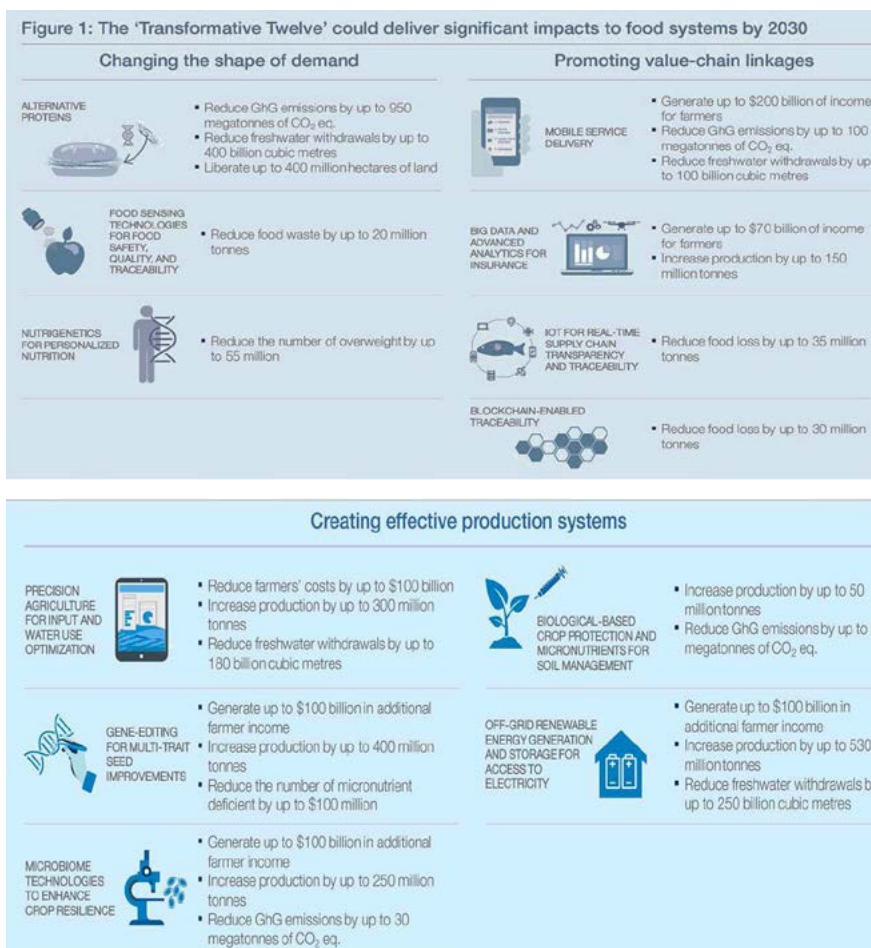


**Figure 2.** Proportions of food types in an ideal human diet (left) compared to proportions of those food types being produced globally.



**Figure 3.** Food systems are central to meeting the Sustainable Development Goals (Caron *et al.* 2018).

A paper just published by Patrick Caron and others, including several people from the CGIAR System, has made the same point as Jessica Fanzo did, summarised in Figure 3 above. The key point is that the food system is fundamental for many of the Sustainable Development Goals. The ‘footprint’ of agriculture is so big that the agenda for global thinking must include rural communities, rural territories and rural societies, which as a whole occupy a big chunk of the planet. We need to be thinking about that from the perspective of broader development.



**Figure 4.** The Fourth Industrial Revolution: high-tech silver bullets for healthy, efficient and sustainable food systems? (World Economic Forum 2018).

There is also range of technological solutions that makes the future extremely exciting. The World Economic Forum has put out a report looking at new and emerging technologies that can make a big difference – from alternative proteins to mobile service delivery (Figure 4). The penetration of the digital technologies is enormous, even in low income countries. For example, we were in the field in Myanmar recently and saw that farmers there are using multiple mobile phones, even in relatively remote and under-resourced areas.

Taken together, this is an exciting suite of technologies. Agriculture needs to be an energy producer via off-grid renewable energy generation, not just an energy consumer and purchaser. Big data, blockchain-enabled traceability, nutrigenetics, precision agriculture, gene-editing, microbiome technologies, biologically-based crop protection and micronutrients, and there are really interesting ways of using genetic modification to manipulate the characteristics of plants so that they are much more efficient as energy producers as well as

food producers. There is an appealing convergence here, and I think for the young scientists in the audience in particular, the coming decades are going to be at least as stimulating as the amazing years after the Second World War.

However, although the technological agenda in agriculture is at the 'sharp end' of innovation, it will not solve the need to make the human population healthier, nor influence societal choices.

### **Implications for agricultural science**

Until now, too often agricultural scientists have tended to think of multidisciplinary teams as maybe comprising an agronomist and economist and a farming systems modeller. Now we need to think also about how agriculture links to public health. We need to work with sectors that we are not used to working with, such as nutrition, ICT and finance – in other words, reconceiving multidisciplinary in much broader terms.

In my mental model, 'trans-disciplinarity' is different: it is when you have the end-users of the research involved in the inquiry process, and that is an absolute must in this agenda. We must have the various players in the food system involved in the process of discovery and developing solutions. There will need to be new collaborations, right across the system – including with the financial sector, with global agribusiness firms, and so on. I have been very encouraged by discussions in recent weeks with firms that do millions of transactions per day with smallholder farmers around the world. That first mile from the farm into the food system is where these firms feel they need much better data, and that is where I think there is a natural synergy between their activities and those of agricultural scientists. At scale, they can interact with farmers far better than we can.

We are under-investing in agricultural research given the size of the sector. Agriculture represents about 5% of global GDP in primary production, or 30% of global GDP over the whole food system. Yet the agricultural science sector gets only about 5% of global R&D funding, about US\$70 billion, and less than US\$1 billion of that goes to the CGIAR System, so while the CG System might have the biggest network and structure in international agricultural research it still receives a small portion of the global expenditure. Therefore, it is crucial that we think about how to make the whole system work better, not just the CGIAR.





My colleague Dr Jürgen Voegelé, the Chair of the System Council of the CGIAR and Director of Agriculture for the World Bank, makes the point that at the moment the world is spending about US\$550 billion per year on agricultural subsidies, many of which are making these problems worse. If we could arrange to have, say, 1% of that expenditure redirected into R&D via the CGIAR, we could really make a difference on some of these issues. To do that will mean forming new coalitions of investors: the global health research sector is far better at mobilising large funds than the agricultural research sector. We need to learn from their tactics in mobilising resources.

### **ACIAR projects that are making a difference**

In July and August of this year I have been in Tibet, Bangladesh and the Philippines. The photo on the previous page was taken ‘on the roof of the world’, 5000 m above sea level, on the Tibetan Plateau, the water column of Asia, the watershed for 13 of the great rivers of Asia that water over half the world’s population. Agriculture and agricultural research are shaping that watershed.

The photo above (this page) is of the Chocolate Hills of Bohol, in the conflict-vulnerable southern Philippines. This is a farm where, 20 years ago, the farming system was cassava grown by ploughing up and down the hill. Soil losses were 50–300 t/ha/year. Yields were declining by 500 kg/ha/year. The main irrigation dam was filling up at such a rate that the engineers gave it a useful-life-expectancy of less than 40 years. ACIAR and ICRAF (the World Agroforestry Centre), applying landcare techniques from Australia, have persuaded the farmers to change from growing cassava up and down the slope to growing mixed vegetables on the contours and perennial plants on permanent vegetation strips.

As a result, this particular farmer’s income for this cropping season was 9000 Philippine pesos per week, equivalent to A\$230 per week. He has extended his house and paid for his son to go through university, graduating as a professional forester. Sedimentation in the dam is now negligible, and poverty rates in the municipality are a quarter of what they were. This fourth-tier municipality won a National Nutrition award in the Philippines last year – ‘fourth tier’ meaning one of the poorest categories of municipalities in the Philippines.





The photo immediately above is of a project ACIAR is funding in Kenya with our sister organisation the Canadian International Development Research Centre (IDRC). In the big slums on the edge of Nairobi, young German and French environmental engineers have developed a new composting-toilet system. In the slums every morning the human waste is collected and used to grow black soldier flies, which multiply their biomass by a factor of a hundred in three weeks. They produce enormous maggots (top right of photo) that are then boiled and sundried and make excellent chicken food. The village chickens lay their eggs for much longer, the eggs are much higher in micronutrients, the waste material (bottom right of photo) is turned into high quality organic fertiliser and the residue is turned into bioenergy that goes back into the grid. The whole plant operates on 1 ha of land, needs no extra water, no extra energy, and is greatly improving food security.

Industrial ecology on the edges of our big cities, improving food security, water, sanitation, human health and nutrition – that is the sort of joined-up work we must be aiming for now, rather than simply trying to lift monoculture crop yields. Bigger yields are still important but they are now a tiny part of the picture.

These are just a handful of ACIAR's 200 or so applied research projects across the Indo-Pacific region, working in close partnership with scientists from the low- and middle-income countries in which we operate. The ACIAR website has more information.

### Summary

We are not going to achieve these new goals unless we have a revolution in governance (see box below). Humans are now operating at a scale we have never operated at before and we are physically changing the planet and exceeding some boundaries already. Many of the changes we are going to confront will be unpredictable. Surprises are inevitable, and so we are going to have to respond at a range of levels.

### **Governance for the Anthropocene**

- Humans are now changing the basic biogeochemical cycles of the planet.
- Exceeding some planetary boundaries already.
- On-going environmental change will challenge governments, industries and communities.
- Many responses need to be designed or interpreted at regional and local levels.
- Durable implementation depends on community support and engagement.
- Policy convergence in food, nutrition, water and health systems (risks amplified by climate change) requires integrated planning & delivery, & decentralised leadership and decision-making.
- Resilience theory warns us to look at scales above & below – need to equate the local & the global.

This means agricultural scientists and policy makers need to have the support of the general community, and that means we must use much more participatory processes than ever before.

To more effectively manage the big convergence of food, nutrition, water and health, amplified by climate change, we need to apply a much more integrated approach than we have ever used in the past. For resilience, we know it is not good enough to just focus at one scale; we need to be able to look at the scales above and the scales below the immediate focus of concern, to produce durable responses.

Global agriculture has two very big framing challenges to face. Nutrition security, along with climate change, is the mega-challenge for agriculture and agricultural and food systems research, this century. How we respond to that – intellectually, organisationally, and in a governance sense – will determine how comfortable this planet is to live on for coming generations.

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Andrew is Chief Executive Officer of the Australian Centre for International Agricultural Research (ACIAR). Through a series of influential national roles, Andrew has been at the leading edge of sustainable agriculture and natural resource management science and policy in Australia for more than 30 years. He has long been recognised for his visionary work on the relationship between people and land, firstly in developing the concept of whole farm planning, and then through Landcare, as Australia's first National Landcare Facilitator. Andrew was previously Director of the Research Institute for the Environment and Livelihoods (RIEL) at Charles Darwin University, CEO of Land & Water Australia, Managing Director of Triple Helix Consulting, and Senior Executive in the Australian Government environment portfolio. He is an honorary Professorial Fellow at Charles Darwin University and at the Australian National University's Fenner School. Andrew has written widely on landcare, knowledge management and sustainability issues for policy, science and general audiences. With training in forestry, rural sociology and knowledge systems from the University of Melbourne, and Wageningen Agricultural University in The Netherlands, his research interests (reflected in more than 100 publications) span the interactions between climate, water, energy and agrifood systems, and the interface between knowledge, science and policy. Andrew maintains an involvement in his family farm (forestry, cropping and sheep) in western Victoria, where his family has been farming since the 1860s.



# Recognising the role of the livestock sector in human health and nutrition

Dr Anna Okello

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## Abstract



Global livestock narratives have hit an interesting, and increasingly conflicting, point in recent history, with the often-lauded 'livestock revolution' accompanied by increasing 'anti-livestock' rhetoric driven largely by environmental concerns and calls to decrease, and in some cases halt, global production and consumption of animal-source foods altogether. However, while the world's wealthier countries have ready access to a broad and diverse range of healthy plant-based

diet alternatives, animal-source foods remain integral to the health and economies of an estimated 70% of the world's rural poor. Moreover, existing opportunities for smallholder and pastoralist livestock-keepers to contribute to improved human health and nutrition are often overlooked by 'blanket' narratives that fail to appreciate the distinct differences between commercial and smallholder/pastoralist livestock systems. Smallholder livestock producers have opportunities to directly contribute to improved human health and nutrition through improving the quality, sufficiency and safety of animal-source foods. Livestock-keeping also has indirect benefits: for example, livestock-derived income can facilitate better and more diverse food choices, and promote health-seeking behaviour and illness-prevention measures. Good governance of smallholder livestock sectors that promotes the social, economic and nutritional benefits of livestock-keeping, while minimising environmental, welfare and public health impacts of livestock intensification, is a balancing act; but one that has never been more important as the world's population continues to grow.

The focus of my work in ACIAR's Livestock Systems Programme is 'One Health'. One Health explores the increasingly complex issues at the human–animal–ecosystems interface. I doubt that anyone in this room would dispute there is a linkage between livestock and human health and nutrition. However, will that also be so in the future?

Understanding trends, and ensuring we are investing in systems and technologies that will still be relevant for the next 20 years, and beyond, is an important part of what we do at ACIAR. At first glance, livestock systems seem a pretty good bet to remain relevant. Demand for animal-source foods is expected to rise by 70% by 2050, to feed an estimated global population of around 9.6 billion. However, we cannot deny that global livestock narratives are moving towards an increasingly interesting and important 'crossroads', and the outcomes will continue to shape human and animal nutrition for the foreseeable future.

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



**Figure 1.** Direct roles of livestock in human health and nutrition. (Image ©FAO/Karel Prinsloo, at Qardho, Somalia, at a displaced-persons' camp. The girl holds a mug of goat's milk.)

### Direct contributions to human health and nutrition

For millennia, livestock have directly affected human health and nutrition, and continue to do so (Figure 1). For instance, dietary change, around 2.3 million years ago, from plant-based foods to partially animal-source foods, was the catalyst for humans to develop larger brains, which led to different physical outcomes such as bipedal motion. Domestication of plants and animals led to more stable food supplies, which encouraged communities to become more sedentary than nomadic and changed societal development. Also, authors including Jarred Diamond have noted that close contact with livestock helped human immune systems develop and change, in response to zoonotic disease.

Currently, livestock provide 14% of the total calories and one-third of the global protein consumed on the planet. Animal-source foods also help combat micronutrient deficiency, or 'hidden hunger', by providing people with essential vitamins and minerals in an efficient way: I have been told that you would have to eat the equivalent of 17 bananas to get the same intake of vitamin A contained in 100 g of sardines. Animal-source foods, particularly eggs and milk, are a source of dietary diversity and supplement, and during times of grain shortage and famine animal-source foods help cover the nutritional gap. They have an important role in overall food security and our humanitarian response to such situations.

Animals are also a source of human disease: over 60% of the diseases that we can get as humans come from animals; the types of pathogens and the risk pathways differ depending on the species and type of production system.

### Indirect contributions to human health and nutrition

Livestock production also has a number of multiplier effects (Figure 2), particularly in countries where incomes are low or middling, where ACIAR's work is focused. These effects are often much harder to define and quantify.

The obvious example is that the production and sale of livestock generate household income which in theory, and often in reality, can result in improved choice and diversity of diet. There can be negative as well as positive consequences.

**Livestock make indirect contributions to health and nutrition**

- Income generation – improved choice and diversity
- Animal traction and manure boost crop productivity
- Financial instruments – alternative for savings storage
- Social status – access to services, resources, increased risk factors
- Gender differences in access to – and impact of – livestock resources

**Figure 2.** Indirect roles of livestock in human health and nutrition.

Livestock are also vital for pulling equipment, carrying goods such as water and trade items, and for producing manure: very important roles in sub-Saharan Africa. Manure helps boost crop productivity and hence food security, and nutrition is an important component of that. And livestock are a well-documented 'bank'; animals can be rapidly converted into cash which improves household resilience to unexpected shocks such as sick family members. Livestock investment and ownership also often lifts a smallholder's social status. There are numerous benefits to this in terms of social security and access to natural resources.

There can also be some negative benefits in terms of social standing; for example, outbreaks of some foodborne parasites in South East Asia have been linked to attendance at wedding and funeral celebrations. Also there are negative gender aspects of livestock's impacts to health and nutrition which must be acknowledged; for example, women are often disproportionately impacted by zoonotic diseases, through their role in husbandry and the handling of raw meat during food preparation.

In summary, there are many positives to the production and consumption of livestock products; but if the risks are not known or not mitigated then there are also potentially negative consequences to the health of individuals, communities and the broader ecosystems within which animal and humans coexist.

### **Global narratives**

In terms of global livestock narratives, since the turn of the century there have been two main themes. On the one hand, the livestock revolution – the narrative that acknowledges that animal-source foods are a means to meeting the growing nutrition requirements for a growing global population, particularly in many emerging and middle income economies.

On the other hand, there are very real and valid narratives around negative impacts to health, nutrition and the environment from consuming animal-source foods. In the more extreme cases these are accompanied by calls for the world to go vegan, or to end animal husbandry altogether and instead rely on cheap sources of artificial meat which is increasingly available.

However, you cannot compare average western meat consumption – around 100 kg/head/year – and meat consumption in sub-Saharan Africa which is less than 10% of western levels. The choices these people face are not equivalent.

### Need for balanced communication

Having outlined the background, my objective now in this presentation is to promote balanced and inclusive problem statements about livestock production.

Balanced statements need to make it clear that different livestock production systems offer different effects, risks and opportunities, depending on the livestock species and on the system in which these species are produced.

Naturally, balanced statements will also acknowledge the multiplier effects of livestock production, and the risk to humans, animals and the broader environment and, very important, the opportunities to mitigate these risks.

Contrast the two images in Figure 3: on the left, sheep in a laneway in Tasmania; on the right, one of our small ruminant projects in Pakistan, in Sindh Province. The differences are stark, but look beyond the obvious socioeconomic or environmental differences and focus on the different production systems, namely the commercial sheep station versus a smallholder sheep and goat enterprise. It is important to be thinking about the broader challenges and the opportunities that each of these different types of production systems presents, and what each context contributes to human health and nutrition.

Looking at it from a livestock systems perspective, there are several overarching criteria that define each production type. In general, commercial systems are characterised by high inputs, high outputs, large land size, large numbers of animals, linkages into formal market chains and, more often than not, some form of paid labour – at least during certain times of the year. Smallholder systems, on the other hand, tend to be low-input low-output, exist on relatively small land sizes and have fewer animals. More often than not they supply informal market chains, and they use free (often family) labour. Both systems are of extreme importance to the overall health and food security of the populations they are feeding, but we cannot deny these systems are different and will therefore require different sets of solutions to mitigate the potential risks of each.



**Figure 3.** Contrasting production systems. *Left:* sheep in a large-scale operation in Tasmania, Australia (*from Google images*); *right:* sheep, goats and cattle in a smallholding in Sindh Province, Pakistan (*photo: Rebecca Doyle, the University of Melbourne*).

We need to consider what happens if problem statements are *not* inclusive and do *not* recognise that these are two distinct but interrelated global livestock production systems.

What happens when we do *not* acknowledge that (i) the two systems may pose *different* risks to the health of humans, animals and the broader ecosystems in which they coexist, and that (ii) each system may require a different set of solutions?

Importantly, what happens if we do not acknowledge the role of livestock in the broader social, economic and cultural fabrics of our various societies, and that in many cases those roles extend far beyond contributing meat and milk to the country's GDP?

### **Consequences**

There are consequences to imbalanced and non-exclusive problem statements. According to the Global Livestock Advocacy for Development initiative (GLAD), funded by the Bill and Melinda Gates Foundation, the livestock sector receives no more than 2.5% of official development assistance (ODA) for agriculture from major donor countries, despite contributing up to 40% of agricultural GDP – and 80% of total assets to rural farmers in East Africa.

The International Livestock Research Institute (ILRI) claims that a so-called 'increasingly anti-livestock rhetoric', highlighting the valid but negative aspects of livestock production, is starting to exert undue influence on global livestock investments and policies. From that, according to ILRI, people are beginning to question why aid agencies should put money into livestock if the animals are so bad for the environment and human health.

The obvious risk from this movement is its potential negative impact on the 900 million global poor, half of whom depend directly on livestock for their health and livelihoods.

It is up to those of us working in international agricultural development to ensure that our problem statements and our research questions – and therefore our solutions – are inclusive of both the smallholders and the pastoralists who provide a large proportion of the world's animal-source foods, and who depend both directly and indirectly on livestock for their health, nutrition and broader livelihoods.


### **What ACIAR is doing to negate those potential consequences**

ACIAR's Livestock Systems Research Programme takes this responsibility seriously (Figure 4), with a focus on smallholder and pasture systems, anchored around six key themes. One of the themes is

- to better understand the linkages and the contributions of livestock to human health, nutrition and wellbeing, particularly in relation to some of the multiplier or indirect effects mentioned above.

We also emphasise holistic approaches, being acutely aware that intervention in one part of the system is very likely to have impacts on other parts of the system

**ACIAR Livestock Systems Programme:**  
**“Livestock research for people, animals and the environment”**



- **Holistic view of livestock systems** - animal welfare, health, production, human health and environmental impacts
- Focus is on **smallholder** crop-livestock and pastoralist systems
- **Six thematic areas:**
  - 6 - Understand and promote the contribution of livestock to human nutrition, health and wellbeing

**“Research that promotes a more inclusive understanding of livestock’s contribution to women, men and their families will assist the global debate”**

aciar.gov.au

**Figure 4.** ACIAR’s Livestock Systems Programme themes. (*Image: ACIAR website.*)

– such as the environment or human health. Impacts may be either positive or negative, and ACIAR is interested in how these things can be addressed.

Ensuring that problem statements are inclusive – that they promote social, economic and nutritional benefits of livestock keeping, to women, men and their families while minimising environmental, animal welfare and public health impacts of livestock production – is a crucial balancing act.

This is a conversation we need to have, and one that has never been more important.

## Reference

ACIAR Livestock Systems Programme:

<https://www.aciar.gov.au/programarea/Livestock%2520Production%2520Systems>

Anna is the Research Programme Manager of Livestock Systems at ACIAR. Since graduating with a veterinary degree from The University of Melbourne in 2002, the majority of Anna’s career has been spent working in the veterinary public health and livestock development sectors, including 10 years researching zoonotic Neglected Tropical Disease control in sub-Saharan Africa and South East Asia. Anna completed a PhD in political science (public health policy) at the University of Edinburgh’s Centre for African Studies in 2012, and has worked in various project management and technical advisory roles for international NGOs, the Australian Government, the World Health Organization and the University of Edinburgh. Anna holds an adjunct teaching position at the University of Edinburgh’s Global Health Academy, and is the One Health Adviser to the Australian Indo-Pacific Centre for Health Security.

# Breaking the food-system divide with Smart Food: good for you, the planet and the farmer

Joanna Kane-Potaka

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)  
& 'Smart Food'

## Abstract



The 'food-system divide' – which is rarely talked about, let alone challenged – is one of the biggest hindrances to achieving a healthy population and sustainable and viable agricultural systems in developing countries. For decades, the majority of investments, whether on R&D, or big company investment, or policy support, or product development or even development aid, have been funnelled into just three major crops: rice, wheat and maize. These 'Big 3' crops provide 50% of the world's calories and protein. As a result, their value chains are well developed and supported, making it very difficult to 'mainstream' other foods. The need for greater diversity in diets and on-farm is well known. Meeting that need will require mainstreaming and ensuring the viability of more foods. This should not be tackled with just any food but with food that is 'good for you (nutritious and healthy), good for the planet (environmentally sustainable) and good for the farmer (viable and climate smart)'; that is our definition of Smart Food. The Smart Food initiative aims to learn from the successes of the 'Big 3' and create the 'Big 5' and eventually the 'Big 7', and so on. Smart Food will focus especially on foods that can be eaten as staples. This way, we will have a major impact on some of the leading global issues. As Smart Food is good for you and the planet and the farmer, these three qualities can in unison contribute to healthy people and sustainable and viable agriculture.

This talk presents just one solution, but it is a solution that can have a huge impact. As Jessica Fanzo said earlier, we need 'business *not* as usual', and that is an idea that is relevant to both lower- and higher-income countries.

In the development world, decades ago, the main focus was on food security – about just having enough food to eat to stop starvation. Then came the awareness of 'hidden hunger' – adding nutrition security to food security. Nowadays, the UN talks about 'sustainable diets' – diets that are more sustainable on the environment. At ICRISAT we are saying that there should be a further step: that we should pull all those foci together into a new focus on what we call 'Smart Food'.

We define 'Smart Food' as: good for you, with high nutrition and health benefits; good for the planet, being environmentally sustainable; and good for the farmer. There is a need to find solutions that focus on smart foods and develop the value chains to support them. Our biggest challenge in that task is what I have termed the 'food-system divide'.

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



### **The ‘food-system divide’ and how to cross it**

For decades the vast majority of investments have flowed to the ‘Big 3’ crops: wheat, maize and rice. Whether it is R&D, private industry investment, policy support, product development, or even development aid, the Big 3 have received the lion’s share across the globe.

This is a problem because it has led to crops being grown in inappropriate agroecologies. This can negatively impact on the natural resources, and increase risk for farmers. It is also well known that globally we need more diversity on-farm, we need more diversity in our diets and more nutritious diets. Yet, in lower- and middle-income countries, typically 70% of people’s meals will consist of just one staple\*. Where that staple is rice, for example, 70% of the food on a plate will be white refined rice, repeated for three meals a day.

Rice and wheat became big, industrialised and well supported foods during the Green Revolution when there was a dedicated focus on these crops. We need to learn from this – learn how such a radical change in the agricultural systems and consumer diets happened. We need to learn how revolutionary change can happen, and use this to make another revolutionary change to create the ‘Big 5’, and eventually the ‘Big 7’.

Key to the Smart Food movement is its focus on staples. The diversifying of diets is a big focus for most development agencies, but very few people are focusing on diversifying staples. Vegetables, for example, have a big focus and are extremely healthy, but they are not staple food and so typically form less than 30% of the food on the plate; possibly only 10%. This means it is more difficult for them to have a major impact on the nutritional intake.

We have to change peoples’ habits of eating mainly one food such as rice. If we do not change habits then there are not going to be the changes in global diets that are needed, both nutritionally and environmentally and for farmers’ sakes.

Therefore we have set up the Smart Food movement.

### **Smart Food movement**

Under the Smart Food movement, ICRISAT has chosen a couple of smart foods and dedicated resources to them, with the aim of converting the Big 3 into the Big 5. The smart foods we chose are millets and sorghum, which used to be traditional staple foods across many countries in Africa, and in India and some areas in China and other Asian countries.

These dryland cereals, now termed ‘nutria-cereals’ in India, fit the criteria of a Smart Food. For example, finger millet has three times the amount of calcium in milk – a huge amount.

Three of the millets are very rich in iron and zinc, which are two of the three micronutrients most widely lacked across the world. Anaemia, which is

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\* National Geographic Society defines staples as food that ‘makes up the dominant part of a population’s diet. Food staples are eaten regularly – even daily – and supply a major proportion of a person’s energy and nutritional needs’. <https://www.nationalgeographic.org/encyclopedia/food-staple/>



becoming increasingly prevalent, is counteracted by iron; iron is an important micronutrient for pregnant women, and lack of iron affects the next generation.

These millets contain typically two to four times the amount of iron in meat. Even though plant-based iron is not so easily absorbed as meat-based iron, consumers can still receive as much iron from these millets as from meat.

The chosen cereals have other benefits, including low glycaemic index and twice as much protein as milk. They need minimal pesticides and fertiliser; they have a low carbon footprint. They survive with three times less water than wheat, and ten times less water than rice – pearl millet is typically described as the last crop standing in times of drought – and they are very hardy and withstand extremely high temperatures as well. These cereals are going to be another important solution to maintaining food supplies in the face of climate change. They have multiple uses: as human food, as fodder, as biofuel, and in brewing.

Millets and sorghum also fit the key health-food trends in developed countries: being gluten-free, a ‘superfood’, an ancient grain, low glycaemic index, rich in antioxidants, high in fibre, and they even support weight loss.

Having identified these hidden resources, the next challenge is how to make these cereals not merely popular but ‘mainstreamed’; not just staples in developing countries but also major industrial crops in the developed world as well.

Our methodology to achieve this has four parts, as outlined here.

- (i) *Scientific backing for the concept.* The biggest criticism of superfoods was that they were not quantified, so anybody can call something a ‘superfood’. We are defining criteria for a Smart Food, and we will publish the scientific case behind our claim that these millets and sorghum are ‘good for you, good for the planet, good for the farmer’, while also developing a certification scheme for Smart Food.
- (ii) *Driving demand from consumers.* This needs to be undertaken at the country level. We are creating consumer awareness; creating a ‘buzz’ around these foods. We aim to change the image of these cereals – and we are working with food processors and the food service industry because to satisfy consumer demand we must have convenient tasty products available.
- (iii) *Ensuring that farmers benefit.* When market demand for these smart foods grows, it is important that the farmers receive a fair deal, especially the smallholder farmers in the lower-income countries. We need to develop the value chains so the farmers are engaged and maximise their benefits.
- (iv) *Filling knowledge gaps.* There are a lot of knowledge gaps for these less invested foods, and they need much R&D. We need to be a catalyst for more R&D and ensure this information feeds into the system and solutions.

In conclusion, there are three huge advantages in this initiative. First, because we are focusing on Smart Food, which is defined as being ‘good for you, good for the planet, good for the farmer’, we can help solve several big global issues in unison, such as rural poverty, hunger, malnutrition, environmental issues,



**Figure 1.** A still from the Smart Food reality TV show in Kenya.  
<https://www.youtube.com/watch?v=7i-LB9DNgQM&feature=youtu.be>

and dealing with climate change. The second big advantage is that because we aim to diversify staples, we can have a massive impact. The third big advantage is that in both low-income countries and high-income countries we can develop new large industries, benefiting farmers, food processors, traders, and the whole value chain.

### Looking for partners

I am here to find partners. We welcome anyone who would like to partner with us to achieve our vision of Smart Food.

For more inspiration, please watch the short ‘trailer’ video (50 seconds; Figure 1) of our Reality TV show, an initiative we have set up to drive consumer demand.

‘Reality TV for a cause’, as I call it, is a Smart Food reality TV show in Kenya. It was supported by USAID funding in its first year. This initiative was so successful in its first season that now it is self-sufficient through sponsorship.

Joanna is the Assistant Director General, External Relations, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and Executive Director of Smart Food. She began her career as an agricultural economist with the Australian Bureau of Agricultural and Resource Economics and later moved into market research in the agribusiness area of the Queensland Department of Primary Industries. She has also worked in private industry and with four CGIAR agricultural research centres in Sri Lanka, Italy, Malaysia and the Philippines and is currently based in India. She also leads the global Smart Food movement which was selected in 2017 by USAID and the Australian Department of Foreign Affairs and Trade as one of the 10 winning global food innovations.

# Tapping the nutritional power of vegetables

Dr Marco Wopereis

World Vegetable Center (WorldVeg)

## Abstract



Vegetables add diversity, flavour and nutritional quality to diets and provide greater profits and employment per hectare than cereals. On-farm productivity of vegetables in low-income tropical and subtropical countries is generally low and highly variable. Public-private sector networks are crucial for piloting and scaling-up innovations to raise productivity in a safe and sustainable manner – including varietal improvement, pest and disease management, and protected cultivation – and to reduce postharvest losses. The nutritional power of vegetables can be tapped on an intensification gradient, from home gardens aimed at family nutrition to intensive market-oriented vegetable farming to address the growing demand for vegetables at affordable prices. Home garden interventions in Africa and Asia that combined training in vegetable production with communication activities targeting nutrition and health behaviours increased vegetable consumption among rural households vulnerable to micronutrient deficiencies. Less is known about the effectiveness of sack and vertical gardens in urban slums. Training and linking youth with markets for quality vegetables in East Africa showed promise in creating income and employment. Training farmers in off-season tomato production in Bangladesh led to dramatic income improvements but also increased pesticide use. Evidence from Tanzania highlights the market potential of often neglected nutrient-dense indigenous vegetables, such as amaranth and African eggplant. The effect of farm diversification on dietary diversity of farming households seems small, with market access being more important. To tap the nutritional power of vegetables, governments and donors must give greater priority to the vegetable sector through a combination of supply and demand (behaviour change) interventions.

This presentation about vegetables and nutrition first outlines some of the diversity in vegetables, because they do not all have the same nutritional power. Then it discusses how to mobilise that power for rural and urban consumers.

## Vegetable production and nutritional power

Vegetable production in Asia is big business. The farm-gate value of vegetable production is about US\$365 billion – not far below the value of cereal production (Figure 1). The biggest contributors (grey and green in the chart) are India and China.

These statistics, collected by FAO, deal mainly with global vegetables, listed in the right-hand chart: tomatoes, cucurbits, chillies, alliums, ..., lettuce, okra.

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

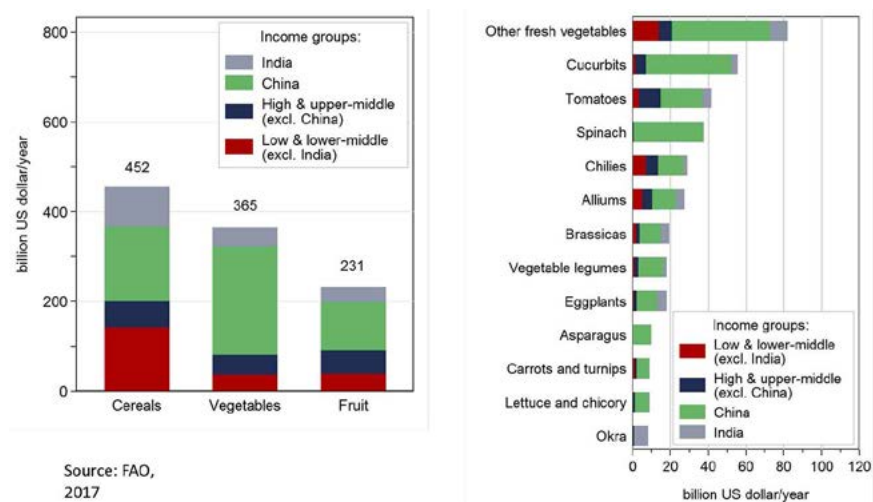


Figure 1. Vegetable production in Asia – big business.


There are also many traditional vegetables. Figure 2 shows seven vegetables that are traditional in East Africa: for example, amaranth, African nightshade, Ethiopian mustard. These are very important in rural areas, where they provide a lot of flavour and diversity to people's plates.

The traditional vegetables are important because they are very rich in nutrients. For comparison, Figure 3 shows the nutritional value of cabbage (grey column) compared to the nutritional values of some of these traditional vegetables. The micronutrient content of these four traditional vegetables is clearly much higher



Figure 2. Traditional vegetables in East Africa.

Micronutrient content of common and traditional vegetables



	Ranges	Cabbage	Moringa	Amaranth	Albika	Sweet potato leaf
$\beta$ -Carotene, mg	0.0 - 22	0.00	15.28	9.23	5.11	6.82
Vit C, mg	1.1 - 353	22	459	113	82	81
Vit E, mg	0.0 - 71	0.05	25.25	3.44	4.51	4.69
Iron, mg	0.2 - 26	0.30	10.09	5.54	1.40	1.88
Folates, $\mu$ g	2.8 - 175	ND	93	78	177	39
Antioxidant activity, TE	0.6 - 82,000	496	2858	394	560	870

Source: WorldVeg Nutrition Lab

Figure 3. Traditional vegetables: robust and rich in nutrients.

than that of cabbage. Growers can also make money out of these traditional vegetables, with urban consumers rediscovering them.

Figure 4 presents data from 250 farmers WorldVeg worked with in Tanzania. Traditional vegetables are as profitable as tomato, and vegetables in general are much more profitable than maize. This result illustrates the market potential of

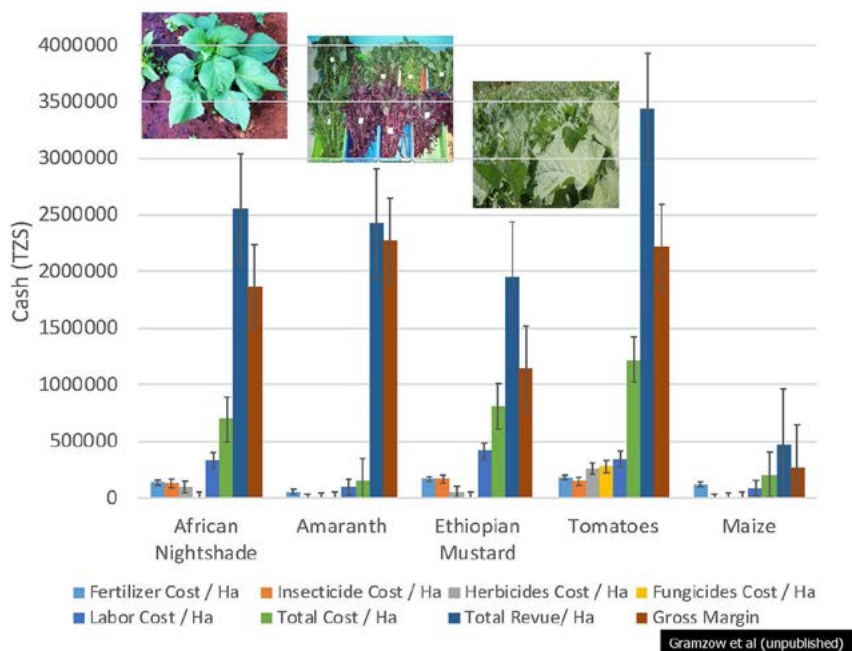


Figure 4. Costs and returns to growers for four vegetables compared to maize.

these often forgotten crops. Moreover, growing traditional vegetables requires less herbicide and fungicide than growing tomatoes (Figure 4).

The World Vegetable Center’s public collection of vegetables comprises about 60,000 accessions from 150 countries, covering 400 species, but sadly only about 5% of that collection covers traditional vegetables, at present.

### Mobilising the nutritional power of vegetables for rural consumers

Figure 5, by the Global Panel on Agriculture and Food Systems for Nutrition (2016), presents consumption patterns of different income groups along a rural-to-urban gradient in Africa. Rural consumers mostly derive food from their own production, with an increasing share from purchased food as income grows.

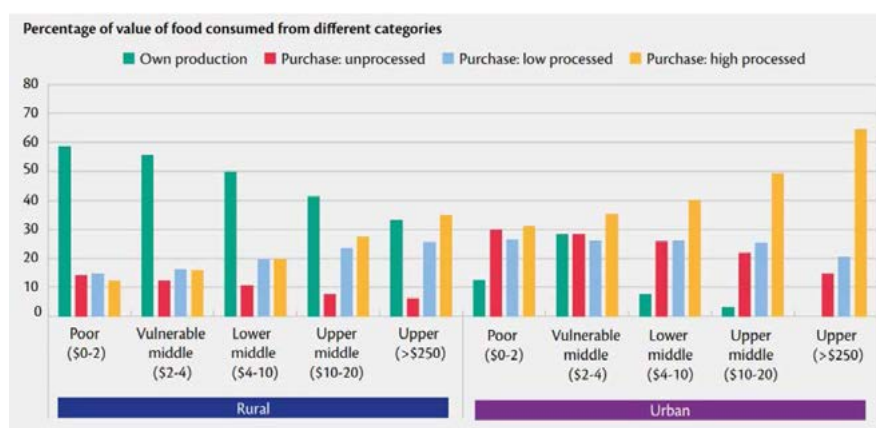
The World Vegetable Center, mainly through USAID funding, has been working with vulnerable households in rural areas in Africa and Asia to help them to grow their own vegetables throughout the year. We work mainly with women (Figure 6), teaching them how to grow vegetables near their homes. These areas (‘household gardens’) usually measure about 35–40 m<sup>2</sup>, enough to feed a family of four.

The impact pathway of our household garden work is indicated in Figure 7.

We link women with seed suppliers, to ensure continued supply of good quality vegetable seed. To motivate them to produce and consume vegetables we provide them with nutrition and health messages, emphasising the importance of sanitation and hygiene and the significance of different vegetables for their families’ nutrition status, and we teach them how to prepare and cook the vegetables in a way that retains nutrients.

### Evidence of rural successes

In north-west Cambodia (Figure 8) 45% of children under five are stunted. We have worked with USAID funding (‘Feed the Future’) in this region since 2016, with about 3000–4000 households. Figure 9 shows that about 80% of the

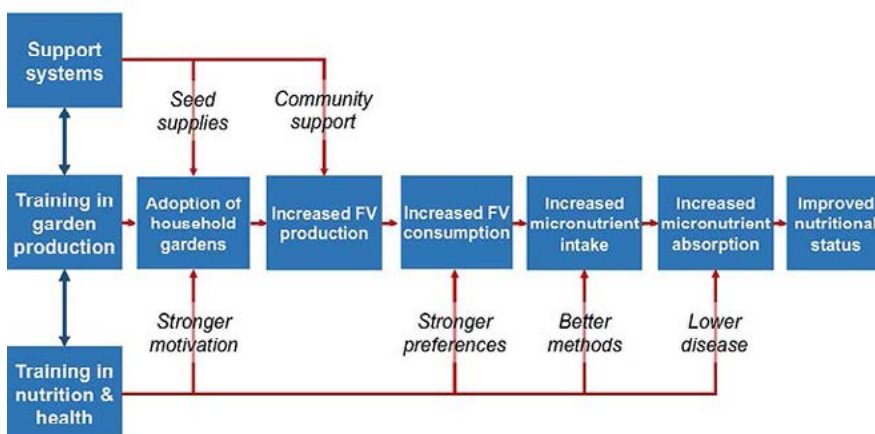


**Figure 5.** Consumption patterns of different income groups in rural & urban areas of Africa (Global Dietary Database; Global Panel on Agriculture and Food Systems for Nutrition 2016).





**Figure 6.** Some of the women being trained by the World Vegetable Center, in their household gardens around the world.



**Figure 7.** The impact pathway of World Vegetable Center's integrated household gardens approach.

produce of these gardens is consumed by the families, and about 20% is sold. In monetary terms, this represents a gain of \$18 per month from not needing to buy vegetables in the market, and \$5 from selling produce: in total a benefit of about \$23 per month.

We are currently conducting randomised controlled trials in Africa and Asia in similar projects. This should enable us to have a good idea of what this type of intervention means for diet diversity in these different families, in particular for children under five.

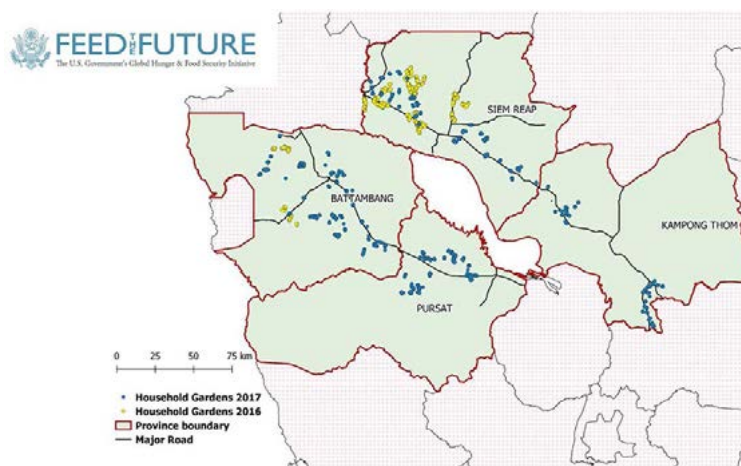


Figure 8. The spread of household gardens in NW Cambodia between 2016 and 2017.

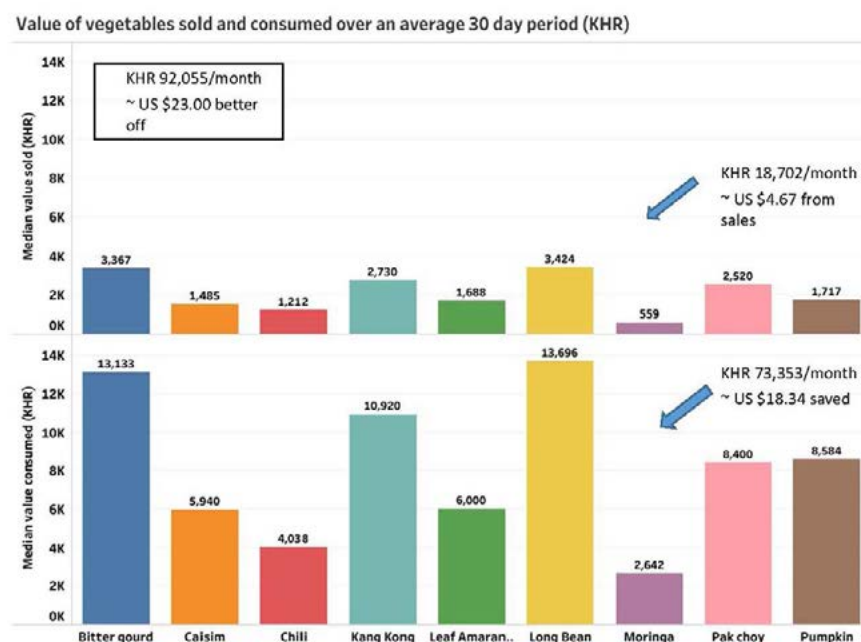


Figure 9. Exploratory analysis – income calculation comparing nine vegetables grown in household gardens, sold and consumed in NW Cambodia.

### Mobilising the nutritional power of vegetables for urban consumers

In urban settings in Africa, only the two lowest income groups still produce some of the food they consume (Figure 5). For these families it may be possible to tackle malnutrition through urban gardens.





**Figure 10.** Potential vegetable garden methods for slums.

There are challenges in growing vegetables in slums: lack of space; poor quality water and lack of water in general. The World Vegetable Center is considering taking on this challenge in the future. Some proven household garden technologies in rural areas could be adapted to urban slum settings (Figure 10): such as sack gardens or container gardens, which need relatively little land and water per unit yield; raised bed gardens and community (group) gardens, rotating scarce labour and potentially using low cost drip irrigation (US\$20/set).

However, most urban consumers buy their vegetables in informal and formal markets, and that situation offers good opportunities for peri-urban farmers to sell their produce. With Australian funding, WorldVeg has trained young farmers in East Africa to produce vegetables for specific markets, such as restaurants, hotels, supermarkets and even for export to Europe. Training (one day a week for a period of six months) involves improving agronomic skills, but also strengthening collaboration among young farmers and enhancing their access to finance and other inputs, in particular seeds.

In Tanzania, WorldVeg and Catholic Relief Services (CRS) have trained six groups of between 30 and 40 young people, two of which have contracts to supply fresh vegetables to export markets. These 'youth vegetable business hubs' are supplying to relatively high-end markets.


To link farmers to urban consumers who use informal and semi-formal markets, WorldVeg has developed the 'pack house model'. The pack house is a simple roofed facility, equipped with a coolbot\* where the farmers' produce is delivered, washed, sorted, weighed, labelled, and can be stored under cool conditions. Using this space, farmers are able to harmonise production and marketing and reduce post-harvest losses substantially.

Food safety issues when producing vegetables for urban markets are of great importance. This is illustrated with an example from Bangladesh (Table 1). In

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\* see <https://horticulture.ucdavis.edu/coolbot>

**Table 1.** Impact of training in off-season tomato production on income and pesticide use, Bangladesh, 2014.

Outcome indicator	Average treatment effect	Significance	% increase	
Total income (USD/capita)	85.9	p<0.05	50.5	
Pesticide use (kg/ha)	2.0	p<0.05	58.4	

Notes: Based on propensity score matching, n=245 (94 trained, 151 control).  
Evaluation conducted 2 years after the training.

2014, WorldVeg worked with Bangladeshi farmers to help them capture very good tomato prices by growing tomatoes in the off-season. We introduced disease-resistant varieties, integrated pest management (IPM) methods (including sticky traps and pheromones) and rain-out shelters and nets (image above). The project was successful in raising farmers' income by 51% but, controversially, pesticide use went up by 58%. IPM methods were not being adopted by the farmers because pesticides are cheap in Bangladesh and easy to get, contrary to IPM technology. Farmers increased pesticide use substantially because they did not want to lose any of their harvest. In fact, they used pesticides as an insurance policy, having put so much effort into the operation.

## Conclusion

Vegetables have tremendous nutritional power. To tap that power for both rural and urban consumers, governments and donors must give greater priority to the vegetable sector through a combination of supply and demand (behaviour change) interventions.

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<http://glopan.org/sites/default/files/ForesightReport.pdf>

Marco is a Dutch national and holds a PhD degree in tropical agronomy from the Wageningen University, Netherlands. He is the Director General of the World Vegetable Center and based in Taiwan. Prior to his current position he served as the deputy director general of the Africa Rice Center (AfricaRice, Benin). He also worked for the French Agricultural Research Centre for International Development (CIRAD, France), the International Fertilizer Development Center (IFDC, Togo), the West Africa Rice Development Association (WARDA, Senegal, Côte d'Ivoire) and the International Rice Research Institute (IRRI, Philippines).

## Session 3 – Q&A

Panel: Professor Andrew Campbell, Dr Anna Okello,  
Joanna Kane-Potaka, Dr Marco Wopereis

Chair: Professor Maggie Gill

**Chair:** Lots of new bits of information, slightly different from the normal, in those four talks to get us all thinking. I will take three questions at a time, so not all the panel need to answer each one.

**Q:**

Joanna, are you doing anything with fonio and teff?

**Q: Julia Steenkamp, The University of Melbourne**

My concern is that here in Australia and in other developed countries a big proportion of our food is highly processed, and that a lot of that processed food is made predominately of sugar, refined starch and vegetable oil. That means our farmers are growing these commodities, possibly affordably, and in abundance to meet food industry demand for cheap ingredients. I believe that there is more an industry demand than a consumer demand for those cheap ingredients. How do you see agriculture diversifying so that we grow food for the health of the consumer rather than to meet industry demand for cheap ingredients?

**Q: Hon. John Anderson AO, the Crawford Fund**

My question is related to the previous one. Poverty and malnutrition are usually caused by lack of opportunity and choice. Obesity and poor diet are very often the result of choice. We are talking about basic freedoms here. One of the big issues seems to be how to get people to be responsible with their diets. And a comment, following on from the last question: very often the business and the farm communities are simply responding to what consumers choose to spend their dollars on – when they have them.

**A: Joanna Kane-Potaka**

ICRISAT is working with teff only in Ethiopia because of government restrictions on teff being taken out of Ethiopia, even though you do see it in other countries.

In response to the last two questions, a person from a large multinational company said: 'Reality is that fat, sugar and salt sell. It's sad but it is reality.' One challenge we have under Smart Food is how we can drive production of processed foods that are healthy *and tasty*. Food has to be tasty, and that is a big challenge. I think the whole food technology sector needs to take on this challenge and help solve it.

It is about consumer choice but also about the options we make available. Smart Food is focused on driving change from the consumer side, and marketing is a big part of that. The image of these foods is very important. I'll give one example: when I was in Mali, the Catholic Relief Services were providing a

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

midday meal to school children, and wanted to provide pearl millet because it's very nutritious and grown locally. The children and the parents reacted negatively, because rice had become very popular and trendy in the urban areas. They wanted rice. This put the Catholic Relief Services in a difficult position because they did not want the only meal they provided each day to be the least nutritious. Development solutions must include marketing, and we must learn from the big companies that market their goods to us every day.

**A: Dr Marco Wopereis**

I would like to give a real-life example about people being unaware that they do not eat well. Last year, when I was in Mali visiting our work on vegetable household gardens around Sikasso, women told us that before our intervention they thought they were eating quite well because their plates were full, mostly with maize-based products. Once we had discussed the importance of including vegetables and introduced new recipes they saw things quite differently. We developed one recipe in particular for young children. This 'enriched porridge', contains maize flour, peanut flour, an egg, milk and amaranth leaves and African eggplant, and a bit of salt and sugar; it is very popular among kids, is obviously highly nutritious, and tastes very good.

It was quite an eye-opener for me that women in these rural areas of Mali did not realise they were not eating well.

A lot can be done in schools. WorldVeg has worked with partners in Africa and Asia and introduced school gardens linked to school meal programs and household gardens. This approach is powerful because children learn how to grow fruits and vegetables, start to appreciate them and may eventually consume more of them, in particular if parents are fully involved.

**A: Professor Andrew Campbell**

On John Anderson's point: on one level, it is really tempting to say: 'It's not our problem what people decide to eat. That's a matter of individual choice. We (agriculture) can stick to growing the food.' But increasingly I think that is an untenable position, because if we follow that track and absent ourselves from the debate about dietary choice at a societal level, then the outcome will be that agriculture is just bracketed as part of the problem.

The impacts on national budgets of these noncommunicable diseases is already incredibly heavy in some of the countries that we work in, for example in the Pacific. The other dimension is that many of the world's 570 million farmers have inappropriate diets, including micronutrient deficiencies that lead to lifelong health problems. Therefore, I think we do have an important responsibility to work with colleagues in the public health and education sectors, and to pick up marketing tricks.

There is certainly a big group of big companies in the global food system that want to be seen as part of the solution as well. They know they have a problem, and they are very keen to be working on producing healthier foods and getting them to more people, more equitably. I think we have to be involved, but we can only do it through partnerships with others in the sector. Agriculture cannot just move holus-bolus into that space.

**Q: Guy Coleman, AgriEducate**

A question for Andrew. You raised an interesting point about the global expenditure on subsidies; you mentioned it was in the range of hundreds of billions of dollars. Agricultural trade, as we probably know, has been one of the most problematic components of global discussions in recent history. At the same time, Jessica Fanzo this morning mentioned that food insecurity could be perhaps solved or at least mitigated significantly with expenditure of US\$7–265 billion a year. I would like to hear your discussion on how we could go about using some of those subsidies, perhaps, and returning benefits to those farmers that had removed subsidies.

**Q: Jojo Jackson: Australian Eggs**

My question also is for you Andrew, and it is slightly related to the previous one. You talked about the need to match GDP to R&D spending, and how those two are out of sync. And you talked about trans-disciplinarity across R&D and needing more and new collaborations. What are your thoughts on the future of R&D models for agriculture?

**Q: Dr Mario Herrero, CSIRO**

We have heard several case studies of approaches that work. My question is: for nutrition-sensitive agriculture to succeed, do we need a fully atomised approach, where context is everything, or can you identify, from your successful interventions, aspects that are truly up-scalable?

**A: Professor Andrew Campbell**

The question about global agriculture subsidies: in a lot of the countries where we work there are national policies around being self-sufficient in a particular crop – for example rice, or wheat. There is strong encouragement for smallholders to go full-tilt into that crop at the expense of some of their traditional crops and dietary diversity. Then, of course, if they achieve the desired level of production, prices go down, returns go down. They would be much better off if countries were able to trade freely with other countries that can produce those particular crops more efficiently.

Similarly, there are subsidies on inputs, and obviously there are restrictions on trade, and overall that creates distortions in the system. We have all seen the examples of some types of activities that could be encouraged with a redirection, but I personally would not favour simply changing some subsidies into other subsidies. I would much rather see that investment redirected into more strategic areas, like R&D, that try and change the underlying knowledge-base for how the food system works. And similarly with energy subsidies.

The International Water Management Institute (IWMI) has a project in India where farmers with solar pumps are enabled to sell their energy into the grid. So they have two uses for their solar energy: one, pumping water, and the other, selling it into the grid. Their irrigation efficiency improves hugely, because IWMI created another opportunity for them to sell energy rather than buying it. This obviously depends on having a functioning grid and the ability to sell into it.

Again, thinking about water, energy and food in more integrated ways leads you into more interesting areas of public policy. But there are powerful drivers

behind subsidies and trade disputes, and as we can see the world seems to be going in a more protectionist direction rather than a more open one, just at the moment. Nevertheless, I think we should be able to point out better ways of investing those funds.

**Chair:** What about the research question?

**A: Professor Andrew Campbell**

I think we had better chat over lunch about what future global R&D models should look like, because that would take longer than 90 seconds to answer.

**A: Dr Anna Okello**

Mario, you asked whether, for nutrition-sensitive agriculture to work, we really need this fully atomised approach or can we take what's up-scalable. For me, working in particular on zoonotic disease and foodborne disease, that is a fairly easy question to answer from the technical side. Modern meat inspection and food safety systems that exist in many high-income western countries have actually eradicated a lot of the foodborne parasites and other 'neglected' zoonotic diseases that are still putting millions of people at risk, daily, elsewhere across the world. My easy answer to your question here is: Yes, of course that is up-scalable. We know what the risk factors are in many cases. We know how to mitigate these risks from the technical perspective and from the risk management perspective.

The harder question, and I think we all grapple with this, regardless of the sector of agriculture we work in, is how this is up-scalable from a social, cultural and economic perspective? This is where it gets tricky, so I'll stop there. I'm sure we can have many long conversations about this and there's a lot of evidence but I still truly believe we need to get better at understanding farmers' perspectives, not just in our own countries but in other peoples' countries as well. I've worked as a vet with a lot of farmers across many countries of the world, and there is no farmer in the world who would do something that doesn't make sense to them and is not economically sustainable.

**A: Dr Marco Wopereis**

I feel very strongly about traditional vegetables: they are very nutritious and robust. There are ways to up-scale conservation and use of these vegetables – for example through community seed banks and maybe also through collaboration with some very conscious seed companies.

Our integrated approach to vegetable household gardens is already being scaled. My experience is that it is important to stick to what your comparative advantage is. For us as World Vegetable Center, that is supplying good quality seed and advice on good agricultural practices both before and after harvest. We link with partners that are better placed to work on demand-creation for vegetables and health and nutrition messaging. In these complex and integrated approaches you need to stick to what you do well, and link to partners that provide complementary expertise.

In the area of creating youth employment and economic opportunities around vegetables and bringing these nutritious vegetables to urban consumers, we are still very much in the pilot phase. There are tremendous opportunities for scaling

of our youth vegetable business hubs approach and our pack house model, harmonising production and marketing of vegetable produce for both formal and informal markets.

**A: Joanna Kane-Potaka**

The question on the future of global R&D: in *Nature* last year an article said that 45% of private industry agricultural R&D globally went into one crop – maize. We know wheat, maize and rice provide 50% of all the calories consumed globally, and that will continue. The vast majority of investments still go to the ‘Big 3’. Whether you are talking about R&D, or private industry investment, product development or development aid, most of it still goes to the Big 3. We have to change that, because if we don’t we are not going to make a big difference. I really believe we have to make that change. On the topic of scaling-up, I strongly support Andrew Campbell’s point about partnerships. I think partnerships are a critical factor in scaling-up. Whether they be private industry or government or others, it is the partners that are going to make the concept scalable.

**Chair:** This time I’ll take four questions because I think we have only time for one more round. Please introduce yourselves.

**Q: Professor Tim Reeves, The University of Melbourne**

I want to comment on the R&D models. I evaluate projects for the European Union, for the H2020 – the Horizon 2020. The last two sets that I’ve done have focused on nexus issues; one I recall was something like agriculture–food–low carbon energy–climate change. You could not pick off one of those components; your project had to address all four, which required the kinds of partnerships you are talking about, not traditional partnerships. Could any of the panel who have had experience with that comment on it? Or what do Andrew and the panel think about that sort of approach? It would be a new R&D model, particularly in Australia.

**Q: John Angus, farmer from 2 hours west of Canberra**

My question is to Joanna. There are, it seems to me, two sorts of nutrients. There are those for which R&D can make a sustainable improvement, and there are others such as zinc where there is a limited resource in the soil, so that the more our plants and animals can withdraw that nutrient from the soil the faster it becomes depleted. Is fertiliser a part of the solution to this problem?

**Q: Georgia O’Shea, The University of Melbourne**

We have touched a bit today on animal agriculture and its impact on climate change, and we have also talked about different grains that are being trialled at the moment that are also producing high amounts of calcium and iron and protein that we need. What are your views on going into poorer countries and focusing more on producing those grains that sustainably produce nutrients that are beneficial for us, rather than moving more towards animal agriculture that may be more harmful to ourselves and to the environment?

**Q: Rebekah Ash, The University of Queensland**

Andrew, you touched on genetic modification (GM) and gene editing, and I think that they both hold huge potential for the future. Obviously there are barriers such as cultural acceptance. How do you think that barrier might affect

when and how those technologies become more prevalent in our society in the future?

**A: Dr Anna Okello**

On the question of animal agriculture vis-à-vis more nutritious choices, I would say yes, let's do everything we can to try and build sustainable food systems in the future. I would like to highlight though, as I was saying in my presentation, something Dr Jimmy Smith, head of the International Livestock Research Institute (ILRI) put quite succinctly last year when he was in Australia. He said there is no moral equivalence between those that make poor food choices and those that have no choice.

That links back to a point I made – that you cannot compare someone that consumes 100 kg of meat per year to someone who consumes 8 kg. In some of these countries there is no choice at certain times of the year: think of pastoralist systems, the Maasai, some of the communities in the Horn of Africa, for example. Those people don't have a continuous choice all year between grain-based or other types of food supplies apart from (particularly) milk. They don't even kill their livestock. They are not eating meat a lot of the time.

What people do depends on their context, and there is not just one way or another way to live. We need to look holistically at the systems to see what may be the best choice for that system at that particular time or in that particular situation throughout the year. We need to try and find balanced choices and look at all the options, and consider situations from farmers' perspectives – they may or may not have a choice about what they do.

**A: Professor Andrew Campbell**

I feel a bit guilty about not answering the earlier excellent question about the future of the research system. Tim, I agree we should be doing more and better and longer-term more-integrated more-holistic 'nexus research'. However, in ACIAR, I would not want that to be more than about 10% of our research portfolio.

I think there is still a very important role for more tightly focused – narrower, perhaps – research that is going to have a higher potential for pay-off in the short term; it is more applied and closer to market. We cannot tackle those big nexus questions just by adding more people to the team and trying to do it in a traditional way. We need to rethink how we go about nexus research. That is going to be exciting. To me it is axiomatic that the people whom we think are going to be the beneficiaries of it – decision makers, policy makers, captains of industry or local players, whoever – have to be involved in the inquiry process because there are no right answers in that sort of work. Answers will inevitably involve trade-offs, interactions and feedback loops, and muddling your way through, finding the least-worst outcomes.

That brings me to the architecture of the international agricultural research system. At our recent meeting in the System Council of the CGIAR in Berlin, the number of projects in the CG that involved less than half a million US dollars was astronomical. A CG centre, I think, should be tackling the issues that are too big for national agricultural systems to handle. It should not be doing projects



costing less than US\$100,000. Like CSIRO in Australia, the CG system should only be working on matters that are too big for anyone else to have a go at.

I would like to see the CG working on some 'moon shots' with the biggest companies in the world, with the smartest people in the world, and with really strong buy-in from governments, industries, corporates and community civil society sectors that are going to be using that knowledge. That would be a different model from the sort of architecture that we have now, with 15 'robber barons' all trying to keep their ships afloat and many of them in financial strife.

Currently the system is not fit-for-purpose for the 21st Century. The investors are nervous about it and so we have a chicken-and-egg situation with people not wanting to invest a lot more money until they are convinced that the system is robust, and also not wanting to invest a lot more money in it to keep doing the same old stuff, when we have these mega-challenges that are demanding new paradigms.

**Chair:** That leads nicely into the question about GM.

**A: Professor Andrew Campbell**

Ah yes! Well, my view is, we have to use all the tools in the toolkit, and we have to use them responsibly, with good governance and good design and good risk management. If we follow those principles, these new tools offer amazing possibilities.

Joanna raised the issue that at the moment a large proportion of GM work is focused on a couple of crops and on particular traits. We could direct some GM work into the exciting opportunity to expand the capabilities of traditional foods and so on. Look at what QAAFI (Queensland Alliance for Agriculture and Food Innovation) is doing in India using GM on sugar cane to radically improve the energetic performance of the cane when it's in bagasse without affecting its sugar content: it radically changes the energetic performance of the cane and means that those mills put a lot more energy into the electricity grid and become more profitable as a result. That's clever stuff that is nothing to do with GM food. Bt cotton in this country has been an incredible success. We would like to be growing Bt chickpea in Bangladesh and places like that, where overuse of agrichemicals is on an extraordinary scale.

I think these modern tools have enormous possibilities and it is up to us to help society have a more mature discussion about their application.

**A: Dr Marco Wopereis**

On the nexus question, I would make the same comment as Andrew. I can add that we are involved in an Horizon 2020 project involving many European universities focusing on the four main solanaceous crops. It is a highly strategic project. The World Vegetable Center contributes 16,500 tomato, pepper and eggplant accessions from our genebank. This is an international effort, involving some top-notch phenotyping and genotyping work to discover genes that confer resistance to diseases and insects and tolerance to, for example, heat. European funding is used for this type of discovery-research project and that is extremely important.

**A: Joanna Kane-Potaka**

A few quick comments. First, on grains versus livestock versus nutrient-rich grains, I agree with Anna that it is contextual. One of the issues we have around Smart Food is that because the 'Big 3' are so well developed, so well set-up and supported, people grow these crops in the wrong agroecologies. For example, in eastern Kenya where we have worked, which used to be a millet- and sorghum-growing area, maize was given out as free food aid during difficult times, so people started growing maize. Maize is not suitable for that agroecology, so now the maize crops survive only one in four years. For three in four years those farmers don't have a crop, but they keep planting the maize because its value chain is well set up; the seed system is there; there is a market for it. If they went back to the traditional foods they would have to find the seed; they would have to take it to the market; they wouldn't know if they could sell it; and so on. This situation is contextual and we have to change it so that crops are grown in the right agroecologies.

Originally I intended to start my talk by saying that I don't believe in nutrition-sensitive agriculture – just to be a little controversial. You see we have talked about sustainable agriculture, then we talked about climate-smart agriculture, and now we're talking about nutrition-sensitive agriculture, and that practice is creating 'silos' in food thinking that I don't believe we should have. That is why Smart Food is so important, because it's looking at all three concepts: 'good for you, good for the planet and good for the farmer'. Smart Food is thinking of solutions more holistically, rather than finding a solution that might benefit one aspect but then may have a negative trade-off. Nothing is perfect, but we need to find more holistic solutions.

Now, to comment on the soil supply of nutrients. Here is an example to show that the soil micronutrients are definitely important. At the start of some work in India, ICRISAT mapped a whole state, right down to those micronutrient levels, such as zinc. Then we gave customised information to the farmers so that they understand the holistic need for the different fertilisers. The Government of India was so pleased with that, they are mapping the whole of India down to the micronutrients, to give farmers customised solutions that they call 'Soil Health Cards'.

I would very much like to see scientists look at the whole agricultural R4D chain: from soil and water management, through to breeding, processing, to food packaging and marketing, to find out which part of that chain can have the biggest impact on the nutrition of the food we eat.

We know the better the nutrients in the soil the better the nutrition in the crop. We know that crop-breeding, through biofortification, can improve nutrition of the grain. On-farm practices can improve the nutrients in the end product; the way we process the food can impact on the nutrition; and so on. I suspect processing has the biggest impact. I know it is hard to do, but I would like to see this analysis undertaken for horticulture, for livestock, for all food production so can we see the parts of the R4D value chain that have the biggest impacts on nutrition.

**A: Dr Anna Okello**

A quick comment on the nexus question. I come from a veterinary public health background, and one clear result we have seen from the explosion of 'One Health'-type approaches, particularly from H5N1 [avian] influenza, is that from a donor perspective it can often be hard to review and evaluate these types of projects, given the range of disciplines and perspectives required; I feel your pain working for the EU on this. The other thing we need to understand as well is that we might run the risk of relabelling 'business as usual' under a new name. We have certainly seen that happen with 'One Health' and some of its offshoots. In other words, I am agreeing with you that it is often very difficult, from a donor perspective, to understand how to fund and manage interdisciplinary and trans-disciplinary projects.

**Chair**

I need to bring this to an end now, so I shall make a few concise points in summary. I think the panel have shown that having diversity of perspectives in a discussion of a particular topic is a good practice and an example of how we need trans-disciplinarity. We have seen the benefit of having people from very different perspectives answering the same question. We have also seen that each of these individuals has a deep grounding in one subject, and I think that has shown that trans-disciplinarity needs to find the balance between different types of people.

We need scientists. Anna mentioned 'choice' in connection with food choices and agriculture choices in developing countries, and 'choice' also needs to be applied to research. Different researchers have different skills; some are good at individual disciplinarity; some are good at talking to farmers; some are good at trans-disciplinarity; etc. We need to celebrate diversity in all those different constituencies, and we need to use that diversity to be able to produce choices for the people who are buying food for their nutrition, and also for the donor agencies who are funding different types of research.

If we are going to address such complex challenges we need the depth and we also need the choice to provide options for decision makers so they can, we hope, make the right decisions.

Please, join me in thanking our speakers and our panel.

## Delivering results – policies and practices for change

Professor Glenn Denning

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Columbia University

### Abstract



On 25 September 2015, the 193 members of the United Nations General Assembly unanimously agreed to ‘End Hunger’ by 2030 through their agreement on the 2030 Agenda on Sustainable Development. Under Sustainable Development Goal (SDG) 2, the world’s leaders agreed not only to ‘End Hunger’, but to ‘Achieve Food Security and Improved Nutrition, and Promote Sustainable Agriculture’ – an extraordinarily ambitious agenda of eight targets and 14 indicators encompassing hunger, agriculture, environment, nutrition, trade and investment. Approaching three years into the 2030 Agenda, an impressively large number of governments, international agencies, NGOs, businesses and universities have embraced SDG 2, along with several other complementary SDGs, as a framework for action towards achieving a healthier and more sustainable global food system. However, delivering results through policies and programs is proving more challenging. In presenting their Voluntary National Reviews to the United Nations, most countries have reported on their aspirational plans and good intent. Results at scale are few and far between. In this overview, I will draw on personal experience from four countries (Cambodia, Malawi, Timor-Leste and Tajikistan) to identify strategic operational and design lessons that can inform a more effective response to SDG 2. My conclusion is that SDG 2 is by and large achievable but more likely by 2040 or 2050, rather than 2030. Across all targets, we have the knowledge and the financial resources to enable an unprecedented positive transformation of our global food system. All that is required is genuine, sustained political commitment and creative implementation strategies.

Let me start at 25 September 2015 at the United Nations: the approval of the Sustainable Development Goals (SDGs)\*, the new development agenda unanimously approved by 193 countries, with much cheering and clapping and backslapping, mostly by men in blue suits.

*Image:* UN Summit adopts 2030 Agenda for Sustainable Development.



*(Credit: UN Photo/Cia Pak.)*

\* <http://enb.iisd.org/post2015/summit/enb/25sep.html>

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



**Figure 1.** SDG 2 compared to MDG 1.

MDG Target 1.C was: Halve, between 1990 and 2015, the proportion of people who suffer from hunger. (*Top image by Glenn Denning, in Tajikistan. Lower image: United Nations.*)

To achieve SDG 2 and others, however, first we have to learn *how*. For the agriculture and food area, it requires a fairly major change to move from the Millennium Development Goals to the Sustainable Development Goals. For the years 2000 to 2015 the corresponding goal (MDG 1) was simpler: to reduce by 50% the proportion of people who are hungry. Goal 2 of the SDGs is much more complex: not only reducing hunger but ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture (Figure 1).

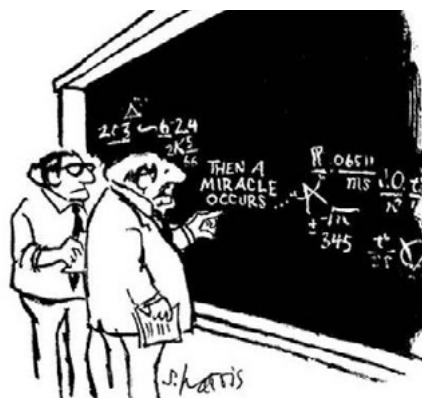
Goal 2 is also linked to many of the other SDGs. It has eight targets (Figure 2) and 14 indicators, also to be achieved by 2030: ending hunger, ending all forms of malnutrition, doubling agricultural productivity and incomes, and so on, right across to infrastructure, research, trade, and marketing. Goal 2 has a much bolder, more ambitious, far-reaching and comprehensive agenda than has ever been adopted in the past by all countries of the UN.



**Figure 2.**

As everybody left New York on the Saturday after the approval of the SDGs, the question was: What do we do next? Some kind of miracle would occur, and all those wonderful targets would be achieved by 2030. What I aim to do here now, very briefly, is to be a little more explicit on how we might move to that level.

The first thing, however (and much of this has been discussed at this conference already), is what exactly do we want? It's always good to define that.



"I think you should be more explicit here in step two."

*Image credit: Sidney Harris.*

I think there will be no disagreement that we're looking for a food system that will end chronic and acute hunger for all; that provides good nutrition and supports good health for all; that is 'good' for the environment, both short- and long-term, and is good for farmers as well; and that is a climate-smart food system and resilient to shocks. In short, it is a **productive, inclusive, healthy, sustainable and resilient food system**. That is the goal we are trying to achieve.

### How do we get there?

Figure 3 summarises the components of a model for how we can reach this goal. Around the outside are some of the aims discussed this morning, and at the centre is this food system that we all aspire to. It is essentially SDG 2++ in simpler words. I argue that to achieve the six components (the outer hexagons)



**Figure 3.** Delivering results: An integrated multi-dimensional framework for investment. A productive, inclusive, healthy, sustainable & resilient food system.

requires additional intensified investment. Therefore, this is really a framework for investment of human resources and financial resources.

### **Sustainable intensification**

In the Sir John Crawford Memorial Address and this morning we heard about the first phase of the Green Revolution, increasing calories, the ‘Big 3’ – wheat, rice and corn. Green Revolution 2.0 arguably came 15 or 20 years later, moving more into marginal environments, and also into rain-fed agriculture with greater sensitivity to the environment, integrated pest management and the like. ‘Sustainable intensification’ (top hexagon in Figure 3) is the third stage. It has a few characteristics I want to emphasise.

- First: no net land area expansion; we may even need to contract the areas planted to agriculture, and in many parts of the world we should. That implies that we still have to increase productivity – I think we should be very very cautious about dismissing productivity and production increases as being unnecessary. I come back to that below.
- Second: sustainable intensification harnesses modern science and technologies, areas that Andrew Campbell mentioned this morning – GM technology, gene-editing, precision farming, use of ICTs and others.
- We also need to improve input-use-efficiency, with more efficient use of water, of nutrients, of energy. This is the area of precision farming.
- Climate smart: that is, agricultural systems, intensified systems that are not only productive but are adapted to a changing climate, and are also contributing to mitigation of climate change.
- Fifth: I agree totally with the previous speakers today: agriculture needs to move beyond the Big 3, even beyond cereals, and look at nutrient-dense commodities like legumes, like vegetables and certainly livestock and animal products, particularly from poultry and small ruminants.

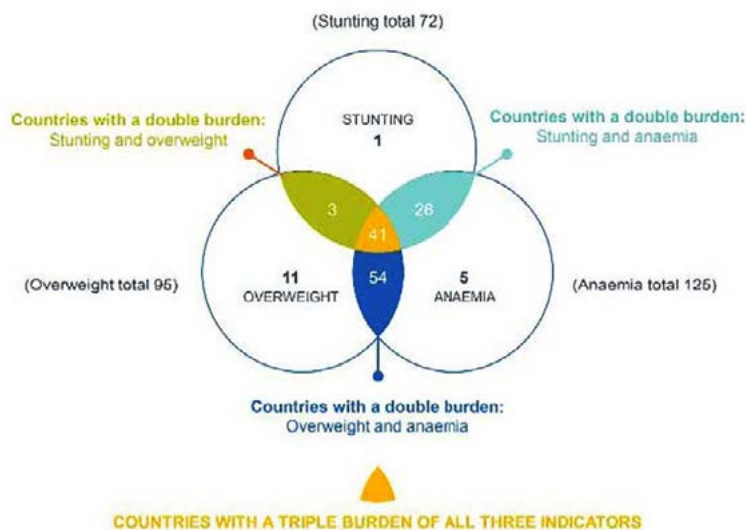
### **Market connectivity**

Next around the outside of Figure 3 is ‘market connectivity’. We need to connect areas of intensive agriculture to the markets and the consumers, by enhancing value chains. It will require investment in hard infrastructure such as roads and rail and ports, ICT and electrification. Also, investment in the soft infrastructure – the policies, the capacity-building that enables us to enhance these value chains. We are seeing more of that being picked up now by the international development banks: the Asian Development Bank, the African Development Bank, the World Bank, and so on. Clearly, enhanced market connectivity is complementary to – and indeed necessary for – sustainable intensification.

### **Post-harvest stewardship**

What is the point of producing all this food if we lose it at the farm level or in transport or processing (loss of quantity or nutritional quality – unintentional wastage) or, even worse, if we end up discarding it at the retail and the consumer level (unwanted food – food waste)? Addressing and reducing those losses is an important part of achieving the kind of food system that we want.

Fortunately, for the first time ever, there is a relatively explicit goal (12: Ensure sustainable consumption and production patterns), and specifically a target,



**Figure 4.** *Source:* Global Nutrition Report (2018).  
Image by Jessica Fanzo, Crawford Seminar (14/02/18).

Target 12.3, that says by 2030 we will ‘halve per capita global food waste at the retail and consumer levels’ – which is extraordinarily ambitious when you look at the kind of waste that we see today – ‘and reduce food losses along production and supply chains, including post-harvest losses’.

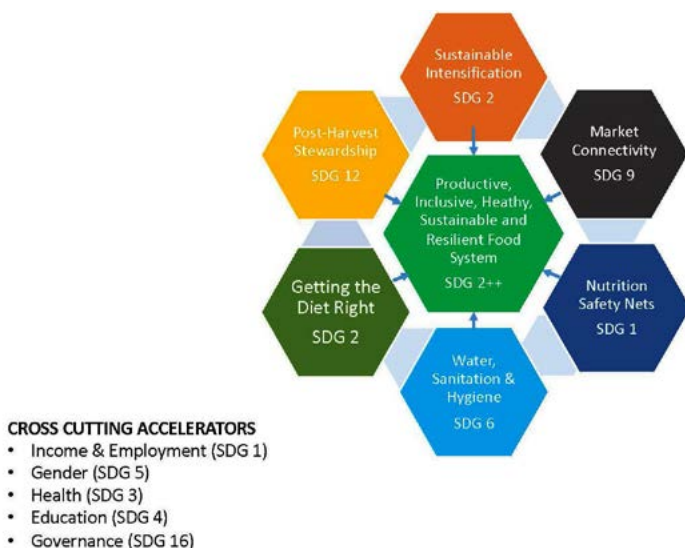
### Getting the diet right

We have been talking about ‘getting the diet right’, this fourth area in Figure 3, already at the conference today. The basic message is that more than 50% of the world’s population is not on a healthy diet at one or other end of the scale. Their diets are not right for a healthy and productive life. Figure 4 (by Jessica Fanzo) depicts the idea that 141 countries are suffering one of the triple burdens: stunting, overweight, or anaemia; 41 countries are suffering all three burdens. There are 141 countries where the diet needs to be made right. There is plenty of good news in terms of nutrition. ‘Scaling up nutrition’ is an initiative that is in 60 countries now, encouraging multi-stakeholder platforms, encouraging strategies on improved nutrition, and many other initiatives. Much of this happened in the last decade, showing there has been tremendous growth in explicit recognition of the importance of tackling undernutrition. The bad news is the amount of contrary advertising – for instance, along the ~12 km route from the airport in Dar es Salaam (Tanzania) to the hotel I estimated 80% of the signboards were advertising sugary drinks. I am confident though that we can win that battle if we put our minds to it.

### Nutrition safety nets; Water sanitation & hygiene

It is obvious that many people cannot help themselves and need support: for example, very young children, women, the elderly and others. They should not have to be subject to market availability of nutritious food: that’s the reason for the ‘nutrition safety nets’ (SDG 1) hexagon in Figure 3.





**Figure 3 (augmented).** Delivering results: An integrated multi-dimensional framework for investment. **A productive, inclusive, healthy, sustainable & resilient food system.**

‘Water, sanitation & hygiene’ (Figure 3) is a topic very rarely mentioned as part of the food system. Even if all the other five points of the model were under control, neglecting the importance of clean water means the body would be unable to utilise those nutrients: food and nutritional security requires availability, access and *utilisation*. I am not suggesting that ACIAR starts a program on Water, Sanitation & Hygiene, but that goal needs to be integrated with improvements in these other areas.

Obviously the components in Figure 3 are not enough. At the bottom left of Figure 3 (as augmented above) I have added SDGs that I think of as ‘cross-cutting accelerators’: Gender, Income & Employment, Health, Education, and of course Good Governance: every one of the areas in Figure 3 can only be effective through good governance and strong accountability.

### Action points

Finally, here are a few action points that I think will be needed if we are to deliver on this kind of a plan to achieve such a food system.

- **Develop and support leaders to exercise political will: ‘Nourish & Prosper’**

In places around the world where there have been successes, they are often because of very charismatic, sincere and committed leaders who have delivered on these promises and brought down malnutrition in their countries. I encourage us all to emphasise the message ‘nourish and prosper’. Jessica Fanzo earlier showed us data on the penalties of poor nutrition. We need to start talking to ministries of finance and explaining that good nutrition is good for economies; it is not social welfare. They need to think of nutrition as an economic development program, part of the national economic development plan.

- **We have to acknowledge complexity and interconnectedness of food systems**

We need to stop saying things like, ‘We produce enough food, we don’t need to focus on increasing production or productivity’. That *does* have to be part of it; we *do* have to produce food more efficiently and more effectively. Cutting food waste and food losses will certainly help, but they are not the whole answer. Improving the markets, making them work better ... all these are important. If we are serious about transforming the food system to achieve the kinds of characteristics we want, then *all* of those areas need to be tackled.

- **Synthesise best practice across the six investment areas**

We need to synthesise best practice across those six areas in Figure 3 and, of course, in other areas as well. Particularly for those first three areas I discussed above, this is where an organisation like ACIAR and universities and other knowledge institutions have a major role to play. As well as developing new technologies and new ideas and innovation – that has to happen of course – they could be synthesising and adapting ideas.

- **Design and execute practical national food-system strategies & plans**

Jessica Fanzo and I have both been working with a number of countries as they synthesise where they are in terms of SDG 2. The aim is to enable organisations, including the World Food Programme among others, to devise programs that are sensitive to those countries’ existing information, and to design and execute practical food system improvement strategies. In most places we visit, there are several – as many as 15 – strategies related to the food system: nutrition strategies, agriculture strategies, rural development strategies, water resource strategies, and so on. They need to be brought together more holistically into food-system strategies and plans.

- **Establish and nurture cross-sectoral, multi-institutional & results-driven partnerships to align and enhance implementation: SUN+**

We have talked about the importance of bringing different stakeholders together, but these convenings should not just be a ‘talk shop’. We have seen that a number of countries have brought together teams to act across different ministries and different sectors. However, it is much harder to find forums and partnerships that are *actually effective* in implementation. It is important that they align in terms of implementation: they should not just coordinate but also *implement* programs together. I think the SUN (Scaling Up Nutrition) Movement does a great job. For those of you not familiar with SUN, I urge you to look at the SUN Movement, though I believe they do not go far enough. There needs to be more than coordination through SUN. And they are not really including agriculture and some of the other important areas I have discussed in this paper.

- **Mobilise and allocate the needed financial & human resources**

Also, we need to mobilise and allocate the much needed resources: the financial resources and the human resources. Much of that has to happen at the national level, which means it will involve national budgets. Nutrition gets a paltry amount of resources for nutrition-specific programs, or even nutrition-sensitive programs, in most budgets. There needs to be more advocacy to include nutrition more explicitly and more accountably. In a number of places,

particularly the international finance institutions, the funding allocations have diminished, including for agriculture. Certainly a lot of funding has gone into health over the last 15 years, but nutrition is still, I would say, an orphan program here.

One very innovative program, which Australia supported, started in about 2008 or 2009, just after the food crisis: it is the Global Agricultural Food Security Program (GAFSP). We need to have a global fund of some kind that takes a holistic approach and mobilises complementary finance in the six investment areas I have described as essential for a better food system.

### **Final comment**

Can we achieve SDG 2, that very worthy goal? Although I am a great optimist I think we cannot and will not achieve SDG 2 by 2030, except in some countries perhaps. We will not end hunger; we will not end all forms of malnutrition. However, I do believe that if we make a start right now we can, by 2050, come up with the kind of food system we need.

The reasons why I am relatively confident are because this conference is so well attended today, and also because a good many of you in the audience are from a younger generation than me. Also, I teach a Masters Program at Columbia University called ‘the MPA in Development Practice’, and I am seeing enthusiasm for and commitment to this topic from my students. They are in their 20s or early 30s, going out into the world, working in UN agencies, working in the private sector, working with governments, starting up their own social enterprises to work on these topics. That makes me pretty optimistic that we can achieve this SDG 2++ probably by 2040 or 2050, rather than 2030.

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Glenn Denning is Professor of Professional Practice at Columbia University’s School of International and Public Affairs, where he directs the Master of Public Administration in Development Practice. He chairs the Earth Institute’s Practice Committee and is Senior Policy Adviser for the UN Sustainable Development Solutions Network. Denning has advised governments and other organisations on agriculture and food security in more than 50 countries. He served on the UN Millennium Project Hunger Task Force (2004–06), the Senior Steering Group of the UN High Level Task Force on the Global Food Security Crisis (2009–13), and the Technical Advisory Committee of the Global Agriculture and Food Security Program (2010–13). Denning, a graduate of the University of Queensland, worked in the CGIAR System for 24 years and held senior management positions at the International Rice Research Institute (IRRI) and the World Agroforestry Centre.

## Behavioural change for better nutrition in Papua New Guinea

Philmah Seta Waken & Tania Paul

National Agricultural Research Institute, Papua New Guinea (PNG)  
& Charles Darwin University, Darwin

### Abstract



There is a decline in the consumption of traditional vegetables in PNG, which adversely affects family nutrition and is increasing the rates of malnutrition and obesity. Traditional vegetables are climatically adapted to PNG, require lower inputs, and are superior in food value when compared to globally popular vegetables. They have more essential nutrients, and historically provided a large proportion of the daily protein, vitamin and mineral intake in the village diet. Turning around the decline in consumption and supply of traditional vegetables will improve food and nutritional security. This is particularly true for remote and isolated communities and poor urban populations. Our research found that people lacked awareness of the nutritional value of traditional vegetables. People consider these vegetables to be 'backward' and 'poverty' food. Conversely, traditional vegetables connect strongly to culture and 'home'.

We trained smallholder farmers to manage pests and diseases and save the seeds of traditional vegetables to reduce their input costs. We worked with families and communities to increase their awareness of the nutritional value of traditional vegetables. We trained families in gardening and cooking so they could grow and cook a variety of nutritious food from their own gardens. We created fresh recipes for local vegetables. Next, we plan to work with maternal–child clinics linked to hospitals where mothers learn to make nutritious cheap food from their own gardens. We will run school-based programs involving teacher education, school gardens and incentive-based lunchboxes. Some growers have applied their seed-saving skills to setting up small-scale seed businesses.

This is Albertha. She's a very typical PNG woman. She is a mother of two, she is a housewife, and she's also a subsistence farmer, and until she joined our project she and her family would have a very modern diet including things like 2-minute noodles, white rice, and bread. Traditional vegetables on the other hand are very high in things like vitamin A, vitamin C, iron, folate, and other



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

micronutrients. They also have the advantage of being drought-tolerant, and climatically adapted to PNG.

There is an alarming crisis in PNG at the moment, where we are seeing more than 50% of children under five suffering some form of undernutrition. Further, around 76% of all childhood deaths are directly attributable to malnutrition.

We asked the question: What role can traditional vegetables play in improving nutrition? To answer that, we worked in northern Australia and PNG, especially in some parts of Bougainville, in peri-urban areas of Port Moresby, rural areas in Central Province, and we also did some work in Lae. This paper focuses on the PNG component, and describes three key aspects of our work: (i) the problem with perceptions around traditional vegetables, (ii) strategies for behaviour change, and (iii) some solutions, looking forward, where there's more work to be done.

### **The problem: perceptions around traditional vegetables**

The problem is that a lot of people now in PNG are eating less of the traditional vegetables, and less vegetables overall. There is a high rate of undernutrition in PNG, and this leads to stunting and intellectual deficits. Many micronutrient-rich vegetables are increasingly being replaced by store-bought foods, in both urban and rural areas. These bought foods are energy-dense but nutritionally poor. For example, in a typical shortcut meal in families today the children are fed basic rice and tinned fish, with no vegetables. The amounts of food children eat, and the kinds of food that they eat, are significant causes of childhood malnutrition.

### **Our project**

To try to counter this problem, we looked first at the market, to find out what were consumer preferences among the rural and the urban consumers of traditional vegetables (Figure 1). What were their most preferred vegetables, and the reasons for those preferences? And how much were they willing to pay for the vegetables? To understand consumption and intake of traditional vegetables in the urban and rural areas, we asked consumers to keep food diaries.



**Figure 1.** Traditional vegetables for sale at the market, PNG.





Figure 2.

With the farmers, we wanted to understand what training they needed in marketing, in basic crop management practices, in pest and disease issues, and in seed saving and germplasm conservation. Figures 2 and 3 show farmer surveys that we conducted; in Figure 3, farmers are identifying common pests of vegetables.

We found out that consumer preferences in relation to traditional vegetables depended on the area they came from.

Generally there is an irregular intake of traditional vegetables and a lack of nutritional knowledge. Figure 4 shows a range of traditional leafy vegetables like aibika, amaranth, and rungia, and they are very rich in iron, folate, and micronutrients. We saw that there was a general decline, in the modern generation, in knowledge of and preparation of traditional vegetables.

Traditional vegetables are relatively expensive compared to introduced vegetables because they are seasonal, but the farmers who grow and sell them



Figure 3.



Figure 4.

can make a lot of money from traditional vegetables. We also found that the women who were selling those nutritious vegetables were then using the money they had earned to buy store food and introduced vegetables, thinking they were doing the right thing for their family.

In summary, we found the growers lacked knowledge in best practice crop management practices. They also lacked knowledge of improved seed-saving technologies, and of pest and disease management techniques, and of conservation of the diversity of vegetables that they grew in their gardens.

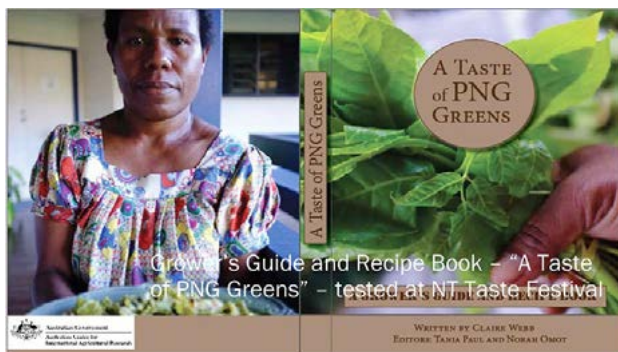
### Some solutions tried

We tried several solutions in this project, to help and contribute to behavioural change in the consumption of traditional vegetables in the country.

Our main focus was on creating awareness of, and interest in, these traditional vegetables. We did this by working with schools, communities, media, families and farmers, as well as other stakeholders that worked with communities. For example, for school children we created games and activities that would be appealing to them (Figure 5). We also created catchy little nutrient and growth packages for them. One success story I want to share is that an egg-producing



Figure 5. Games and activities to make vegetables interesting to children.



**Figure 6.** Grower's guide and recipe book: *A Taste of PNG Greens*.



**Figure 7.** An example recipe.

company in the country also included these packages in their cartons, and the egg cartons were sold nationwide in the stores that sold their eggs.

Then we went further and created a *Grower's Guide and Recipe Book* (Figure 6), as a resource that would be useful for extension officers, agricultural teachers, families, and leading farmers – and anyone who would be interested. The recipes that we created adopted the traditional method of cooking but included a twist and fresh approach (for example, Figure 7). We also did cooking



**Figure 8.**





**Figure 9.** An ACIAR-supported kitchen garden.

demonstrations, and found there was keen interest from the participants, who included a lot of men as well as young women and mothers (Figure 8).

We provided information as recipes, factsheets and posters to a wide range of audiences by attending and participating in shows, exhibitions, and meetings. We also gave radio talks about traditional vegetables and about our project. We also had traditional vegetables featured in local newspapers as well as on local TV programs and on social media such as Facebook.

We established community kitchen gardens in peri-urban areas (e.g. Figure 9), to be a model for farmers in the surrounding communities, and we conducted farmer-training sessions based on their needs: for example, training in integrated pest management by staff of the World Vegetable Center. In those sessions we also took the opportunity to bring in important stakeholders such as the Health Department, especially staff of the malnutrition section in one of the biggest hospitals in the country. We wanted families to see the value in the vegetables that they are growing, and to understand that rates of malnutrition are very high in their communities.

You remember Albertha, from the start of this story? In Figure 10 she is attending one of the first seed-saving training sessions, one of many training



**Figure 10.** A session training smallholders in seed-saving techniques.

sessions that she has attended. She has now started a small seed-saving business, and is training other women farmers as well.

### **Our hopes for the future**

Education is the key, so we want to keep on promoting school programs, as well as working with maternal clinics linked to the hospitals. We will teach mothers to grow kitchen gardens and to have the three main food groups in those gardens so they can make nutritious meals with them. We will also be working with other stakeholders, especially Church groups, that can take our messages out to the remote areas.

For seed saving, we want to look at expanding the concept of community seed banks, and improve knowledge of seed-saving technology in the wider grower community. We will also work with the Government to strengthen the seed-saving systems for traditional vegetables, and we hope to go further into conservation and germplasm conservation of the huge diversity of traditional vegetables in PNG.

We also want to continue working with existing role-model farmers like Albertha, to carry on training the farmers.

### **Acknowledgements**

We want to acknowledge our collaborators and partners in this project: first, the Australian Government through the wonderful work that the ACIAR does; and also Charles Darwin University, the University of Queensland, the World Vegetable Center, the PNG National Agricultural Research Institute, the Fresh Produce Development Agency in PNG, the PNG Women in Agriculture, and World Vision International, the in-country program. Thank you all.

Philmah has six years' experience working in research and development activities, mainly with vegetables, promoting sustainable production and community gene-banks with farming communities in Papua New Guinea (PNG). She is an agronomist with the Papua New Guinea National Agricultural Research Institute, and is a passionate advocate for agriculture in PNG, especially working with young people and women from rural areas. Ms Waken graduated with a Bachelors degree in Agricultural Science from the Papua New Guinea University of Technology and is currently enrolled in a Masters in Agricultural Science degree program with the University of Queensland.

Tania is currently the Horticulture Team Leader and Research Fellow at Charles Darwin University in the Northern Territory, and leads the ACIAR project 'Promoting traditional vegetable production and consumption for improved livelihoods in Papua New Guinea and northern Australia'. She has lived and worked in Timor-Leste, Papua New Guinea and Indonesia, including remote areas of West Papua in community-driven development, capacity building, natural resource management and agriculture. Tania has a background in agriculture and natural resource management, and has a strong interest in education, training and capacity development including TVET (Technical & further education Vocational Education & Training) research and pathways.

# Nutrition-sensitive agriculture programming: addressing demand- and supply-side factors in Timor-Leste

Annie Major

Adam Smith International (ASI)

## Abstract



To contribute to the reduction of malnutrition in Timor-Leste, particularly for women of reproductive age and children aged 6–23 months, the To'os ba Moris Di'ak / Farming for Prosperity program (TOMAK) run by the Dept of Foreign Affairs & Trade, applies a nutrition-sensitive agriculture (NSA) approach. This approach seeks to strengthen the contribution of agriculture to improving nutrition outcomes.

Agriculture is nutrition-sensitive when it addresses the underlying causes of malnutrition. The program focuses on supply-side and demand-side issues surrounding nutrition. On the supply side, TOMAK aims to improve supply and year-round access to nutritious foods – particularly for women and children. This includes building NSA knowledge and skills at institutional as well as community level, and developing gender-equitable decision-making in households. On the demand side, TOMAK is influencing awareness of and demand for nutritious food at the household level through social behaviour change (SBC) communication, to maximise consumption of nutritious foods. To create this change, TOMAK works with and through partners, including NGOs and government. The approach has allowed TOMAK to build on and expand the work of the non-government organisations Mercy Corps, Catholic Relief Services and World Vision and their local partners, as well as providing opportunities to trial new approaches to NSA and SBC in Timor-Leste. TOMAK works closely with the Ministry of Agriculture and Fisheries and Ministry of Health, taking a multi-sectoral approach to augment the Government of Timor-Leste's existing nutrition work and develop increased NSA capacity for delivery in municipalities.

It is great to be here representing the TOMAK (To'os ba Moris Di'ak) program in Timor-Leste. The TOMAK program is a nutrition, food security, and agricultural market systems program. This quite broad program is in its first five-year phase of a ten-year investment by the Australian Department of Foreign Affairs & Trade (DFAT). The program mobilised in mid-2016. For the first eight months or so we reviewed the vast quantities of secondary information and data that are available in Timor-Leste in these key areas, as well as making targeted studies to help us develop our program's guiding strategy. We started implementing our program early last year. As a result we are still in the early phases, so this talk is less about results and more about our approach to the program.

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

## Objectives and locations of the program

The program has dual and interlinked objectives. For Component 1 the objective is to improve food security and nutrition, through nutrition-sensitive agriculture (NSA) and by strengthening the way agriculture contributes to good nutrition. We particularly focus on women of reproductive age (15–49 years) and children aged 6–23 months.

We aim to address both demand and supply in the local agriculture so these women and children can have access to sufficient and diverse food all year round. Ultimately, we hope that:

- more children in this age bracket will have the minimum-acceptable diet, and
- that women of reproductive age will have a more diverse diet.

Component 2 focuses on nudging rural subsistence farmers towards commercial agriculture. Our objective here is to:

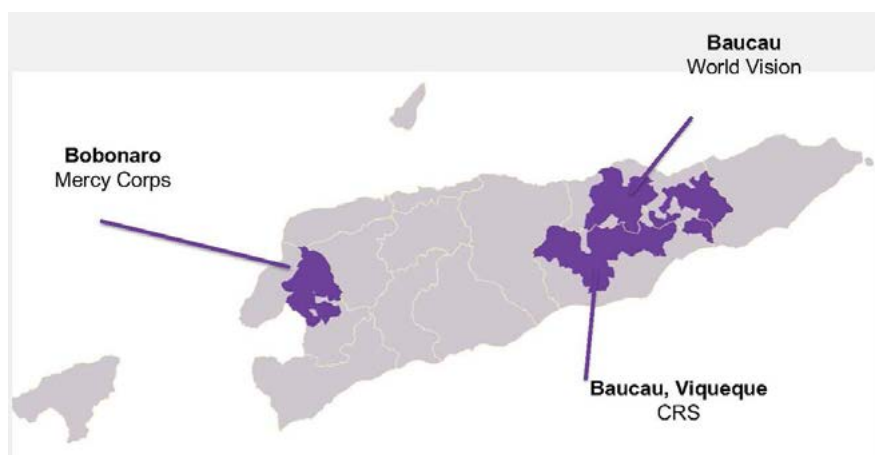
- strengthen overall market systems, so that farmers can make a living at commercial scale, rather than subsistence scale.

Across both components we aim for integrated gender equality and social inclusion throughout.

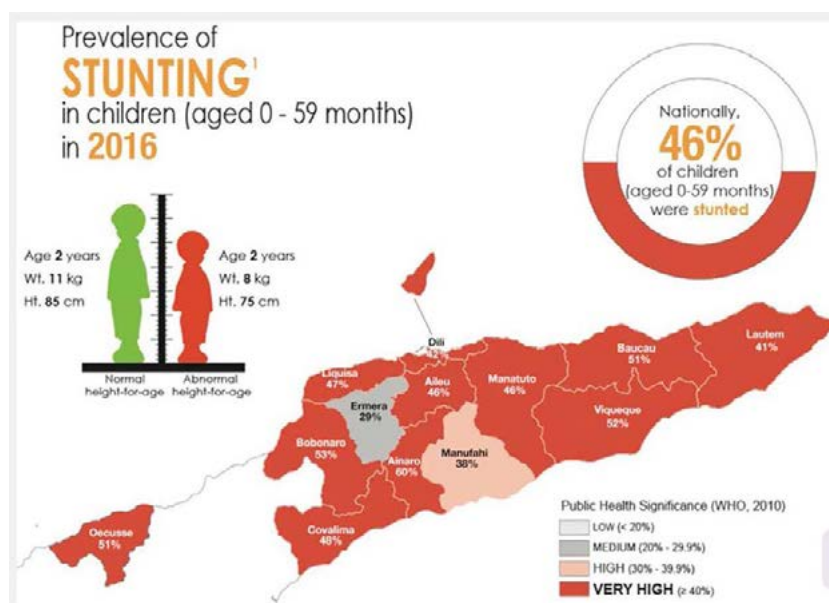
There has already been extensive work on both components in Timor-Leste, by a range of groups, and the TOMAK program recognises what they have done. We hope to build on their activities and partner with these groups – which include government and non-government organisations (NGOs) and the private sector – working together to add value and augment their work.

Geographically TOMAK is located in three municipalities in Timor-Leste: Bobonaro, Baucau, and Viqueque (Figure 1). In these municipalities our important implementing partners for Component 1 are Mercy Corps, World Vision, and Catholic Relief Services (CRS), as Figure 1 shows. We work with and through these actors, as well as through the Timor-Leste Government.

We work very closely with the Timor-Leste Ministry of Agriculture and Fisheries and also collaboratively with the Ministry of Health, helping those two ministries



**Figure 1.** The three geographic focus areas (municipalities) for TOMAK.



**Figure 2.** Malnutrition among children in Timor-Leste aged 0–59 months.

*Original source: DFAT; adapted by TOMAK.*

link together in their work towards improving nutrition outcomes. This initial focus will then expand – probably in the second phase of the program.

### Nutritional status in Timor-Leste

As you may know, key nutritional indicators in Timor-Leste are extremely low (Figure 2), even by least developed country standards, due to constrained availability and diversity of nutritious food. This is exacerbated by generally poor knowledge, attitudes, and practices related to nutrition behaviour at community and household level. The results from the Timor-Leste Demographic and Health Survey in 2016 actually showed that these statistics are worsening in some key areas. Poor diets for children are a factor contributing to that.

The survey found that nationally only 13% of children (aged 6–23 months) are eating the minimum-acceptable diet, and this refers to both the frequency and the diversity of their diets each day. The TOMAK baseline review which we conducted recently supported these statistics in our focus municipalities. We particularly found that both breastfed and non-breastfed children in our target age bracket had very little diversity in their diets, but while non-breastfed children had very infrequent meals, breastfed children ate surprisingly often.

Similarly, we found that women of reproductive age in our target municipalities had very little variety in their diets (Figure 3), and that they most commonly eat staple foods and green leafy vegetables rather than the other food groups. Our baseline showed us that dietary diversity is critical for women, and that they need to be encouraged to eat a wider range of foods including meat, seafood organs, fruits and vegetables rich in vitamin A, pulses, other fruit and vegetables, and nuts and seeds.

**Figure 3.** Minimum dietary diversity for women.

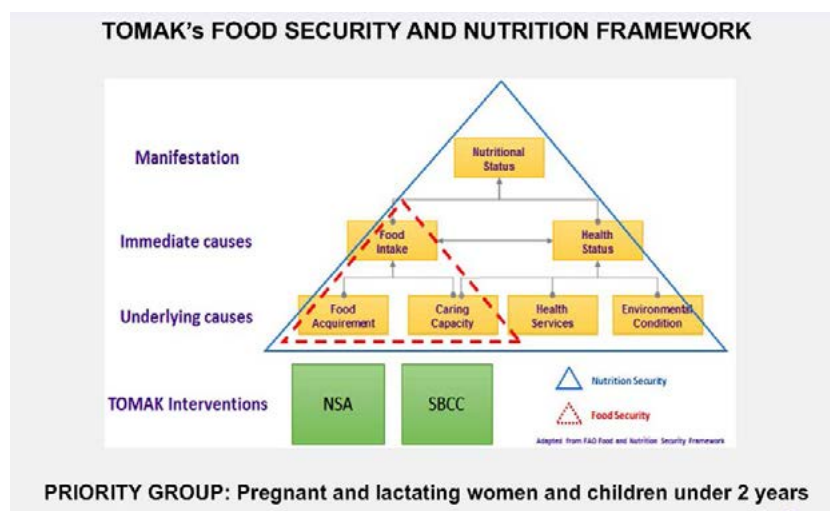
A recent TOMAK survey found that only 15% of women of reproductive age were getting the minimum dietary diversity (in TOMAK areas).



TOMAK's food security and nutrition framework acknowledges that a range of other factors also affect nutritional status and malnutrition outcomes and those statistics. The TOMAK program is responding by focusing on agriculture, and on access to and use of nutritious food. As Figure 4 shows, we are considering nutrition-sensitive agriculture (NSA) approaches on the supply side, and ways to achieve social behaviour change (SBC) to modify demand.

Our supply-side activities, with our major partners, include support for:

- increasing and diversifying production – this can mean supporting home gardens or fish farming (which we are about to begin with CRS), poultry production and conservation agricultural approaches;



**Figure 4.** TOMAK's food security & nutrition strategy.





- improved storage, processing and preservation: better storage techniques for grain and seed; better food processing and preservation techniques;
- better handling and utilisation of nutritious food to prevent the loss of nutrition during preparation;
- increased household purchasing and investment power, recognising that use of income is important in the purchase of nutritious food; and
- inclusive decision-making processes regarding nutrition, recognising the important role men have to play in household decision-making around what is consumed by the family.

On the demand side we have developed a social behaviour change strategy which guides our staff and our partners to make detailed identification of the intended audiences, main messages and important behaviours that TOMAK will promote – and how they will be promoted, and with whom at the community and household level.

Our focus is on a set of feasible practices, recognising what the target audiences are already doing, and what program features might lead to significantly different nutrition in households. For instance, we would like to see mothers incorporating foods rich in micronutrients into family meals at least four times a week, so we worked with our partners to identify specifically what that meant: i.e. mothers incorporating beans or soy into family meals at least two times a week, and incorporating eggs for instance, and being able to source and use fish protein also.

In other words, on the demand side we hope to work with and influence the behaviour of households so they adopt better nutritional practices, and we are working very closely with our key implementing partners to achieve that.

### **Implementation**

We have important implementation partners, with whom we have developed an implementation approach. This is how it works:

- we have strategic long-term partnerships with several leading international NGOs (INGOs) in each municipality, as well as their local partner networks. The arrangements vary: some partners work with local NGOs; some work with community groups. We aim to build on, and learn from, the work they have done, and augment it based on the lessons learned.

- we also work with the Ministry of Agriculture and Fisheries and Ministry of Health at the municipal level. They are key delivery and coordination partners. Recently we have been delighted that the Minister for Agriculture and Fisheries has advocated for the adoption of the Nutrition-Sensitive Agriculture curriculum as a national curriculum for their extension officers. We are currently piloting that across the three municipalities, and they are considering adopting it across the nation.
- we have built on work that has been done before, and partner experience, as I mentioned above, adapting existing materials and ensuring that their messages align with national strategies and priorities, and that partners are working together to use these messages and reinforce them at the local level. These groups include care groups, parents, Church groups, food processing groups, and others.
- to ensure that we learn from our partners, we have developed a learning and development platform so that we can exchange lessons about what has worked and what has not worked, and so we can compare the various implementation models across our partners at the municipal level.

Annie is a Senior Manager for Adam Smith International (ASI) Asia-Pacific, and their in-house Monitoring and Results Measurement systems specialist for the region, with experience working in Timor-Leste, Cambodia, Indonesia and Vietnam. She brings significant experience in the development of program logics, as well as practical experience in the use of the DCED Standard on 'Making Markets Work for the Poor' programs, covering value chain, business development services, and micro, small and medium enterprises. As the Monitoring Manager for the International Labour Organization (ILO) on the Business Opportunities and Support Services Project in Timor-Leste, Annie delivered an impact assessment on an agriculture invention and co-wrote a case study on this experience, reflecting on the application of the DCED Standard and realities of measuring impact of market systems projects in thin markets. She has also provided advisory inputs to the ILO on the use of the DCED Standard, has undertaken a baseline study on ASI's 5-year horticulture project in Myanmar (funded by the NZ Ministry of Foreign Affairs and Trade), and leads the design of Monitoring and Evaluation (M&E) frameworks for ASI's projects in South East Asia. Annie led the development of the M&E framework, systems and baselines for DFAT's 5-year A\$5 million agriculture market systems development and nutrition program in Timor-Leste (TOMAK), which commenced in June 2016, and she recently established the Monitoring & Results Measurement Framework and Plan for DFAT's A\$14 million market systems development program in Solomon Islands (Strongim Bisnis). Annie has a Bachelor of Management from the University of South Australia, and Masters degrees in International and Community Development, and International Relations, both from Deakin University.



## Small fish, big impact: nutrition-sensitive approaches to fish agri-food systems

Dr Jessica Bogard & Dr Shamia Chowdhury

CSIRO & WorldFish

### Abstract



Fish plays a vital role in the nutritional quality of diets in Bangladesh, especially for the poor. It is also inextricably linked to the culture of Bangladeshi people and supports the livelihoods of more than 17 million people. Nutrient composition analysis has shown wide variability in the nutritional value of different fish species, with small indigenous fish species (SIS) being particularly rich sources of iron, zinc, calcium, vitamin A, vitamin B12 and other micronutrients, in comparison to commonly farmed species. Given widespread malnutrition issues in Bangladesh, there is significant opportunity for fish to play a greater role in contributing to improved food and nutrition security. WorldFish and partners have developed a package of approaches to maximise the benefit of fisheries and aquaculture for nutrition outcomes among vulnerable groups through nutrition-sensitive fish agri-food systems. These involve inclusion

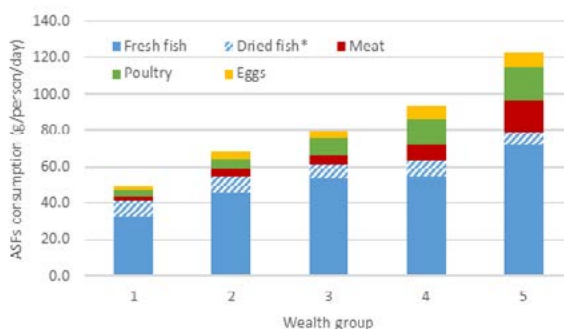
of nutrient-rich SIS in pond polyculture systems, enhanced stocking of SIS in wetlands, integrated vegetable production on pond dykes and in homestead gardens, simple processing of fish to improve suitability for consumption by infants, and engaging women in fish harvesting to promote frequent consumption of SIS by women and children. These activities are supported by broader approaches including transforming norms, attitudes and practices around gender equity, and social behaviour change communication for improved nutrition and hygiene practices. The integrated and multi-component nature of these approaches has shown numerous benefits for nutrition, gender equity, income and livelihoods. Nutrition-sensitive approaches to fish agri-food systems are central to contributing to the Sustainable Development Goals in Bangladesh and beyond.

**Dr Jessica Bogard:** As a nutritionist I am absolutely thrilled to present this paper at today's conference. Having first attended a Crawford Fund conference a couple of years ago as a Crawford Fund Scholar, when the conference theme was on feeding the nine billion, it is a pleasure to see that this year's theme is how we can nourish the growing population, and to present part of our study on nutrition-sensitive fish agri-food systems.

Bangladesh is a South Asian nation of 160 million people, situated at the convergence of three of the world's largest river systems: Ganges, Brahmaputra and Meghna. It has extensive floodplains and is very rich in aquatic resources

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



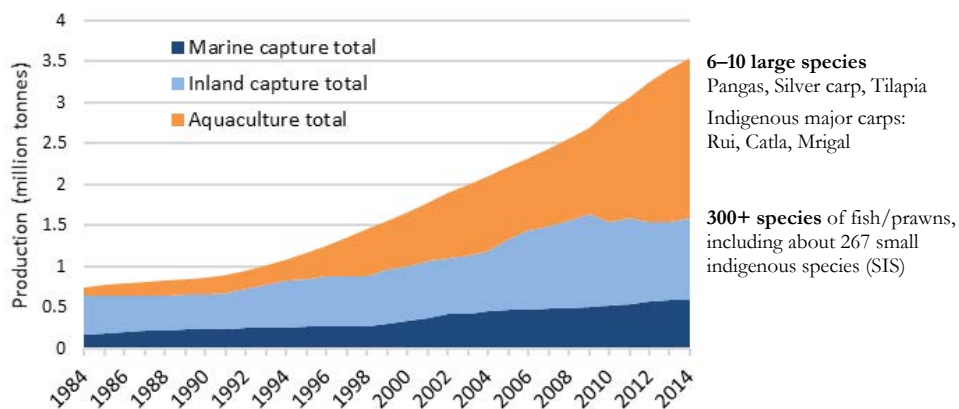
**Figure 1.** Animal-source food consumption in Bangladesh (g/person/day) (Bogard *et al.* 2016).

which form a vital part of the economy, livelihoods, the culture and local food systems. Fish, rice and pulses form the traditional diet, which is epitomised in the proverb ‘Machh-e Bhat-e Bangali’ which translates to ‘Fish and rice make a Bengali’.

Figure 1 shows animal-source food consumption by different wealth groups. Fish, shown in blue, is by far the most important animal-source food across all wealth groups, though it is consumed in relatively smaller quantities by the poorest (group 1).

While progress has been made, malnutrition remains a pervasive issue, with 36% of children under five years being chronically stunted, nearly 60% of adult women (aged 15–49) suffering from zinc deficiency, and more than 75% of children under five being deficient in vitamin A.

The fisheries sector in Bangladesh is undergoing a transition, as it is globally, with declines in capture fisheries and rapid growth in aquaculture. Figure 2 shows production volumes from aquaculture in orange, and capture fisheries



**Figure 2.** Capture fisheries and aquaculture production in Bangladesh over time (Dept of Fisheries: Fisheries statistical year books 1993–2015).

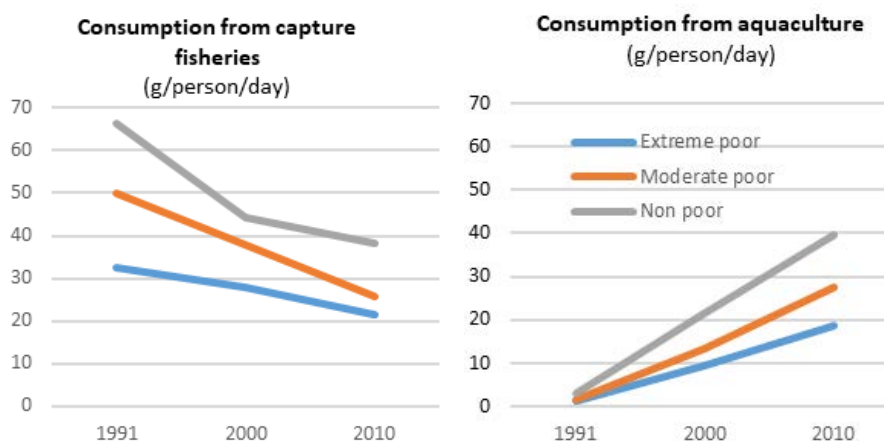
in blue, from the 1980s until now. There is clearly a stagnating supply from capture fisheries over the last ten years or so, and continuing rapid growth in aquaculture. The decline in capture fisheries has been driven by a number of factors, including: overfishing related to increasing demand; industrial pollution; urban encroachment; expansion of transport infrastructure; and, most significant, changes in water and land management. Floodplains have been mechanically drained for the purposes of agriculture, and floodbanks and enclosures have been constructed for the purposes of aquaculture. These structures prevent fish migration and interrupt their breeding cycles, and that has led to loss of both biomass and biodiversity.



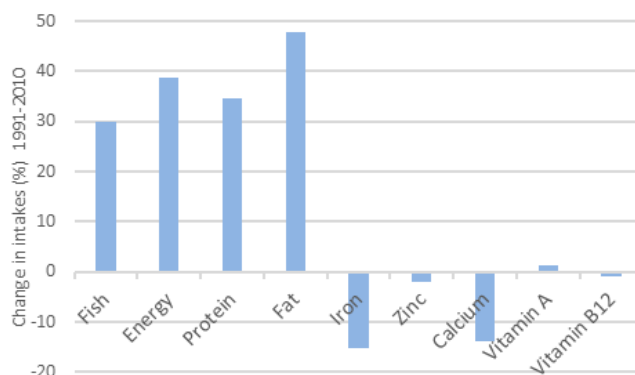
**Figure 3.** Bangladesh is one of the world's largest producers of aquaculture products.

A large focus of government and donor policies and programs has been on aquaculture (Figure 3). There have been significant investments in research and technology; a proliferation of hatcheries and fish traders; investment in a large aquacultural extension network; and significant private sector investment. These factors combined have led to Bangladesh becoming the world's fifth largest producer of aquaculture products.

Not surprisingly these changes in availability are reflected in diets. In Figure 4, the left-hand graph shows a clear decline in consumption of fish from capture fisheries, and the right-hand graph shows a large increase in consumption of species from aquaculture.



**Figure 4.** Shifts in fish consumption over time (Bogard *et al.* 2017).



**Figure 5.** Change in nutrient intakes from fish, 1991–2010 (Bogard *et al.* 2017).

### Does it matter?

To explore the impact of this change we analysed the nutritional value of 55 fish species from both aquaculture and capture fisheries, and we found that all species had a very similar content of protein but there was huge variability in micronutrient content. In general the species from capture fisheries were much more nutritious than those species which were being farmed.

This finding prompted the question: Has increased availability of farmed fish offset the decline in consumption from capture fisheries in terms of nutritional quality? To answer that question we matched nationally representative fish consumption data to the fish nutrient composition data to look at nutrient intakes from fish in the early 1990s compared to 2010. We found that there was an average increase in fish consumption by around 30%, and similar increases in energy, protein and fat from fish. However, intakes of micronutrients from fish showed either no change or even some decreases, despite that increase in quantity being consumed (Figure 5). These micronutrients are precisely those for which we have seen pervasive deficiencies across the population. This tells us that more is not better and, in this case, attempts to improve food security have had a negative impact on nutrition security. Aquaculture has had a vital role in maintaining availability and affordability of fish, and will continue to do so. However, the findings emphasise the need to move beyond measures of quantity in production systems, to also consider nutritional quality.

My colleague Shamia Chowdhury now describes how we are working towards bringing a nutrition-sensitive approach into fisheries in Bangladesh.

### Nutrition-sensitive fish agri-food systems: various approaches

**Dr Shamia Chowdhury:** The nutrition-sensitive fish agri-food system is a combination of many approaches. One approach is the polyculture of diverse large and small fish species. Another approach is enhancement of large and small fish-stocking in wetland waterbodies.

Small species in polyculture include the mola fish (*Amblypharyngodon mola*). Mola is a small indigenous species which is very common in Bangladesh and is



**Figure 6.** Women in Bangladesh working in pond dykes; preparing vegetables for meals; and beside a fish-farming pond. *Images: WorldFish.*

naturally rich in vitamin A, calcium, iron and zinc. The large fish are carp species. The mix of small and large fish increases household consumption, and supports income generation.

From their ponds, householders can make frequent partial harvests of small amounts of small fish for family meals, which is especially beneficial for women and young children. Meanwhile, sale of large carp yields household income.

In another approach, households are encouraged to integrate micronutrient-rich vegetable production into their household routine, with a special focus on the orange sweet potato (rich in vitamin A) and other seasonal local vegetables rich in essential micronutrients. In Bangladesh vitamin A deficiency is very prevalent. By growing vegetables in their homestead gardens or on the dykes around their household ponds stocked with fish, families can add the small mola fish and the orange sweet potato to their diets, providing both iron and vitamin A (Figure 6).

### Fishing technique

Women harvest the small fish using a mola gill net (Figure 7), which was designed by WorldFish. The net catches the minimal requirement for the family meal.

Women are able to catch the fish by themselves. In our country they are usually dependent on the men for the daily harvest of fish. Because of social customs, women cannot go outside the household to do the harvesting, and also they cannot enter themselves into the waterbodies. With this net they do not need to enter themselves into the pond because they can harvest the mola fish from the pond-side. This simple technology is now being adapted for use in other countries where WorldFish operates.



**Figure 7.** Women using the mola gill net. *Images: WorldFish.*

The women can also make the gill nets by themselves, either for their own use or to sell at the market to earn a small income.

### **Transforming gender norms**

In transforming gender norms, we focus on household approaches: not only women but also men, mothers-in-law and others. Previously it was men who were responsible for buying or providing the family food, and mother-in-law was in charge of the kitchen and food distribution among the members of the household. Men's work was the main way the family could generate income.

Women and men easily understand the value of sharing the workload. By sharing the food-providing role and earning some income, women are gaining more influence in household decision-making processes.

### **Supportive communication materials**

To increase the health of women, children and other family members, and to transform knowledge into practice, we have prepared a range of communication materials to encourage change in social behaviour, including information about the value of small fish and vegetables in the diets of women and young children. Our publications include training manuals, audio visual materials, and food cards, for example. Women in the communities promote the system for its support for production and consumption. We also work with government staff and NGO stakeholders in the health and the nutrition sectors, sharing our messages about 'Essential Nutrition Actions' and 'Essential Hygiene Actions'.

### **Lessons**

During implementing this agri-food system we learned several lessons which are helping us continue to extend the system in Bangladesh and in other countries where WorldFish operates, and to scale it up.

- We have found it is very important to gain the support of the community and all family members. Without that support we do not see the positive changes taking place.
- The women taking part and as promoters are motivated by the respect they receive from their family and the community.
- Most important, we found that neighbours and other members of the community, whom we had not yet contacted, are also adopting pond aquaculture and growing orange sweet potatoes.
- Fish polyculture is increasing small-fish production and diversity. Polyculture increases total fish production by 3.5 times in household ponds, and doubles production in the larger waterbodies. More dried small fish are also being produced from the waterbodies.
- Women and young children older than 6 months are eating more diverse diets including fish and vegetables, more often.
- Household incomes are increasing, through the sale of surplus fish and vegetables at the market. The household can then use the income to improve their lives, including their health, education, and other facilities.

- By bringing in income, the women gain power to share the decision-making which gives them empowerment.

### Key messages

Where nutrition is not actively considered from the start, fisheries interventions can have unintended negative consequences. Therefore it is essential when planning interventions to think through the potential impacts on diet and nutrition.

Also, working together across all disciplines is the only way to make sound progress on achieving the Sustainable Development Goals, and so we invite everyone who is working in agriculture to invite nutritionists to their table for research planning and decision-making.

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Jessica, a former Crawford Fund conference scholar, is an Accredited Practising Dietitian (APD) and Nutrition Systems Scientist with CSIRO Agriculture and Food. As a dietitian and public health nutritionist, she works predominantly with ‘non-nutritionists’ on approaches to leveraging agriculture and food systems for better nutrition outcomes, particularly among vulnerable population groups including women and young children. Jessica completed her PhD at the University of Queensland where she examined the contribution of fish to nutrition and food security in Bangladesh. Previously she worked for WorldFish, a CGIAR research centre, developing approaches to integrate nutrition considerations into their work on food security related to fisheries and aquaculture.

Shamia is a Nutrition Specialist with WorldFish, one of the Consultative Group on International Agricultural Research (CGIAR) centres, that harnesses the potential of fisheries and aquaculture to reduce hunger, ensure food security and alleviate poverty. Shamia is a Dental Surgeon by background. She also has a Master of Public Health (MPH), and a Master of Science (MSc) from the Institute of Tropical Medicine (ITM) in Antwerp, Belgium, focused on Health System Management and Policy. Working towards improvements in maternal and child health has become her professional forte as well as a personal area of interest. Being inspired to serve the underprivileged, she has shifted her profession from clinical practice to the development sector. Her last eight years of professional experience have provided her the opportunity to work with several respected international non-government organisations in Bangladesh, particularly in relation to health and nutrition.



## Iron-biofortified cereals to reduce hidden hunger in Africa

Associate Professor Alex Johnson  
The University of Melbourne

### Abstract



Micronutrient deficiencies are among the most serious health issues facing billions of people in developing countries of Africa, Asia and Latin America. Rice and wheat provide a significant proportion of dietary energy in these countries, yet people who consume large quantities of cereals often suffer from ‘hidden hunger’ due to low concentrations of iron, zinc and provitamin A in the grain. Human iron deficiency is the most common nutritional disorder in the world, affecting more than

two billion people, with symptoms ranging from poor mental development in children and depressed immune function, to iron deficiency anaemia. The development of iron enriched crops – a process commonly referred to as iron biofortification – has emerged as a highly economic and sustainable approach towards increasing iron intakes in developing countries at no additional cost to growers and food manufacturers. We have used genetic engineering to produce rice and wheat plants that are more effective at mining soil for iron and transporting iron to grain. These iron-biofortified plants contain significantly increased iron concentrations in edible grain tissues. They yield normally in multi-location field trials, and have high iron bioavailability as indicated by cell culture assays. Whilst the first release of iron-biofortified rice will likely occur in Bangladesh, subsequent adoption of iron-biofortified rice in West and Central Africa could contribute to major reductions in human iron deficiency. Iron-biofortified wheat is likely to have similar impact if adopted in wheat growing regions of North Africa.

The talks that have preceded this presentation have made it clear that ‘hidden hunger’, or the lack of vitamins and minerals, affects a huge number of people around the world. Iron deficiency, for instance, affects more than two billion people around the world (WHO Global Health Observatory database). It is the most common nutritional disorder that we have on the planet affecting humans. There are also huge problems with zinc deficiency and vitamin A deficiency. All these deficiencies negatively impact on our health. They can cause anaemia, in the case of iron, and stunting when you lack zinc. Earlier today we heard that over 155 million children are stunted. The effects of hidden hunger are terrible, and definitely need to be corrected.

How did we get to a situation where we have such big problems with hidden hunger, particularly in developing countries around the world? Some of this situation is a legacy of the Green Revolution. During the Green Revolution we worked to produce more calories, mostly focusing on the ‘Big 3’ crops:

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



rice, wheat, and maize. Those crops were bred to provide calories, not micronutrients. Today there are a huge number of people who depend on, say, rice and wheat, for most of their daily calories, yet those grains do not contain significant amounts of micronutrients. Rice, for instance, contains no vitamin A.

This presentation focuses on iron. None of the major cereals is a rich source of iron because those cereals do not accumulate much iron in the grain. The small amount of iron that they do accumulate is in the outer layers of the grain – the bran and germ layers – which are removed by milling. That outer layer is quite oily, and the milling makes a much more stable product that does not go rancid. Milling, however, also removes most of the iron. Further, most iron in cereal grain is bound to phytate, a storage molecule that humans cannot digest. Therefore most iron in wholegrain is not bioavailable to humans.

Lack of micronutrients is likely to get worse in cereal grains, according to a few high profile studies that have been published over the last few years. A wide range of experiments have found that as atmospheric CO<sub>2</sub> increases so the concentrations of iron and zinc are likely to decrease by about 10% in all the C3 grains – including wheat and rice – and also in the C3 legumes, and protein concentrations are likely to fall also (e.g. Myers *et al.* 2014). We shall be dealing with this situation in the very near future, at CO<sub>2</sub> levels that we expect will occur by 2050. The effect is not simply dilution because the plants seem to take up as much iron as at lower CO<sub>2</sub> levels, but more remains in the leaf and less is distributed into the grain.

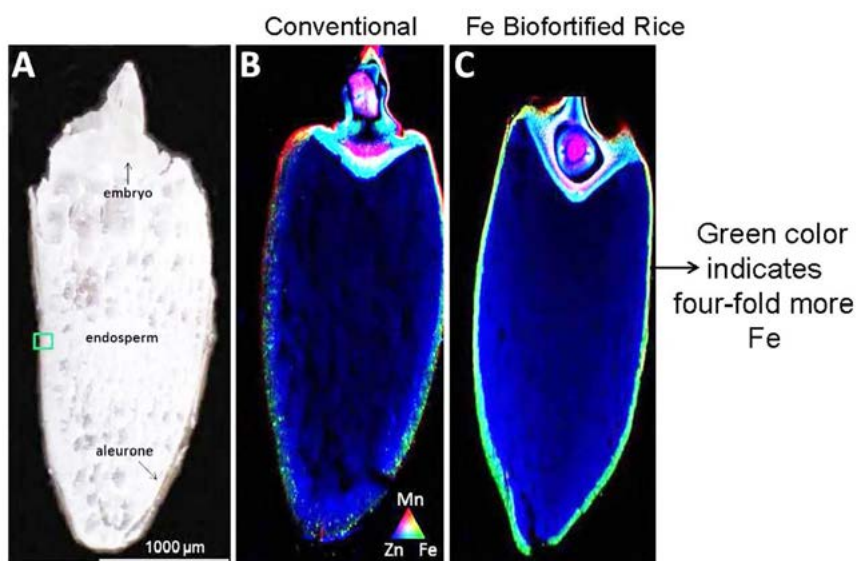
## Biofortification

There are already many tools available to tackle hidden hunger, and we need every one of them. One approach is to supplement and fortify cereal products via food processing, but the costs are recurrent and this approach work best in urban areas or cities, therefore largely not benefiting rural populations. On the other hand, biofortification – the development of micronutrient-enriched cereal plants – benefits consumers in urban *and rural* regions.

Biofortification can be very expensive, but it is a one-time investment that then can have impact around the world. Some crops have been biofortified through conventional plant breeding: for instance, high zinc rice and wheat. Other nutrient concentrations cannot be fortified by conventional breeding, and the enhanced vitamin A in golden rice is a good example. That modification to the rice plant, giving the grain its golden colour, requires genetic engineering.

Fortifying with iron also requires genetic engineering. I have worked with an organisation called HarvestPlus for over ten years on the problem. Decades of conventional breeding have failed to adequately biofortify the three major cereals with iron.

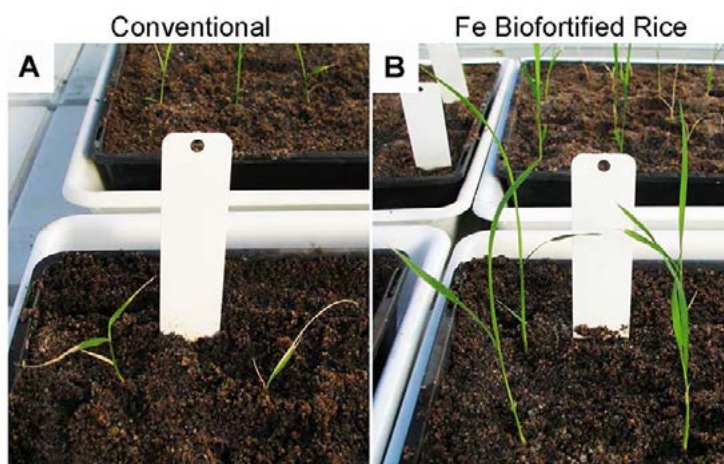
Modifying a single gene can make rice more effective at extracting iron from soil (Johnson 2013), and a similar outcome is possible for wheat. The work entails finding genes that are involved in the chelation of iron, which keeps the iron soluble in the plant. Then the geneticist amplifies that effect with a strong promoter, a ‘constitutive promoter’. Figure 1 shows a conventional rice grain on the left, and a biofortified rice grain on the right, imaged in the Synchrotron



**Figure 1.** Biofortified rice grain (Johnson *et al.* 2011; Kyriacou *et al.* 2014).

where we are able to colour-code where elements are within a grain. The green colour in the right-hand grain reveals that these biofortified rice plants are putting about four-fold more iron into the grain, which means that the milled grain reaches biofortification targets. To achieve this we ‘turned up’ a single rice gene so it can chelate iron more effectively and the plant can harvest more iron from the soil. That success in harvesting iron is indicated by the good growth of the biofortified rice plants (see Figure 2) in soil of pH 8.5, pre-alkaline soil, which almost kills the conventional plants.

We can do the exact same thing with wheat, by taking that single rice gene and implanting it into wheat. With this approach we observed big increases in the



**Figure 2.** Genetically modified rice seedlings (right) grow well in soil mix with pH 8.5 (UC Davis soil mix), unlike unmodified rice in the same soil mix (left) (Johnson 2013).

amount of iron deep in the endosperm of the wheat grain. Therefore, even after milling, the grain is still iron-biofortified.

### The future

The iron-biofortified rice project has now moved into a deregulation phase, with the aim of making this genetically engineered biofortified rice available in Bangladesh.

Why Bangladesh? In 2013 the Bangladesh Government approved genetically engineered eggplant (Bt brinjal) which is resistant to its major pest, and that has been a big success. They are quite open to biotechnology, so we see this as an opportunity to release the iron-biofortified rice and have a big impact in a country where the people eat a lot of rice, and rice is grown on 80% of the cultivated land.

Our next challenge is to see if biofortified grain can be accepted in Africa, because so far we have not found a country in Africa that is as open to biotech as Bangladesh. If iron-biofortified rice and wheat crops could be grown in Africa – say in West Africa for rice, or North Africa for wheat – they could make a big difference.

I think that to tackle hidden hunger via biofortified plants there needs to be a change of attitudes towards agricultural biotechnology, from everyone around the world who is working in this area. Conventional breeding can deliver a range of biofortified crops – provitamin A cassava, iron-biofortified pearl millet and beans, for instance – and that should be applied wherever it achieves the targets. But where that is not the case we need to use crops modified by agricultural biotechnology – for example, golden rice and iron-biofortified rice and wheat.

It is expensive technology: the costs of discovery, development and authorisation (deregulation) of a genetically engineered crop can exceed \$100 million. Therefore we need the support and investment of developed countries like Australia, and of governments, to enable genetically engineered biofortified crops to be commercialised for use in developing countries – via public–private partnerships for example – to realise these crops' full potential.

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Alex Johnson heads a research laboratory focused on plant nutrition and biofortification in the School of BioSciences at The University of Melbourne. His research explores how plants absorb nutrients from soil and the factors affecting nutrient bioavailability in edible parts of plants. He has worked with the non-profit initiative HarvestPlus over the past decade to develop iron-biofortified varieties of rice and wheat to combat human iron deficiency in developing countries. Alex has a Master of Science and PhD from Virginia Tech in the USA. Prior to Melbourne he held postdoctoral positions at the University of Cambridge (Cambridge, UK) and the Australian Centre for Plant Functional Genomics (Adelaide, Australia).

## Session 4 – Q&A

Panel: Professor Glenn Denning, Philmah Seta Waken, Tania Paul,  
Annie Major, Dr Jessica Bogard, Dr Shamia Chowdhury,  
Associate Professor Alex Johnson

Chair: Dr Sarah Pearson:

**Chair:** We have only a short time for questions.

**Q: Delegate from University of the Sunshine Coast**

Thank you to all the speakers for amazing presentations. Two quick questions for Alex Johnson.

First, how do these nutrients become absorbed into human bodies, because it is one thing for the plant to have a bigger nutrient content, and quite another thing to have the nutrients absorbed. Do we know if these nutrients are being absorbed better or in bigger quantities in the body?

Second, in regard to food sovereignty. These technologies will help big populations throughout the world, but the technology still belongs to biotech companies. I would like to hear from you how these technologies could influence the food sovereignty of these people.

**A: Associate Professor Alex Johnson**

Thanks for your questions. I'll start with the first one: What do we know about the absorption of iron from biofortified cereals? We have looked at that extensively with both the iron-biofortified rice and the wheat. We usually do an *in vitro* cell culture assay called Caco-2, where we feed rice or wheat to cells that are very similar to the human intestine. Then we can measure ferritin, to see how much iron enters those cells. Using that method we have been able to show that the iron is highly bioavailable, and also that it is not bound to phytate, in the case of the rice and wheat that I just talked about, but instead is bound to a chelator which makes it very bioavailable in the human diet.

In relation to food sovereignty and who owns this technology, for the work that I have shown here a lot of the proof-of-concept work has been funded by HarvestPlus, which is a non-profit organisation working to tackle hidden hunger with biofortified crops. The HarvestPlus goal is to give away its crops in developing countries to, say, national breeders who can then incorporate those genetics into the background of major germplasm. In this way they avoid the technology being tied up in intellectual property rights or owned by a large company. It is not just HarvestPlus that is doing this. The work aiming to get the rice into Bangladesh has been funded strictly by the Gates Foundation, and they also don't want to tie that up.

**Q: Md Hasanuzzaman, University of Tasmania**

I am from Bangladesh and I have a question for Alex Johnson. We know that Bt brinjal and golden rice, the genetically modified crops, are still a controversial issue in Bangladesh. Do you think it will be easy for the farmer to get the biofortified rice?

**A: Associate Professor Alex Johnson**

Well if it can be deregulated, then I can't see why it wouldn't be able to reach the farmers. Of course it needs to be accepted, and that's something that we always have to be sensitive about. So I guess we would follow closely in the footsteps of Bt brinjal and how that was released, how that was rolled out to farmers. We would want to follow a similar policy, and of course not give it to someone who doesn't want it. So it does need to be a carefully thought out process, how you distribute it. I think we would take Bt brinjal as our case study.

**Q: Jack Hetherington, The University of Adelaide and RAID**

A question for Glenn, but I am interested in the rest of the panel's thoughts. Obviously there's a lot of complexities around food systems. Glenn you mentioned a few, including food waste, and water and sanitation. How realistic do you think research projects, such as an ACIAR-type project, can be in addressing all these? There would be many constraints, including trying to work in the timeframes, and also some of the context and geographies; a lot of first principles would be needed. What level should this be focused at, do you think? Should it be at the project level, or at an organisational level, or between different donor parties, considering it could be trying to address these nexus issues?

**A: Professor Glenn Denning**

Thanks for that question. I wouldn't say that a research project should incorporate all of those aspects. I am thinking much more at the level of a national development program, a national nutrition improvement program, a food systems program. It would need to ensure that in the diagnosis stage, for example, we have a clear understanding of the roles of all of these components, whether it be agricultural intensification including GM, or post-harvest improvement, and how important each of these is in various commodities that are part of the food system.

I don't see any problem at all in then going back to basics and working intensively on components. But I think you need to create that overall analysis and framework, and then at a later point, when it is time to roll out these programs and test them via the sort of community projects that we have seen in some of the case studies today, that is when you bring them together as well. For instance, I mentioned hygiene and sanitation, and they are incorporated in nutrition-sensitive agriculture programs.

One thing I forgot to add in my presentation was that, as part of preparing professionals to be able to do this, I think it is very important that all of you who are studying agricultural science are also taking courses in health, in infrastructure and environment and some of these other areas, so you are sensitive to the other sectors and the roles of those other sectors.

**Chair:** We have run out of time. I think one of the beauties of having short ten minute speeches is that you get a feel for the areas these people work in, and you can follow up with them to find out more later. I encourage you to do that.

Please join me in thanking the panel for their insights and for their impact.

## Achieving impact and outcomes with farmers and families

Rebecca Boustead

Kellogg Asia Pacific

### Abstract



Improving farmers' livelihoods and solving morning hunger are two critical strategies to help to reduce hunger and improve human potential. According to the Food and Agricultural Organization of the United Nations (FAO), the Asia-Pacific region still has 490 million hungry people, more than any other region. This paper outlines innovative programs that are increasing productivity and resilience among farmers in the Kellogg supply chain by advancing

practices that help them to produce using fewer resources, and to reduce post-harvest food loss, to boost yields and income. Programs in Thailand, Bangladesh and Australia have created impact for rice and potato farmers, and the paper also describes a new model of creating social change to solve morning hunger. In spite of the importance of childhood nutrition being well understood, and significant progress in the last 25 years, global childhood hunger is still widespread. Every year, globally, 3.1 million children die (8500 children per day) because of poor nutrition. In the developing world alone, 66 million children of primary school age go to school hungry. Research shows that food insecurity in childhood can limit a child's cognitive and socio-emotional development, and therefore its long-term productivity and economic potential. This paper showcases programs from India, Australia and South Africa that are beginning to have an impact, and it presents a new collaboration model to drive social change and create even more impact. Ultimately, improving agricultural practices and reducing morning hunger are two key strategies that can create a spark to help transform countries' social and economic conditions.

This paper is about how we can work together to create outcomes and impacts, to improve the livelihoods of farmers that grow our foods and the ingredients for Kellogg products across the Asia-Pacific region. It also shows how we can work with the families that we serve in those regions, to help improve the health of those families.

I would like to share with you the programs we have been supporting to help build sustainable impact and address key issues in terms of nutrition and food security. I would also like to share a new model of collaboration that could have bold impact in the next decade to improve the effectiveness of what we can accomplish together.

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



Figure 1. The Kellogg 'Heart and Soul Strategy'.

## Heart and Soul Strategy

Kellogg has a 'Heart and Soul Strategy' (Figure 1). It is integral to our 'Deploy for Growth' Strategy at the Kellogg Company. Our vision is to 'Enrich and delight the world through foods and brands that matter', and our purpose is to 'Nourish families so they can flourish and thrive'. Under the Heart and Soul Boost, we have four pillars that are our 'north star', that guide all the work that we do: nourishing with our foods; feeding people in need; nurturing the planet; and living our founder's values.

Our target at the moment is to work in support of Sustainable Development Goal 2. Specifically, by 2025, through our signature program 'Breakfasts for Better Days', the Kellogg Company aims to:

- donate 2.5 billion servings of food to people in need;
- expand the breakfast programs and nutrition education, to reach 2 million people;

and, by 2020, to:

- improve the livelihoods of about 500,000 farmers, including 15,000 smallholder farmers that work within our supply chain networks, with a particular focus on women farmers that we know hold a lot of the keys to the success in those communities.

## Our history: supporting farmers and communities from the start

Before I explain our current work, here is a short history of the Kellogg Company. Our founder, W.K. Kellogg, was an amazing man who invested in farmers and agricultural research and also in communities, very early on in the life of the Kellogg Company, which he created when he was aged 46. The brothers W.K. Kellogg and John Harvey Kellogg were looking to release the nutrition of the grain and develop a convenient better-for-you breakfast meal. They succeeded almost by accident. They left some grain in a bucket of water for a





Figure 2. Farming and biodiversity initiatives set up by W.K. Kellogg.

couple of days, and when they put the grain through the rollers they found that, to their surprise, the grains formed thin large flakes which they then toasted on the kitchen fire. They discovered the ‘tempering’ process, which is still used in grain processing. Most Kellogg cereals, such as Just Right®, a breakfast food that you eat here in Australia, begin as a single grain of wheat that is flattened into a single flake. Corn Flakes® is made from a corn kernel: you slice the kernel across into three pieces and each third creates a flake. It is an interesting technology that has been around for 100 years.

In 1927, W.K. Kellogg purchased 125 acres of land near Michigan, where he set up the Kellogg Bird Sanctuary, which he then donated to Michigan State College. To this day the sanctuary provides field education in biological sciences to the public and also to researchers within the Michigan State College. At about the same time he also provided additional acreage to begin the Kellogg Demonstration Farm (Figure 2), which is still run by the Michigan Agricultural Experiment Station and used to conduct research into farm practices. It is very close to our headquarters at Battle Creek.

### Philanthropy for families

As well as supporting farmers, W.K. Kellogg also wanted to provide for healthy communities. In 1930, he established one of America’s largest philanthropic foundations, the W.K. Kellogg Foundation, and to this day 20% of Kellogg’s profits go to this Foundation to help it continue its great work. The Foundation aimed initially to improve children’s and families’ nutrition in the local community. The Foundation set up three summer camps for underprivileged children; they would attend for three to six months, and be educated on leadership skills, good nutrition, recreational programs such as physical activity. The government was required to contribute to this program by working with the children’s families back at home to improve their home lives. Kellogg has a long history of helping to achieve impact and outcomes for farmers and families.

## Modern programs for farmers

This takes me to how we continue this legacy today. Currently the Kellogg Company runs several programs in the Asia-Pacific as part of our Heart and Soul Strategy to improve the livelihoods of farmers as part of our ‘Nurturing the Planet’ pillar. I shall outline three of them.

### In Thailand

Thailand is part of ‘emerging Asia’. In 2016 there were 3.9 billion people in emerging Asia, and the population is expected to increase by 11% by 2030. In this region, 40% of the people are living below the poverty line, and 49% of the land is dedicated to agriculture. Thailand exports 8% of its food production.

For Kellogg, Thailand is one of our manufacturing hubs for cereals and snack foods which we then export to our Asian markets. One grain we needed was medium grain rice, which was not being grown in Thailand. That situation was a significant issue for us, so we set out to try to secure a supply of that type of rice within Thailand.

We began a collaborative effort with the Thailand Bureau of Rice Research and Development, identifying farms and smallholder farmers with whom we could partner to develop a medium grain rice that they could grow on their farms. Through conventional breeding practices and two years of work we developed a non-GMO (non-genetically modified) medium grain rice variety that was high yielding and had pest resistance.

We really wanted to work with the farmers to educate them on climate-smart agricultural practices and help them improve their productivity and resilience. For this work we also partnered with the United Nations Environment Program, and Charoen Pokphand CP Thailand and the International Rice Research Institute. Through that partnership we could give farmers access to some of the latest information and technology.

The farmer in Figure 3 (top) is named Jana. She talks about our rice as being a high quality rice that is quite well suited to her fields. She likes this variety because the stalks are quite short and strong, and it is robust. Our first crop of medium grain rice was harvested in 2015, working with over 700 smallholder farmers, 60% of whom are women.

The market expansion has resulted in increased incomes for the smallholder farmers because we buy the rice they produce and we pull it straight into our supply chain, thereby giving them a guaranteed market. This initiative has also



Figure 3. Jana (top photo) and Samurai.



**Figure 4.** Kellogg is sourcing its potatoes for Pringles® from Bangladeshi growers.

created a new export crop for Thailand, and there are times when medium grain rice sells at higher prices than other crops. Samurai, the other farmer in Figure 3, now has enough money to send his children to school. He's extremely proud to see the boxes of cereals containing food he has grown, and that his rice is going out and being used across the region.

### **In Bangladesh**

The second example of Kellogg's work is in Bangladesh where we are looking to source potatoes to bring into our supply chain for Pringles® (Figure 4). Bangladesh is the third largest producer of potatoes in the Asia-Pacific. Pringles® for the Asia-Pacific region are manufactured in Malaysia, in a state-of-the-art facility that we built there about three years ago.

In Bangladesh, about 78% of the population is below the poverty line. The majority of farmers use outdated technology, and we wanted to work with them to see if we would be able to use their potatoes in our manufacturing facility instead of sourcing potatoes from Europe. In working with these farmers we wanted to give them access to markets, and to educate them on climate-smart agricultural practices.

Through a program with the Bangladeshi company SEBA Limited we have trained more than 1000 smallholder farmers in eight different districts. An additional 1500 farmers have visited the demonstration farms where farmers who are not currently using our practices in their cropping can see how our methods can benefit a farm.

Through our training, our Bangladeshi growers have improved their yields by 25–100% compared to the national average. We have been able to give them higher profit margins, and we have linked the potato processors directly to the farmers without a middle man. The farmers themselves have been very happy with what Kellogg has done, and we are now in a capacity building phase, and undergoing quality assessments, and hoping to bring these farmers into our supply chain permanently from 2019.

## **Australia**

My third example is in Australia. We source Australian grain for all the cereal products that we make here in Australia. Kellogg is very proud to have been here since 1927. Our factory is in downtown Botany. We buy around 30,000 tonnes each year, mainly of wheat, corn (maize) and rice. We have had long partnerships with some of our suppliers: for example, 60 years partnering with SunRice, and over 20 years with the Manildra Group.

Kellogg is a significant purchaser of Australian wheat products, procuring over 20,000 tonnes of wheat materials each year including wheat bran, whole wheat and gluten. One of our main foci is exploring ways to improve soil health. We know how important it is to get the soil health right, so the foods we market have the right nutritional content.

From SunRice farmers, we sourced 12,500 tonnes of paddy rice in 2017. Rice farmers in Australia use good water-conservation methods, and we want to find new varieties that can be grown using even better climate-smart agricultural practices in Australia as well.

## **Other grains**

It is very difficult to bring in other grains – such as indigenous grains – although in India we make products with an indigenous grain called ‘ragi’ (finger millet).

Kellogg is doing some work on biofortified grains with HarvestPlus in the Asia–Pacific and sub-Saharan Africa regions. Our company sees it as extremely important for the food industry to be involved in that initiative, because as food processors we can provide demand for biofortified grain and a market for the farmers’ production. When farmers grow those grains they can also eat them themselves at home.

## **Focus on families**

The Asia–Pacific region has more than 490 million people going hungry, and 66 million children of primary school age going to school without breakfast. Children who go to school without breakfast miss out on learning properly in the morning session of school. Most governments in the Asia–Pacific region provide only a midday meal, and so children are potentially wasting those morning two or three hours of education because they cannot concentrate well on what they are doing. As other speakers have said, we know that with hunger and malnutrition children stand to lose more than 10% of their lifetime earnings, and it really is important for the economic prosperity of Asia–Pacific countries that we address this.

Kellogg is working with families and children in South Africa. Since 2016 we have been partnering with an organisation called FoodForward South Africa that has been providing breakfast to 25,000 children in 44 schools. All the schools have been selected in partnership with the Department of Education because they are in needy areas with low socioeconomic status. This program, giving the children access to breakfast, gives them an opportunity to get more out of their education in the morning. Where the program is operating we have found there is better attendance at school. Children now want to come to school because



**Figure 5.** Boys involved in the Clontarf Foundation’s football training program which is attracting the boys to finish year 12 at school and find jobs.

they want to have that breakfast, and they are coming to school on time. They have longer attention spans, and that is having a positive impact on their learning in class. Further, parents are also showing interest in coming to school, because they want to help feed the children in their breakfast programs.

Another example of our work with families is in Australia, with the Clontarf Foundation. Kellogg has been supporting the Clontarf Foundation since 2015 with both cereal supplies and funds. The Clontarf Foundation focuses on Aboriginal and Torres Strait Islander boys, aiming to improve their education, discipline, life skills, and self-esteem. Football is the vehicle they use to achieve participation in this program: Aussie Rules and rugby. The boys come to school to take part in training programs (Figure 5). The Clontarf Foundation team sends a bus around to pick up these boys every morning, without fail, from their homes, to make sure they get to school. There is a comprehensive approach, including a mentoring program with the boys in schools, focusing on keeping boys in school through to year 12 so they can complete their final year certificate and get jobs. In 2017 Kellogg donated over 40,000 serves of breakfast cereal to these programs – a combination of foods that are high in fibre, such as Sultana Bran®, and other foods such as Corn Flakes® that the boys want to eat. The results from the Clontarf Foundation speak for themselves. In 2017 they had a school retention rate of around 90%, an average attendance of about 80%, and a two-fold increase in the number of students that completed year 12 and got their final year certificate. There were 384 boys in 2016, and more than 700 in 2017. The Clontarf Foundation also helps these boys find jobs, and keeps them supported through that process as they move out into the world.

A third example is a program that Kellogg ran in India with United Way Mumbai, supporting a project in Maharashtra with 750 school children. It was a program of targeted intervention, in partnership with the Government of India and the Integrated Child Development Services scheme, and it provided nutrition and health information, as well as a locally sourced nutritious meal, which was



very culturally relevant, with a daily nutrition supplement, for a period of five months. The program included growth monitoring, medical referrals, support for parents to ensure treatment compliance, training of the workers, and parent counselling.

The program resulted in 725 of the 750 children gaining weight. Reasons why the other 23 did not have the same result included illness, travel, or they pulled out of the program. This program showed, on a very small scale, what targeted nutrition, a morning meal and education can do to help to solve hunger.

### **Families and farmers**

The six examples I have given show the importance of building farmers' capability to generate income and have viable businesses, to produce nutritious foods both for themselves and for their families, and the importance of addressing families' hunger so that children are able to get a better education and lift themselves out of poverty. Agriculture is critical, and working with smallholder farmers and with communities is vital to achieve those outcomes.

### **Could a new type of partnership model achieve more?**

Despite all that is being done, we are only at the tip of the iceberg. I believe we need to do things differently to create a sustainable impact. To scale up the programs Kellogg has been running will be very expensive in time, money and resources. Therefore I want to suggest that perhaps we could try a different model, where a range of partners can work together, with different partners taking on different roles and utilising their particular skills to make these types of programs more effective.

I am interested in creating a movement, an 'eco-system' (illustrated below), to try to create change. It would be led by a collaboration lead – a company like Kellogg that sets the direction in consultation with the partners. Partners – that play specific roles based on in-kind contributions or expertise – will help to create the movement to make the programs more viable. Advocacy



partners could help drive policy change and gather support at the highest level of government. A technical partner or partners would provide the technical expertise on the ground to run these programs. Another partner could be a social-change creator – someone that has skills in generating social action where people take issues into their own identity and champion them; that is important to get this change to occur. There would be a content partner – it might be a media organisation, or an organisation with educational programs. There would also be implementing partners on the ground to roll out the programs.

Through all the partners' work in their own fields, this 'eco-system' could help create sustainable impact at large scale. Perhaps we can consider this different way to form partnerships to work together for sustainable change.

I look forward to future collaborations with everyone within this room, perhaps via the model that I have just proposed, so that we can achieve bigger sustainable impact with farmers and families across the region.

Ms Boustead is the Head of Corporate Communications, Government Relations and Public Affairs for Kellogg Asia Pacific. She is accountable for External Communications, Internal Communications, Government Relations, Philanthropy and Sustainability for Kellogg across the Asia-Pacific and sub-Saharan Africa. She leads a team of Corporate Affairs experts across sub-Saharan Africa, India, China, Japan, South Korea, Hong Kong, Taiwan, South East Asia and Australia/New Zealand. She sits on both the Kellogg Asia Pacific Leadership Team and the Kellogg ANZ leadership team and is a board member of the Kellogg Australia Charitable Foundation. Rebecca began her Kellogg career in 1997 as a Nutrition Communications Coordinator after training as an exercise physiologist and dietitian. Throughout her 20 years with Kellogg she has used her skills learnt as a dietitian – of translating complex science into behaviour change messages – to drive innovative communications while adapting to the ever changing communication vehicles available. Ms Boustead is a member of the Asia-Pacific Association of Communications Directors, the Australian Institute of Company Directors, the Dietitians Association of Australia, the Nutrition Society of Australia, the Sports Dietitians Association of Australia, and the Academy of Nutrition and Dietetics in the US. She holds a Bachelor of Applied Science – Human Movement from Royal Melbourne Institute of Technology, a Masters in Nutrition & Dietetics from Deakin University, a Certificate in Marketing Management from the Australian Institute of Management and she is a graduate of the Australian Institute of Company Directors.

## Afternoon & Morning Keynotes – Q&A

Panel: Rebecca Boustead & Dr Alessandro Demaio

Chair: Malcolm Thompson

**Chair:** We have time for a number of questions to our two keynote presenters: Alessandro, the first speaker this morning, and Rebecca who has just given a private sector perspective.

Rebecca, I am interested in the push and pull factors operating on private sector players and the way in which you engage with those push and pull factors in markets that your company serves. What scope do you think there is for a company like Kellogg to lead consumer choice? I noted what you said about corn and rice and wheat being still dominant in your products, and many others. I am interested in what scope you think there is to lead consumer choice, including around genetic modification (GM) and nutrition.

**A: Rebecca Boustead**

First, I think the GM topic is probably bigger than we would like to tackle at this point in time. Having spent 20 years at Kellogg, and originally trained as a dietician and exercise physiologist, I have been integral in trying to get the company to change the way it looks at things. The Kellogg of old was focused on encouraging people to eat our brands, such as Corn Flakes®. We now have a new approach for working with emerging markets. It focuses on adapting to the habits of the local people in those markets, and it is driven by the local leaders in those markets. One example is our use of indigenous grains, for example the ragi (finger millet) I mentioned in my presentation, which is high in calcium. We have incorporated that into our food products in India, and we are having a great deal of success with that indigenous grain.

With some of these indigenous grains Kellogg faces a challenge in getting the volumes we need for our big-scale operation to meet the mass market demand for our products. Psyllium is another seed we have used here in Australia for a long time: we use it in a product called Guardian®, based on some research around lowering cholesterol.

Another very real challenge is creating consumer demand for those healthy products. I could give you a large list of foods that we've tried to bring into our products but that consumers just will not accept.

There is also the challenge that nutrition ideas change. In the 1980s, it was all about low fat, so the food industry pulled the fat out of their products. But fats have come back into favour now. There was a movement saying that salt was really bad, and that led to our sodium reduction programs across the Asia-Pacific and also in Australia. We have halved the salt content of a lot of our products: for example, Just Right®. Sugar, I think, is the Achilles heel at the moment, and there is no doubt that there is overconsumption of sugar.

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This paper has been prepared from a transcript.



However, I think we need to focus much more on whole foods and helping consumers to understand what they need to do to eat correctly. I would love to see governments promote the dietary guidelines that tell you what to eat. I would love the Australian Government to promote the Australian Guide to Healthy Eating, which tells you how *much* you should eat. And there is the Health Star Rating system which tells you what items within a category of food you could choose: say for breakfast cereals, choosing in the range 2–4 stars.

There is not enough promotion to help drive consumer demand for healthy foods, and therefore the food industry struggles as well. It's a complex situation.

**Chair:** Yes, it is complex. Thanks for pushing it back onto government right at the end. That's interesting.

**Q: Dan Etherington, Kokonut Pacific**

Rebecca has been the first person in this whole conference who has mentioned a root crop: potatoes. In Africa and the Pacific, root crops form a large part of the diet. This has been ignored in discussion. When we are talking about poverty and nutrition, root crops are fundamental to the diets of rural people in Africa and the Pacific. Where do we go from here?

**A: Dr Alessandro Demaio**

That is a very important comment. Yes.

I agree with a lot of what we have discussed today, but I think we have to make sure that we base our work on the fundamentals, that we go back to the evidence, and also that we go back to the roles and responsibilities of different parts of society.

Having this conference in the Parliament building is a reminder that it is very important we do not outsource the role of good government, including their role in the governance of food and nutrition, to the private sector. And particularly not to companies that have an unhealthy portfolio. Many food company products are very helpful, but many others of their products are very high in sugar and major sources of free sugars, particularly in children's diets.

We have talked about breakfast cereal programs being run by companies, not just Kellogg, and I think it's important to commend Kellogg on providing those. I think it is an incredibly sad situation that we have hungry children in Australia, and a sad indictment on government and on society more widely that we don't take collective responsibility. But I don't believe that it is the responsibility of a company – whose mandate is ultimately, like any company, to return profits to shareholders – to provide breakfast to vulnerable kids.

The profitable parts of the portfolios of these companies are still breakfast cereals that include roughly 30% sugar, with the average serving making up roughly half a child's daily intake of added sugar. The Government has published science showing that breakfast cereals, along with sugary sweetened beverages, are major contributors to added sugar in Australian children's diets.

No child in Australia should go hungry. But maybe we do need to think about the role of government in providing these services, and also have a very careful and nuanced approach to the engagement of the private sector. Today we have not

talked a lot about sugar. Many of the policies that we have talked about – such as education-based policies and the Health Star Rating, which is voluntary and (many would argue) still incomplete but a great start – are not going to bring the change. We still see rising rates of child obesity (roughly one in four, or one in three children) in Australia.

So I think we need to take a step back for a moment and think more widely about the role of the private sector in addressing big public health and sustainability challenges around nutrition. We need to be much more mature and nuanced in our approach. I think agriculture and the agricultural community can be very helpful in this, because the health sector doesn't do it very well.

We tend to talk about the private sector as one homogeneous mass, and that is not very helpful. I apologise that that is the way I framed this answer at the start of it, but I want to make it clear that I do not see the private sector as one homogeneous mass. There are very important parts of the private sector that are fully aligned with public health outcomes; there are parts of the private sector that are partly aligned; and other parts of the private sector that, quite frankly, are very unhelpful.

Within the food sector, companies like Kellogg have a wide portfolio of products, so they are much easier to work with than other companies that only make sugary drinks, for example. Where in the food system are they? EAT is partnering with companies that are food retailers, because it is much easier for them to substitute and redesign the food environment. They are not so fixed on certain products. At the other end of the spectrum, agricultural producers again can be very helpful to work with. However, in that middle ground of food manufacturers, we have to be quite careful, particularly, to understand which stage of the policy process we engage them in. And so I think we do need to take a step back and think.

It is great that companies are providing breakfast programs to kids. It is happening increasingly around the world, and not just by Kellogg but also Nestlé and many others. And nevertheless I suggest we need to consider whether this is the best way forward for our children.

Are we confusing the role of government with the role of private sector? With the policies that we are outlining, we need to make sure that we base them on the evidence. The policies that we know work are:

- the school-based programs that are run independently;
- the pricing policies, which we haven't talked about;
- the advertising bans, which we haven't talked about;
- the nutrition labelling which, when it's not mandatory, then falls back to being the responsibility of business; that is like the fox guarding the hen house, so to speak; and
- supply chain opportunities, which we've talked about a lot already today.

**Chair:** Thank you Alessandro. That's taken us well beyond potatoes, and I want us to come back to Dan's comment about root vegetables at some point.

**Q: Hon John Anderson AO, the Crawford Fund**

Just a comment. Knowing a little of the history of the Kellogg family – and I think they would have taken this point very strongly – there are certain things that are not the responsibility of the collective nor of government. They are actually best done by parents. I want to urge that we don't forget that. The problem in a lot of remote areas of Australia comes back to the need to inculcate a sense of responsibility, as well as empowerment, in parents.

**Chair:** Thank you. I just want to give Rebecca a chance to make a couple of comments before we go to more questions.

**A: Rebecca Boustead:**

I agree with a lot of Alessandro's comments. There are roles for different parts of private industry. From my work in the last 20 years, I am in the top 100 leaders of the Kellogg Company, and my role is to help to try to make change. I have learned how to put those ideas forward, so that I can get change. We had a significant renovation program on our Nutri-Grain® product; we took 35,000 tonnes of sugar out of the Australian food supply by our work in that program. Our challenge is that although we want to improve the food supply, we have to do it over time. It is much easier to change existing foods rather than try to introduce new foods, as I can testify having tried to introduce so many new healthy foods that just don't sell.

Can we work together (1) to encourage food companies for the work that they do, and also (2) to find innovative ways for them to do it.

My biggest fear with all these discussions around sugar or fat or fibre is that we will do what I call 'trans fat the food supply' again. There was a movement against saturated fats that are used in a particular way from a food technology perspective. So instead of saturated fats we created and used trans fats, which research then found were much worse than saturated fats. Then we spent millions of dollars pulling the trans fats out of the food process again. My big fear with sugar is that the pressure becomes so strong that we turn to putting artificial sweeteners, artificial fibres, and different chemicals into our food, and that will move our food away from what it really should be: that is, whole foods.

I am not saying that there isn't a problem. I know from the national nutrition survey data that breakfast cereals on average contribute 2% of total sugar intake, and about 4% of added sugar intake. Despite this evidence, cereals continue to be used as a lightning rod to generate discussion, because our packs are very visible, but that is not to say we aren't doing things to try to rebalance that. Can anyone remember the last time they saw a Coco the Monkey advertisement? When I first started with Kellogg, 21 years ago, the main advertisements that we were running had Sam Toucan, and Tony the Tiger (who was skiing) and we had Coco the Monkey. Now they have not been on air for over 15 years. Yes, they are still on packaging, but when we talk to children these days they don't know who those characters are.

I think you've made some really great points, and I think we are trying to work very hard to change and to do the best thing without destroying what is a great business, and a business that has been around for a long time.

**Q:**

Rebecca, you have spoken a bit today about marketing, and the ability to create consumer demand for different products. There are so many different ways that marketing is used, and so many different platforms. I think that consumers are ‘switching off’ to marketing, more and more. Marketing is obviously super powerful, but people are switching off, and there is probably a growing distrust between consumers and what big companies like Kellogg are saying. How do you address that, when you have very good intentions in creating healthier products and driving consumer demand? How do you go about addressing that when consumers are switching off?

**A: Rebecca Boustead**

Yes, I think we just continue to put forward the benefits of our foods, and make sure that they can see them on the shelf, so when people come to the point of purchase, when they are making that decision, that they see the brands there that they know and love.

People talk about the growth of the small cereal manufacturers, such as for granolas. If you look at the nutritional profiles of a lot of the granolas that are made under niche brands, you find they’re not fortified. Our foods are fortified.

If I knew the answer to your question, I would be a richer person than I am at the moment. We continue to trial different ways. We have had quite a successful campaign in Australia off the back of some research we did around fibre and the importance of fibre for helping to reduce the health budget, by increasing the consumption of, particularly, wheat-based fibres. We ran a program called ‘Is Your Gut Fibre Fit?’, and that has helped our high fibre brands – All Bran®, Sultana Bran®, Bran Flakes, etc. – grow through the comprehensive program that we ran behind the program, showing that when we get it right, it works.

But we still have the challenge, as does everyone. People say one thing and they do another. If I could work out how to get people to tell me what they’re going to do, we’d be in a fantastic place.

**Q: Julia Steenkamp, The University of Melbourne**

It has been lovely to meet you and great to hear about the wonderful work that Kellogg has been doing with food security, both here and internationally.

I had the pleasure of spending some time in Thailand just a few weeks ago, and being partly a dietitian I couldn’t help but check out some of the processed foods on their shelves. What struck me, and it strikes me every time I visit some of the poorer areas of the world, was that their processed foods are different to our processed foods. It has been wonderful to see here in Australia that when I pick up a packet of Pringles®, or many other processed foods, there are more wholefood ingredients, and the ingredient lists are much shorter. There are many fewer additives, and these foods look more like a ‘real food’. But when I visit these other countries that sell the same brands – Pringles, for example, which I did happen to pick up – the ingredients list looks very very different.

Does the demand for change have to come from the consumer, or is it an ethical responsibility of the food industry to make sure that, if we know that there is a healthier version of this product, it should be sold in every country everywhere?

**A: Rebecca Boustead**

Yes, I agree with you. We are led by our consumers and consumers drive demand for our foods. We are removing ingredients from foods that our consumers do not want and adding in more of the ingredients they do. It is a journey that we are on, and I hope we will reach a position where all the foods are culturally relevant and meet the needs of the people who are eating them.

**Q: Rohan Yargop, The University of Adelaide and RAID**

My question is about information. If I go onto Instagram and put in ‘#nutrition’, 33 million posts show up. These days, and for new generations, the Millennials, social media is going to play a really crucial role. What are your views on how we use social media? How can we leverage this tool so that we achieve what we have set out to achieve?

**A: Dr Alessandro Demaio**

Yes, this is something that is of concern to me as well. I think it is wider than social media. It is the digitalisation of our food environments and our food systems.

We have very large companies like Amazon entering the market; we have food aggregators like Uber Eats, Foodora ... Melbourne is, I think, the second largest Uber Eats market in the world, after Los Angeles. It even beats London, despite being much smaller. But there is high market penetration of these apps. The uptake of these apps by Australians has been largely unprecedented in the world, and that presents a huge challenge – and opportunity – for us.

In policy and in public health we are far from understanding the complexity and the level of specificity that we can now use to reach consumers with very specialised messaging, without even including the concepts of advertorials (advertising plus information). It is almost impossible to decipher what is what in product placement, and the influences on young children. We see this used a lot by the food industry.

In fact, we see it used by all industries, and often even in less regulated markets for products that should be, or actually are, banned through normal advertising channels. It is a huge challenge, and I don’t know what the answer is.

The World Health Organization prepared a very helpful report about three years ago on digital food advertising\*, and I think it is a good report for policy makers to read. It was prepared for policy makers because there is almost a total lack of understanding around how specialised and how specific we can now tailor advertising to be. For instance, we largely know where individuals live based on where they go each day, where they start their journey, where they come home to. We can link advertising to what they are writing on social media. We can link it to who their friends are. We can work out roughly who they vote for, and what their income is, based on their postcode, and where they spend most of their time. We can work out where they’re buying food; how they are interacting; what their sentiments are. Piecing all of that together you have a very accurate

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\* *Tackling food marketing to children in a digital world: trans-disciplinary perspectives*. WHO 2016.

understanding of an individual, even if they are a minor, and then it is possible to sell that information, in an aggregated form, to a large herd of like-minded people, to whoever is willing to pay the highest price.

That is not necessarily right or wrong. It is just the reality of digital advertising, and that does not even include paid sponsorships on Instagram and similar things that we see more and more these days. How do we tackle that? My biggest concern is really the lack of awareness of how far this technology has already run, among those who are responsible for governing it in some way.

**A: Rebecca Boustead**

I will answer that from quite a similar but different perspective. We see a lot of misinformation that circulates, particularly about product quality, or about ingredients that we may have in our food, and it is very hard for us to manage that. Something that might go viral pretty quickly is not necessarily the truth, and we need to try to understand how to correct that.

A lot of these social media tools are what I call ‘grey’ social media tools: they are not the ones that we have in the developed world. I think in the developed world social media information is a much easier avenue to manage, because there the social media have codes of practice and regulations that define them.

It is much harder in the developing world where, for example, they might have WhatsApp, or they might have Weibo in China. They have a whole lot of different grey social media channels that operate on a platform where you cannot see what is going on behind them.

Another challenge is that there is very limited regulation around bloggers, or so called ‘influencers’ or ‘thought leaders’, if they are putting out information that’s incorrect – unlike journalists, unlike health professionals such as dietitians, unlike tax accountants and others who have a code of practice. We need to try to get more regulation in social media, in order to enable truths, I think.

**Chair:** I’m afraid we have to close this session there. Thank you all for a stimulating Q&A. Please join me in thanking our panellists.

## Conference synthesis

Professor Robyn Alders AO

The Crawford Fund



In this synthesis of today's conference I have been asked to address this question:

**What are the best ways for agriculture and the food industry to promote healthy and sustainable diets? And what are the policy levers?**

I think we can agree there has been some convergence of ideas in today's presentations. First, that we need to take a systems approach. Our individual disciplines have been focusing on agriculture, food, nutrition, health, and they all bundle up into our current food systems, which are complex and diverse. We do need to take a systems approach if we are going to really tackle the issues that are now dominant.

It was heartening to also hear the idea that nutrition and food are absolutely central to the Sustainable Development Goals.

I am a farmer as well as a researcher. I really appreciate farmers and the work that they do. In fact, we would have no civilisation without farmers. We can sit in cities because farmers produce excess to feed us. Everything that we do, all our achievements, are thanks to farmers and those who produce and deliver food to us. This is an achievement we should not forget. Farmers; agricultural researchers: you should take a bow.

### How we got to the present situation

As we think about moving forward, perhaps it is wise to also reflect a little on history, and the important contributions that can be offered by historians and philosophers. We did hear a bit of history today, and it was contained in that really striking table that Dr Marco Wopereis presented (see page 64) where the cabbage looked so poor by comparison. As a sheep farmer I never thought I would want to defend the cabbage. However, that cabbage is the result of 'us': that is, it's the result of our selection pressures and farming practices.

If we look back to ancient varieties of cabbage they probably had a much better nutritional profile. Then, after the Second World War, when the (laudable) decision was made to achieve freedom from hunger, we turned our focus to increasing the production of staples, and agricultural researchers pursued research in line with market signals and systems to keep farmers financially sustainable.

Our work as agricultural researchers focused on those market signals, and they were, and are, largely about quantity, or volume. They are *not* about nutritional

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

quality. That poor cabbage was selected to grow fast and was probably grown on depleted soils, but this was done with the best of intentions. Farmers are squeezed because farmgate prices are unacceptably low, and agricultural researchers have done their best to keep their enterprises viable.

Nutritionists, we really need your help, though we also need to remember, at least here in Australia, that some farmers are a bit nervous about working with you. Remember cholesterol? Some of today's audience are young enough that you won't remember nutritionists telling us, 'Don't eat eggs. Cholesterol is bad for you.' Yet today, the egg is recommended as a superfood.

In defence of farmers, they are doing their best to get a product to market. In the case of livestock, abattoirs, the suppliers, are doing their best to get a sale price for all parts of the carcase. Inappropriate foods being sold to consumers, such as in the Pacific, are not being sold to them by the farmers. Here in Australia, somebody makes the decisions about which cuts of meat we consumers want to eat. Then other people try to find a market for the remainder of the carcase. There are inefficiencies in this approach. If we ate the whole carcase we would possibly have a more balanced diet. It would certainly be a more nutritious diet if we ate the fifth quarter: that is, the offal, the parts of the carcase that producers are not paid for.

Nutrition as a discipline also has been a little bit hijacked, and this is where I think agricultural scientists and plant and animal nutritionists have a strong role to play in discussions with human nutritionists. Much human nutrition research is done via biomedical science, using rodents. Rodents are cheap to keep, and you can generate a lot of research papers based on work with rodents. However, physiologically, people are *not completely like rats*. In terms of animal models, the pig is probably the closest to a human, but pigs are considered expensive to work with.

A very important factor differentiating humans is that, in relation to the female of the species, neither rodents nor pigs menstruate. Women of reproductive age have much higher iron needs because of menstruation. As we think about how we allocate scarce resources, consideration of groups with special requirements should be front and centre. It is almost unbelievable that recommended daily dietary intakes on food labels are commonly based on the needs of males in their 20s, not on other more nutritionally vulnerable groups in the population.

In summary, there is work to be done to adjust targets and foci for our food systems, and I trust that nutritionists will forgive us if sometimes we're a little slow simply because history has taught us to be cautious when moving forward.

In agricultural research we have also made mistakes, but, once again, with the best of intentions. We thought monocultures and an emphasis on cash crops were going to be the answers to solving world hunger. Certainly, farmers need to be able to sell products, and those products have to be valued in a way that's going to reward the farmers, to enable them to manage their land sustainably. However, it is now clear that we need much more complex targets.



### **Policy goals – not part of today's discussion**

A challenge for agriculture and health is that these two disciplines report to different ministries within government structures, at least in Australia. Health has pride of place because human life is invaluable, so, in theory, no expense is spared. Agriculture tends to be linked to economics, and therefore the driving factors for policy are purely economic.

Until market signals, until economics, are overlain with human health indicators we are not going to achieve our nutritional and quantity goals, and farmers are not going to be rewarded fairly for their produce.

We have all the technology. It is possible to price food according to its nutrient density. I think the Sustainable Development Goals are going to help us do that.

### **Antimicrobial resistance – not discussed previously today**

There was no time today to discuss antimicrobial resistance, a serious challenge confronting animal and human health, and one that is frequently blamed on agriculture because of antibiotic use in our intensified food systems, particularly for animal production.

Antibiotic use has been one way of dealing with the economics of farming, trying to keep farmers going, and trying to keep feedlot systems going. Concentrated cereal diets are not natural for pigs nor poultry nor ruminants, so antibiotics were introduced as a way to manage the microbial populations in intensively raised animals. We have similar problems with pesticide and insecticide use, with cumulative toxicities in individuals, and growing resistance problems as well.

### **Challenges that lie ahead**

There are no Members of Parliament here at the moment because they are all required for voting in the chambers. Therefore, it is up to us here to respond to what we have heard today in relation to the completely inadequate investment in agricultural R&D. Our society depends on it.

We need to do better, and we need, as we've learnt, to look much more broadly than the 'Big 3': that is, maize, rice and wheat. We need to look at neglected plant varieties and livestock breeds, because we do not know what the future holds and which of them will fill a niche in the changing world that we are entering. We also need to match food with local circumstances. The reason there is such a beautiful variety of cuisines all the way around the world is that those cuisines developed in harmony with their locations and local produce.

Population trends were briefly mentioned today. Once again, food is central to population trends. To have a good education, we need full bellies to be able to concentrate and to learn. Metadata analysis tells us that women who are well-educated have fewer children, and when you have fewer children and you are sure that you can care for them, then your children are more likely to reach adulthood. These are really really critical aspects of life.

A key reason why we have focused our food systems on staple grains was simply because storage and transport were so much easier than for perishable vegetables, milk, eggs. Perishables need a supply chain that can maintain them in suitable conditions. This is where trans-disciplinary approaches could involve our engineering colleagues working with food scientists; it is very important that we find ways to preserve perishable food with minimal processing so that nutritional quality is maintained.

On that note, an opportunity for disciplinary networking is the International Congress on Engineering and Food\* being held in Melbourne in September 2019. There is a session on humanitarian food science and technology. Ideally, many of us will participate, potentially to form new partnership models for nutrition.

### **Blended teams**

We all know it is hard to work across disciplines, especially when it takes so much time to get trained in just our own disciplines and their associated technical languages. Today's range of presentations has covered an uncommonly wide range of disciplines, and we have heard that we need to embrace that challenge of learning different languages, different approaches – and that it is okay to make mistakes.

Today we have also heard about working with public health people, whose data frequently comes from randomised control trials. Such trials are very hard to do, but in my experience the thing I like about randomised control trials is that they force you to work with a random selection of the community.

In contrast, in agricultural research, certainly most of my work with communities has been with farmers who wanted to work with us and who were willing to take a chance on 'crazy foreigners' who had arrived with yet another great idea. When you do a randomised control trial you work with people from many different socioeconomic circumstances within a community, and therefore you have to face the hard reality that sometimes what you are proposing may not be a match for the most vulnerable. You can learn a great deal from that.

Another key area where interaction between agriculturalists and public health specialists would likely be beneficial, is in relation to the care of mothers. Animal scientists know well that, with species that normally give birth to one individual at a time, if the mother does not eat enough the offspring will have a small birth weight. With optimal food for the mother, the young usually has an optimal birth weight, and if the mother eats too much she will likely have a large offspring that could lead to problems at birth.

In many parts of the world, human mothers' traditions and experiences are handed down from grandmother to mother to daughter, and that can include instruction to avoid certain foods. I believe part of the reason for that is that mothers are worried that eating food that may be too 'rich' (which usually means very nutritious food such as eggs) will lead to a large child which could be

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\* [https://www.melbournecb.com.au/event/international-congress-on-engineering-and-food/conventions\\_1788/](https://www.melbournecb.com.au/event/international-congress-on-engineering-and-food/conventions_1788/)

a problem if she is to give birth in a place without adequate obstetrical care. It's referred to as 'eating down'. It's a tragic thing to have to think about. So if we want mothers to feel free to eat a good diet we must also be aware of the range of needs that they have, because for humans the size of a child's head in relation to the mother's bony birth canal can be a challenge.

### **Emerging thinking**

That thinking – about mothers' diets in relation to birthing difficulties – is starting to appear in the literature.

In agriculture, soil stewarding is beginning to be mentioned, certainly in relation to linking soil health, plant and animal nutrition together, and focusing on nutrient recycling, so as not to deplete the soils. Engineers can help ensure that precious nutrients are not lost, by improving recycling of food, human and animal 'waste' back to the soil.

Sustainability is often considered in relation to ecosystems, but farmers' operations must be financially sustainable for them to stay in business. We have to recognise that the term 'sustainability' has that broader sense. It is important to work with farmers to make sure they get an adequate reward for producing foods they can be proud of while still reaching consumers at an affordable price, and that allows them to take care of their land in the process.

These are emerging ideas and wonderful challenges, and this conference has brought together the spectrum of people who can tackle them.

### **Summary**

In summary, our speakers have eloquently explained the problems facing us. They have skilfully illustrated options for moving forward, for taking a food systems approach that will help countries to achieve their Sustainable Development Goals, and most importantly to improve individual, regional and global health and wellbeing.

We have focused on what nutrition can do for physical strength and wellbeing, and on what it can do for cognitive development. Research is also telling us that good food and a balanced diet will help to make us happy by improving our mental health. That is going to be good for everybody.

I look forward to watching developments emanating from this conference today.

## Closing comments

Dr Colin Chartres

The Crawford Fund



Thank you to all the speakers in today's conference, which has been on a very complex nexus topic. You have given us fascinating information about the relationships between agriculture, food production, diets and health. Although today's discussions have only just touched on the surface, they have shown us there are many opportunities to address this big challenge for agricultural scientists.

The clear opportunity, nationally and internationally, is to look at the ways in which we can use science and technology to produce healthier food and at the same time reduce the footprint that production makes on ecosystems and the landscape and the water resource. In doing that, we will have the support of many technological advances that we have heard about today.

I think a critical issue is that there are going to be multiple players involved, both in the debate and in tackling the challenges, which take in everything from the science of agricultural production through to the role of government, and also the role of the individual. It is a very tough and worthy challenge to get everything right, to change the current situation for the better and make a lot of people healthier: a worthy challenge.

One point I found particularly significant was not so much the idea that solving that challenge will require trans-disciplinary solutions, but that the solutions must be underpinned by disciplinary excellence. In other words, we must still burrow deeply into our own disciplines to gain a sound understanding of the components of the big picture, but then we must look up and out and confer with our colleagues in public medicine, in industry and in policy to really look at how to effect change. This is a great opportunity, and it applies across the whole spectrum, from science through technology to legislation and right through to marketing.

Speaking of marketing, a few years ago I was lucky enough to visit the World Vegetable Center, where Marco Wopereis's predecessor talked to us about all the benefits of vegetables. He took me out to the plots and showed me Slippery Cabbage. It reminded me of eating overboiled cabbage as a boy, but sounded even less bearable. I do think that to market vegetables effectively there needs to be careful thought about their names!

We face a big challenge to get this all right, but it is also an exciting opportunity, especially for the emerging generation of scientists in the room, in agriculture, food and diet, and I hope you will all tell those of your colleagues who are not here, about what we have heard today.

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This paper has been prepared from a transcript.

In concluding, I want to thank all those people who have contributed to the conference, particularly the many sponsors – including universities, private sector companies, individuals and government, and I make special mention of ACIAR and the Department of Foreign Affairs and Trade (DFAT) and the Department of Agriculture and Water Resources. Thank you to the session Chairs for their sterling inputs. The conference would not happen without the leadership of Ms Cathy Reade and her team and all their background work. And of course the ultimate components of this conference have been the contributions made by our speakers and you the delegates. Thank you.

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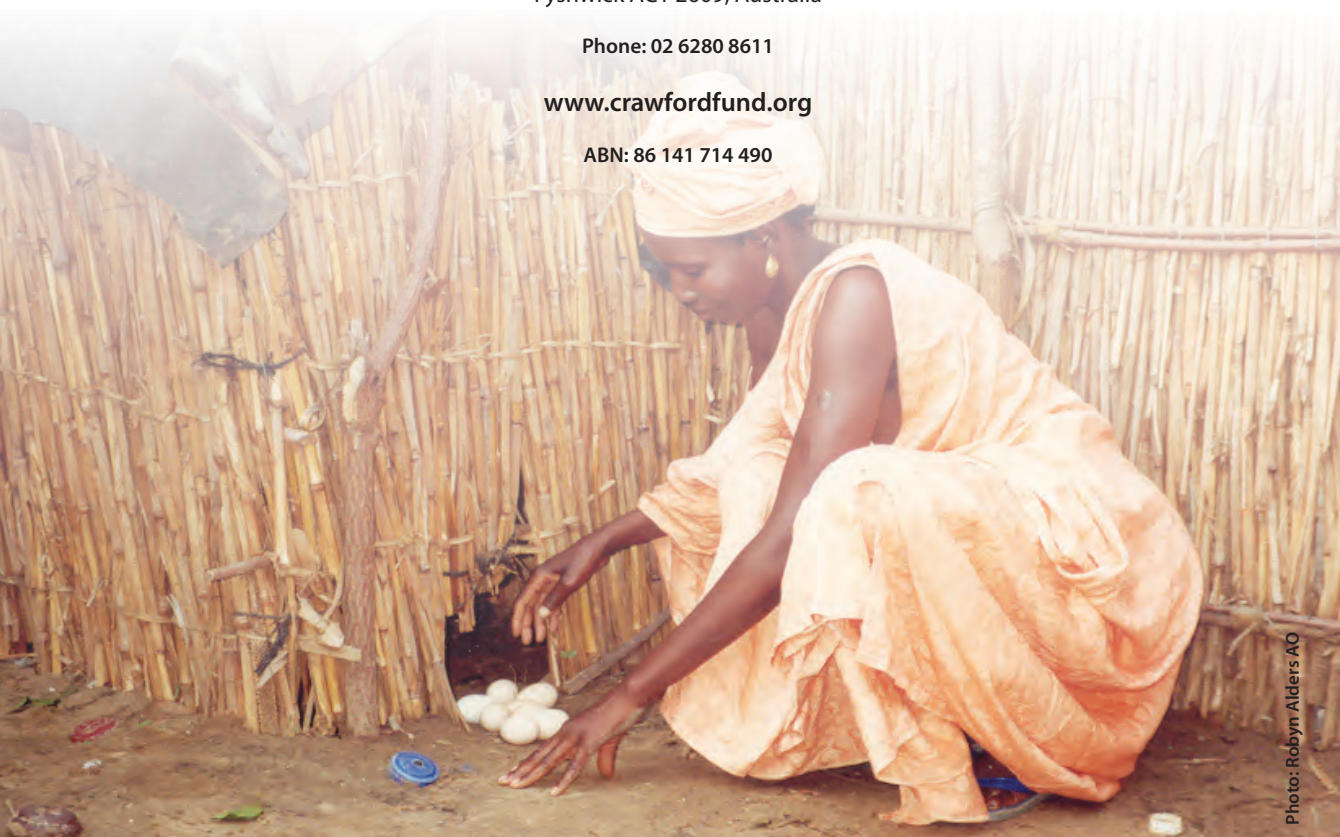


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