

KEYNOTE ADDRESS

Transformative international agriculture R&D: the road to future success

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ABSTRACT



The climate, biodiversity, and health crises are deeply interconnected, demanding integrated solutions. But in overcoming these crises, agricultural R&D faces its own tests: the interconnectedness and complexity of food system challenges; funding constraints; policy and regulatory barriers; and the need to ensure equity and inclusivity. Overcoming these will hinge on collaboration, partnership, and co-design in developing holistic, systems-based solutions. Successful examples can be found in crop breeding partnerships, landscape management collaborations, climate smart villages, capacity sharing in Africa, and more. By highlighting the transformative power of genuine partnerships and participatory research, this keynote aims to demonstrate how collaborative approaches lead to sustainable and impactful outcomes. Through many examples, we can see that robust partnerships, co-designed strategies, and sufficient investment can help ensure food, nutrition, and environmental security for future generations.

Good morning. First, I want to say that I am an alumnus of the Grains Research & Development Corporation (GRDC), which provided a fellowship for me to do my PhD on a project that was run by CIMMYT and ICARDA. So I am grateful to all Australian grain producers for their support, via GRDC.

I am here today as the Executive Managing Director of the CGIAR, which is the world's largest research partnership for a food secure future, dedicated to transforming food, land and water systems in a climate crisis. We gather today at a very critical juncture in our collective efforts to address the profound challenges that define our era.

Our climate, biodiversity loss and health crises are deeply interconnected. These challenges demand holistic food security, food systems solutions that we in this room have been working on, and we need to deliver. People are looking up to us to deliver those solutions, and more than ever it requires collaboration, partnership and co-design – the main theme of the conference this year.

As agricultural research and development professionals, we need to recognise both the great contributions that were made in the past, and also the challenges that we have. This morning, in accepting the Crawford Fund Medal, Dr Tony Fischer took us back to the Green Revolution with Borlaug, and the Minister mentioned the alarming numbers: that 50% of the kids in the Pacific region are not eating well and are never likely to develop to their full potential.

We have four big challenges. The first is the intertwined climate change, environmental and health challenge. Agriculture is under immense pressure to develop solutions that mitigate and adapt to climate change. This includes creation of resilient varieties of crops and animals and fish; improving soil health; and developing sustainable farming systems.

Second, the funding constraints and sustainability. It is very important that we put in enough investment to find solutions for today and tomorrow.

The third challenge is policy and regulation. There often are inconsistent and restrictive regulatory environments that can hinder the adoption of new technologies and practices. Effective collaboration between research institutions, government and private sector capacity sharing is essential to align policies with scientific advancement.

The fourth challenge is equity and inclusivity. I think we all talk about many of the Sustainable Development Goals, but very few of us address SDG 10: Reduced inequalities. I think reducing inequalities is one of the most difficult SDGs to get to, because inequalities are growing instead of reducing. Inequalities could be solved globally but still exist within a country or within a community.

Partnership and co-design

Today's conference explores how partnership and co-design can help us meet these challenges. It is increasingly important to co-design solutions now. I think agricultural innovations cannot stand alone; they feed into and are a result of a systems approach, holistic solutions, that cannot be developed without broader partnership and co-design. Historically, many efforts to support our overstretched global food system focused on a single solution or a single aspect of a solution, such as developing better crops or reforming subsidies or reducing food waste. However, system transformation requires coordinated bundles of innovation – that is, not one solution but many solutions that together can do better. Those innovations can be technological, but that's not enough. We need social innovation, institutional innovation, political innovation. Partnership is crucial to bring those together.

CGIAR advocates systems thinking – a holistic approach that accounts for the interplay of all elements, assessing both the potential benefit and the potential harm of new developments. We should consider at the outset whether a particular innovation will be accessible and practical for women as much as men, and how it will impact the environment, the trade, the food prices, the livelihoods, the nutrition and so on and so forth. Likewise, new crop varieties, technologies or incentives to increase yield are meaningless if there is no water to irrigate, for example, if it's on irrigated land, or if there is no infrastructure to take the crop to the market.

Innovation systems rely on engagement among many actors, including farmers, communities, government, enterprise, universities, research institutions and much more. There is a growing understanding of the interconnection between food, land and water systems and how these then connect to climate, to gender, to policy, economics, etc. CGIAR recognises the need to shift away from a focus on single solutions developed by single entities, which might increase productivity at the expense of other elements of the food system, ecosystem, equity and climate goals.

Partnership needs to be much more than just a slogan. It is the cornerstone of effective agricultural research and development. It involves equitable participation, mutual respect, and a shared vision. Transforming food, land and water systems within a climate crisis must be undertaken together, with each stakeholder contributing their unique strengths and perspective. When we think about it logically, it makes sense: we all get together and each of us brings the best from us; but in reality it's very complicated.

One of the transformative approaches we and many others have adopted is the co-design of projects with local stakeholders. This participatory approach ensures that our research is not only scientifically sound but also culturally appropriate and socially accepted.

For example, our participatory breeding program increasingly involves women and men farmers in the design of crop varieties. Decisions aim towards meeting their market needs and their preferences. For example, in the breeding of common beans (*Phaseolus vulgaris*), participatory breeding has allowed us to develop quick-cooking common beans that take 30% less cooking time (and therefore less fuel). This is expected to be delivered to 1.8 million women farmers in East Africa. The project involved collaboration with several partners, including The University of Western Australia and a lot of support from ACIAR. Farmers' involvement from the outset ensures higher adoption rates and greater impact.

There are many other agrifood innovation examples. There are projects on irrigation technologies, soil management approaches, chicken breeding (which is doing wonderful work in Ethiopia and in East Africa), and agroforestry practices.



More and more research projects are aligning solutions with stakeholder needs, relying on deeper collaboration to drive impact and scaling.

Of course, organisational partnerships are often at the core of this work, and I want to give you two examples. The first one is with the African Development Bank with a program called TAAT, Technologies for African Agricultural Transformation, that established partnerships between the research institution, national system, private sector and development agencies in delivering proven technologies. And because it brought everybody together, it sped up the delivery process and it has delivered climate-smart seeds to 12 million farmers in 27 countries in only three years.

The other example is from the World Bank. It's a program called AICCRA that is scaling climate-smart agriculture and climate information services to reach millions of smallholder farmers in Africa. Teams in Senegal, Ghana, Mali, Kenya, Ethiopia and Zambia

work with national and regional partners to increase access to life-changing innovations.

On a national level, IRRRI recently launched a new partnership with Papua New Guinea National Agricultural Research Institute to boost adoption of high yielding, climate smart, healthier rice varieties and systems. This will include the latest production and post-harvest techniques, seed production, irrigation and infrastructure, and economic assessment, all tailored for Papua New Guinea's rice sectors.

This bottom-up and collaborative approach should also extend to capacity development, capacity sharing. We should no longer employ the traditional uni-directional transfer of knowledge and skills. It is time for the next generation approach: mutual learning, co-development and sharing evidence, innovation and technologies among partners. CGIAR research engagement in Africa takes this approach. CGIAR partners in Ethiopia, Rwanda and Senegal are prototyping a model with NARS (National Agricultural Research Systems) partners leading the research aimed at enhancing sustainable research, development and innovation capacities, catalysing investment and delivering impact. As well, we have 'citizen science', which is increasingly a powerful tool, a bottom-up approach that engages local communities in research. For example, we involved banana farmers in data collection for crop improvement and pest management. Farmers across Asia and Africa shared pest-sighting and crop-health data in real time using mobile apps. This helped improve pest management techniques, reducing crop losses and providing wonderful data for the scientists as well.

Multi-stakeholder platforms can boost inclusion by bringing together diverse groups such as farmers, researchers, policymakers, and private sector representatives to co-create and implement solutions. All these types of partnership-focused, inclusive approaches have led to smarter innovation, more equitable distribution and greater stakeholder buy-in, enhancing the sustainability and the impact of our science.

Partnership examples

To look at partnerships in more detail, first consider PABRA (Pan-Africa Bean Research Alliance). This very successful model of co-creation and partnership has successfully influenced policy, and delivers innovation to farmers. Africa needs new varieties of beans that can grow more quickly, produce higher yields and withstand climate impacts such as drought, as well as pests and diseases. Farmers and consumers also have preferences in the colour, shape or size of the beans, and the beans have to become more nutritious because they are a staple crop in many parts of Africa.

To meet these needs, PABRA unites farmers, researchers, policymakers and development partners to address the challenges of bean production across Africa. Its approach involves farmers in the research process, ensuring

that the bean varieties developed meet their preferences. They also wanted to shorten the life cycle: it has been reduced from 90 days life cycle to about 70 days. PABRA has helped 37 million farmers across the continent, 58% of whom are women, to feed their families and expand their businesses and strengthen their communities. Right now, we have about 650 bean varieties that are used by smallholder farmers and communities.

PABRA's success has significantly influenced agriculture policy in several African countries. For example, bio-fortified beans that are rich in iron and zinc have been integrated into national strategies to combat malnutrition. In Rwanda, PABRA's work led to the integration of improved bean varieties into the crop intensification program, boosting both food and nutritional security. By involving stakeholders at every stage, PABRA has created a model where science effectively informs and shapes policy, leading to sustainable agriculture and improved livelihoods, particularly of farmers. For this PABRA received last year, 2023, the Africa Food Prize in recognition of exceptional leadership in both expanding but also protecting the biodiversity of beans.

As a second example, CGIAR is actively engaged in reducing greenhouse gas emissions in livestock production through several innovative approaches. One of the key strategies involves the adoption of improved livestock farming practices and the selection of specific breeds that are more efficient in converting feed into meat or milk. We are aiming to have less methane emitted per unit of production, which is a huge challenge, particularly in most of the lowest-income countries. A combination of livestock genetic gains, drought tolerant and water-efficient forage species, the use of knowledge networks and pioneer households, and the use of comprehensive feed databases and tools to aid in decision making and environmental analysis, has allowed higher buy-in from the farming community.

We are integrating all these strategies, not just taking one approach. The genetics of the livestock; the forages, most of which are new, coming from the ACIAR genebank; the work with the communities; and the influence to the policies to align with it, will allow us to reduce greenhouse gas emissions from livestock by 30%, contributing to the global effort to combat climate change.

Another compelling example demonstrates co-design in technical innovation, in a concept called Agroecological Living Landscapes (ALLs), spanning seven countries. We have tried it in Zimbabwe, Tunisia, Burkina Faso, Kenya, Senegal, Peru and Laos. These agroecological living landscapes are spaces for multi-stakeholder engagement among actors who are part of territorial food systems. Participants exchange views and knowledge, and co-develop and adopt agroecological innovations.

ALLs integrates agriculture, environmental and socio-economic research to develop and achieve realistic and context-specific agroecological transition aligned with the 13 agroecological principles such as soil health or economic diversification. ALLs includes local farmers, researchers, policymakers, collaborative partners, communities; and the fact that we bring them all together allows us both to be scientifically robust and to meet local needs. This collaborative framework has led to significant policy impact by engaging with national authorities and stakeholders from the start. The initiative ensured that the policy shift was both impactful and sustainable.

These three examples demonstrate how collaboration can meet complex intertwined challenges. The interdependent nature of these challenges necessitates comprehensive approaches that cross partnerships, cross sectors, cross disciplines and cross continents.

About CGIAR

CGIAR works with about 3000 global partners to develop and deploy innovative strategies to adapt and mitigate these challenges. We work in over 80 countries. We have a staff of about 10,000 people across 15 centres. Here are a few examples of how our partnerships are addressing the interconnected challenges between food and nutrition, food security, nutrition security, health, climate and sustainability.

Our work harnesses the rich genetic resources available in nature. CGIAR has about 11 genebanks that provide genetic variation, across 3000 plant species, to researchers, to extension services programs, to communities and farmers around the world. These help users develop options for more resilient, diverse and environmentally sound agrifood systems. On a smaller scale, we also support community seed banks, which are essentially farmers' social networks designed to produce food and deliver seeds, especially to marginalised farming communities. As well, through our national breeding networks partnerships we are pioneering the development of nutritious crop varieties with higher tolerance to climate variability. For example, our drought-resistant super beans are maturing 33% faster; flood-tolerant rice has brought a yield increase of up to 1.2 tonnes per hectare; and we have distributed about 200 varieties of climate-smart maize across sub-Saharan Africa, with around 40% greater yield.

Looking ahead

Looking ahead, broad but strategic partnerships that integrate agriculture, environment and health will be pivotal in our effort to achieve food security and improve human well-being. We can develop and scale new innovations together. For example, new technologies and tools for mapping and discovering food composition offer immense potential.

I am very proud to be part of PTFI, the Periodic Table of Food Initiative that is led by the Rockefeller Foundation. PTFI addresses a crucial gap in our understanding of food biomolecular composition, through an easy standardised platform. It truly shows collaboration, engaging partners from both the Global South and the Global North, and a wide array of disciplines such as food, agriculture, environmental science, human health, data science and analytical chemistry.

One of its recent studies, published in *Nature Food*, included the meticulous curated list of 1650 nutritionally and culturally diverse foods. That paper shows that when you look at all the food and all the biomolecules, we know less than 1% of the biomolecules. So out of the 20,000 biomolecules that we found in the first thousand foods, we knew fewer than 50 of them. That has underscored a critical opportunity for our scientific understanding of nutrition.

When we talk about nutrition, we think we know that if I take vitamin D I can absorb it in the same way as another person. Well, that is not true. That is why we are bringing the American Health Association into alliance with CGIAR and with people from the agriculture sector, to better understand nutrition. I encourage you to look-up PTFI and access that paper (Jarvis *et al.* 2024) and see how over 40 years of analyses show that we know only about 1% of nutrition.

Another example is a collaborative project between the Alliance of Biodiversity International and CIAT (The International Center for Tropical Agriculture) with cultural support from Kenya's smallholders to co-design diversified maize mixed farming systems, to improve practices and policy support. The project uses on-farm participatory action research called the Mother-Baby approach (Rusike *et al.* 2005). Scientists first run the 'mother' demos and then the farmers later run their own experiments called 'baby' demos.

More than half of the participants were women in this example, and of the results one farmer said: 'Using crop diversification and water management technologies, I can harvest beans and follow up with maize. My family is assured of food.' This kind of co-design research is the future for improving sustainable practices and food security, and that is just a glimpse of the many methodologies that we are looking into and that we are trying in different parts of the world.

Global investment

We cannot discuss transformative international agricultural research and development, the subject of this session, without addressing a core need: global investment.

Myself, I am not just a science manager or CEO: I used to be a scientist. Throughout my career, I have watched as investment in agricultural research and development, particularly in low-income countries, has declined. According to the Status 2030 Report, we need to double investment in agricultural research and development to end global hunger and malnutrition. That is why a significant increase in funding is required to strengthen productivity, sustainability and resilience of global food systems, particularly for the Global South.

In 2023, for example, only 7.4% of the public funding Official Development Assistance (ODA) globally was spent on research and innovation. We need definitely more ODA to be spent on research and innovation to tackle the root causes of hunger and malnutrition, to build resilience in agrifood systems, and to prevent crises from occurring in the first place. And we cannot rely on ODA: ODA is very limited.

We need collaboration and contributions from across society. This means the promotion of public–private partnerships and innovative financing, and I think Australia is a very good example in that sphere. Further, the research and development overseen by people like us in this room must be better targeted toward the Global South, where climate impacts are most greatly felt, and particularly to small island and big ocean countries as well.

Only 5% of agricultural research and development is currently relevant to the Global South, where the world's most vulnerable people live. Therefore, as we navigate the complex landscape of agricultural research and development and the challenges it needs to meet, I call on all of you to invest, innovate, collaborate and be true partners to each other and to the Global South.

Our collective success hinges on our ability to connect and align. By embracing robust partnerships and co-design we can achieve greater impact and build a more resilient and sustainable future. Let us move towards a shared commitment to collaboration. Together we can do it, but only if we come together and if we address SDG 10 along with SDGs 1 and 2: zero hunger, no malnutrition and reducing inequalities in the world.

I think with science we can, and we need to speak up a bit louder, to say the things we know and the things we don't know, to recognise them, but above all really working together as equals. It's learning: not one way, but both ways.

Some useful references

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Dr Ismahane Elouafi is the Executive Managing Director of CGIAR. She previously held the position of Chief Scientist at the Food and Agriculture Organization (FAO) of the United Nations. She was earlier the Director General at the International Center for Biosaline Agriculture (ICBA) based in the UAE. Dr Elouafi previously held senior scientific and leadership positions, including Senior Adviser to the Assistant

Deputy Minister, Agriculture and Agri-Food Canada Research Branch; the National Manager of Plant Research Section; and Director of Research Management and Partnerships Division at the Canadian Food Inspection Agency. She worked as a scientist with several international research organisations and has been a member of various strategy expert panels and advisory groups, including the Global Commission on Adaptation and HarvestPlus. She was a board member of the International Food Policy Research Institute (IFPRI) and the Centre for Agriculture and Bioscience International (CABI). Dr Elouafi was also a member of the Scientific Group for the 2021 UN Food Systems.

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KEYNOTE Q&A

Chair: Professor Wendy Umberger

Chief Executive Officer, ACIAR

Q. Peter Wynn, Charles University: Thank you very much for the excellent talk. You spoke about producing high quality foods in all these countries. Yet with climate change, we are going to increasingly have extremes of climate, like floods and drought, and so the distribution of high quality foods becomes important. Merely sending grains around the world controls energy and protein. But how about hidden hunger? And how can we get high quality foods in packages in drought- and flood-affected areas and war zones where people are starving? And so it becomes a distribution problem. How do we do that?

A. Ismahane Elouafi: That is a very good question. Definitely, I think we need first to diversify our agrifood system. The fact that we are using 125 species and only a few animal species and a few fish species is not good for the environment nor for the planet. Diversification is a must. If you go to a bank they will tell you to put your money in different portfolios. Same thing with food. We cannot have only a few countries producing, or only a few crops produced in different parts. I think we must have adaptation and be getting ready for the plus-2 degrees and plus-4. It is important to have diversification.

In relation to conflict zones, unfortunately, the number one problem causing extreme hunger is conflict, before climate change. That's what the World Food Programme says; that's what the data say. They are human-made issues, and the only way we can [solve hunger there] is to do more in the conflict and post-conflict zones. We have shied away from them, considering the issues mostly humanitarian. But we recognise now that in most of those zones it's not a matter of weeks, it's a matter of years. Hence, working in that particular area and working on a humanitarian–environment nexus is very important. Within the CGIAR we are developing our research portfolios for 25 to 30 years ahead, and the scientists came together and said we need to find solutions for those people as well, those that are in conflict or post-conflict zones so that we save lives.

It is something that we are debating and developing. What kinds of strategies, and who are the partners we need to work with? We had projects in Syria when the Syrian conflict happened, and the same case applies right now in Sudan and in many other parts of the world: Somalia, Democratic Republic of Congo, and so on. I think scientists need to jump in and find solutions to help those people.

Chair: It is really good that CGIAR continues work in conflict zones. We are proud that CGIAR remains committed to agricultural research and development in conflict zones.

Q. Shanice Van Haften, The University of Queensland, and a Crawford Fund 'nextgen' scholar: Thanks for the opportunity to be here today. I guess we know what these problems are. What is your advice on the challenges of going in-country and trying to co-develop these partnerships and relationships to form meaningful projects that people on the ground want, when you often have funding bodies which have different priorities that may not directly align with what people on the ground might want or need?

A. Ismahane Elouafi: That's a very difficult question. Unfortunately, many of the organisations do not have the luxury of really doing what is needed, because the donors also have quite a lot of push towards their own priorities. I think that's a reality. And that's where I like very much the model here in Australia, with the levy. At least you have a levy, and then that may give you a pot of money that you could use somehow with some liberty to use it in the countries where you need to.

I am Moroccan originally. I moved to Canada in 2004, and my first year was with McGill University. I began in the lab of Diane Mather, who now is at The University of Adelaide, and I remember we were designing a project for the Canadian International Development Agency at that time, and we had a meeting with students. And the students told me they were going to go to Africa to help farmers. These were first year or second year, or even fourth year agriculture students. And I said, 'Really? You think you are going to go and help? Isn't it the other way around, that you are going there to learn, or at least to have a two-way exchange of information?'

I think that is the bottom line. We need money that is independent from any agendas, and we need to tell the politicians that ODA has to be non-political; that there can be a levy, for example like GRDC and others, that is non-political.

There is also the relationship with the local people. When you go into a country, you have to recognise that they have been there for millions of years, so they know something. With those students (I was a professor at that time), I told them, 'It is about learning. It's not about going and showing African farmers how they are going to do it. Your professor might be helpful to the farmers in that way. But you, as a student, you are going to learn, and the learning needs to be in both directions.'

I think we come in with a presumption that we know it all. It seems to me that the best formula is to recognise the local knowledge, because the knowledge locally is the best because they know their environment better than anybody else. We might have the trends, but they have lived there for centuries. You combine the local knowledge with the new technology, the new analyses, so as to find better solutions for that particular environment or particular ecosystem.

Chair: The listening part of the engagement is very important. I might just make a comment, Ismahane, with regard to ODA funding. ODA funds are separate to levies. When Sir John Crawford and colleagues established ACIAR, they made it very clear that as part of our Act and as part of our mission we listen to our partners and their issues. 'Localisation' is the big key word right now – but ACIAR has been doing that from the beginning. We don't have strings attached other than keeping in line with the values of the Australian people, and I think that has really been why we have been able to have such strong partnerships over time, with that listening approach and considering the comparative advantages of our Australian agricultural innovation system.

We are lucky that the research and development corporations like the GRDC are able to sometimes co-contribute. It may not be well known that over 70%, maybe as high as 80%, of the varieties of wheat in Australia have come out of CIMMYT, through largely Australian funding that has gone into the R&D to produce those varieties. That is, varieties grown here came through that CGIAR system.

Q. Sud Kharel, DPIRD Western Australia, and a Crawford Fund 'nextgen' scholar: My question is around climate change. How do you get farmers in all those countries to change their behaviour, knowing what's going to happen in 2050? Also how do you tackle what's currently happening and help them with that, and also get them to be ready for what's happening in 2050, which might be shifting the farming systems?

A. Ismahane Elouafi: In the mountain areas of Morocco where I grew up, farmers never adopted any new varieties. They always refused them. They grew a mix of varieties anyhow, because they are not farming big lands, not thousands of hectares; they have really small plots. They didn't believe in the science, but they knew that the climate is changing: it has been going on for a while. One year you get more rain than others. So these farmers grow a mixture of grains, and hence if there is rain, this one will come up. If there isn't much rain, this

other one is going to come up. The coping capacity of farmers is huge! We need to understand that, and we need to work with it.

It seems to me that shifting of behaviour or coping with climate change is needed more in modern agriculture than with subsistence farmers. And in that sphere, you need to align all of them: data and science; science communication is very important. As scientists we tend to write papers that only other scientists can read. We need to speak up, and I think Next Gen should use the new media and the new communication tools to speak up and say what science is and what we find out.

You need to have the right policies, you need to have the right investment, and you need to have a plan. Things won't happen by themselves, and I think that's where national systems are very important, and national strategies.

Look at the UN Food Systems Summit (UNFSS) that happened in 2021. We were looking at the SDGs, and all the countries were providing their reports on Non-communicable Diseases and what have you, and the SDGs as well.

With reference to the Food Systems Summit in 2021, we said that we are off track completely for SDGs 1 and 2, and the only way to solve that is to have national pathways. So every country needs to define how they going to transform their agrifood system, and the only way to do it is to provide metrics. There are about 200 indexes that are published in *Nature* by a cohort of scientists that came together.

Last year we had the first one which we called UNFSS+2 that was reporting from countries at the national level. How they were going to transform their agrifood systems; and it was mostly by change of practices in adaptation to climate change.

What is lacking is incentives, right now.

I always say agriculture is maybe the hardest sector to be in, and I think Minister of Agriculture is one of the hardest jobs to have, because we are asking agriculture to produce food. We are asking agriculture to not emit anything. We are asking agriculture to not use enough resources. It is a sector that has a lot of pressures, and it is a sector where incentives are not well aligned with that strategy. We need to align the incentives. The best situation would be that the farmers are paid for the food they produce, and they are also paid for the ecosystem services that they provide.

But right now, the metrics and the standards are very, very off. Carbon credits started over 20 years ago, and they are not working, except in few markets. They are not improving the lives and livelihoods of small-scale producers because we are not able to monitor carbon sequestration; so the incentives are not aligned. If we really want to have a transition and transformation of the agrifood system, it has to be national. We have the standards and we have some targets that are regional or global, but it has to happen nationally. We need the policies and the regulations to be aligned.

And we need to incentivise farmers. If you don't incentivise farmers, they won't change. It is the only way to do it, and I don't think it is happening properly. Europe tried, partly, but it was mainly within Europe. There were a lot of mistakes there as well. Many countries are not yet aligning the policies, the incentives and the new strategies to transform their agrifood systems.

There is need for more science. As I said about nutrition, we know only 1%. We talk about the soil microbiome, but we know very little in human health, in livestock ... there is a lot of knowledge that is not yet there; and we are not investing enough in science and innovation to reveal that, and in biology in general.

Chair: Thank you so much for some great points raised. This point about needing more funding into agriculture R&D is one that is very important. I think people may not realise that funding of agriculture R&D can help reduce the need for humanitarian aid, and reduce many of the conflicts around the globe, because people are in subsistence conditions or short on food or needing more income, which agriculture can contribute to.

Sometimes we forget to tell the good story about agricultural investment. Agriculture R&D can contribute to solving health issues. Funding is being taken from agriculture to other needs such as humanitarian aid and health, and many of those health issues are diet-related and agriculture could play a role in solving them. Climate is also related to health and humanitarian issues, and (as we say all the time) agriculture makes huge contributions to climate. So, I think the CGIAR has much important work to do. And as a behavioural economist (prior to becoming ACIAR CEO), I would encourage study to improve understanding of what incentives drive people and how they decide to adopt new practices and to change their behaviour. More investment is needed, including in social science, economics, and policy understanding.

I would like everyone to join me in thanking Ismahane for her presentation.