

## OVERVIEW

### Nexus gains to the environment and sustainability

Dr Jean Balić

CGIAR – Southeast Asia and the Pacific; and  
International Rice Research Institute (IRRI)



Thank you for giving me the opportunity to be here with you today, representing the CGIAR and IRRI, and celebrating the 35th anniversary of the Crawford Fund and the 40th anniversary of ACIAR. It is an important milestone for us, given the very strong partnerships that CGIAR has with both the Crawford Fund and ACIAR, and we hope that this will continue into future years and decades.

This presentation will tell the story of what the CGIAR has been trying to achieve in previous decades – we have already heard a little of that today – and what we certainly need to continue doing for the future in transforming food systems and improving lives. I was asked to focus on the impact that the CGIAR has on natural resources and environmental issues and sustainability – that is, economic, social and environmental sustainability, of course. This is a very broad issue, and difficult to tackle entirely in 20 minutes. I will only be able to provide a few of the best examples of what we have been doing. I would invite you to look at more of the evidence that the CGIAR has provided over time that is available on our website to really understand what Professor Pardey was saying before, and the profound impacts that the CGIAR is really having. I was also asked to shed light very briefly on what is ahead of us, in terms of challenge, and to talk about what I call a necessary paradigm shift.

I think it is useful to start with the diagnostic and recall very briefly – with a specific focus on the Asia–Pacific region – the current challenges that our food systems face in the region. This is very well known to this audience, but it's worth recalling that these drivers are already affecting us through our food, our health, environmental resiliency, economic growth and other ways that are basically the result of a social–political construct. We need to realise that these challenges are, for the most part, anthropogenic. They are the result of the way we have been conducting our agricultural and rural affairs.

For many years we have grappled with different challenges that directly affected the way we feed the world (Figure 1). There are climate change effects that, if anything, are manifesting earlier than foreseen or anticipated, and Australia and many countries can confirm that. Biodiversity loss is putting our food system resilience at risk. There is food and nutrition insecurity and, as we have already heard, we are moving backwards in terms of both macro-nutrient deficiency and other nutritional aspects. This is certainly worrying, and it is in the context of growing inequalities and inequities, within countries and across countries.

When COVID-19 hit the world these challenges were already there, and it has exacerbated them, putting even more strain on an already fragile food system. COVID-19 has helped us fully realise that, besides being fragile, our food systems are interdependent. They are also

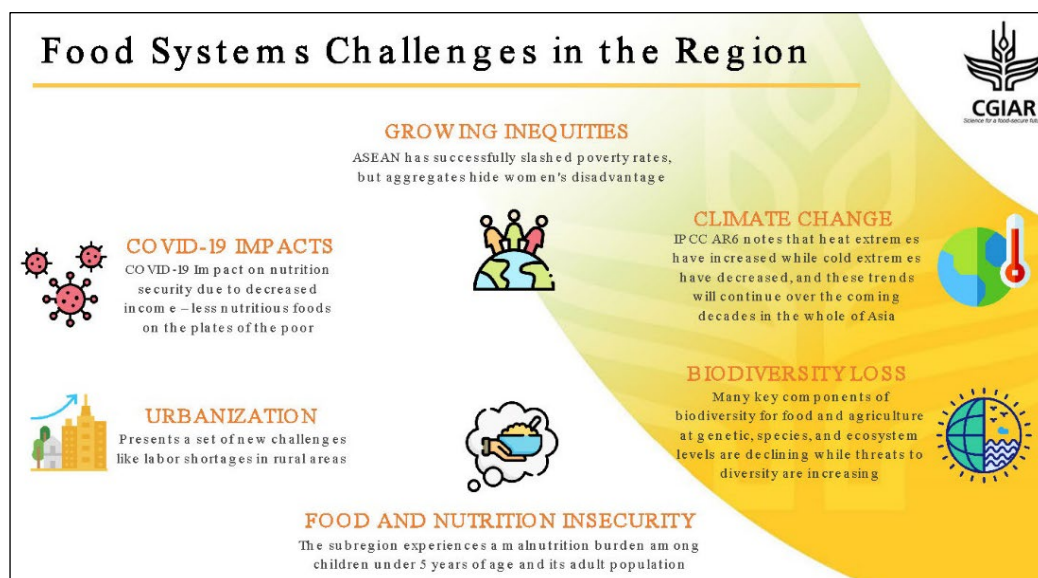


Figure 1.

dependent on outside shocks to other systems such as our health systems, and the energy sector, among others. The core of what the CGIAR is trying to do now is to understand all these intertwined mechanisms that drive the way food systems can evolve forward.

The One CGIAR is now operating with a different structure – a reformulation of the value proposition of the formerly-named CGIAR.

Our strategy is articulated around the five impact areas listed at the right-hand side of Figure 2: climate adaptation and mitigation; environmental health and biodiversity; gender



Figure 2.



countries. This helps us highlight that over the years the CGIAR has delivered innovations and more, that support, empower and improve the livelihoods of the people that we serve, and especially farmers.

We need, again, to build a case for agriculture. Still too many young people are *not* attracted to agriculture because the sector is not perceived as the way to fulfill the legitimate aspirations youth have, and that is a very difficult situation for many countries. We need to make the agriculture and food sector attractive again. That is one of the conditions for the agricultural sector to continue to be the engine of transformation and structural transformation of the various economies.

As Professor Pardey has already told us, we now have very robust evidence that the returns to investment in agriculture research are massive with a cost–benefit ratio of 1:10 or tenfold, and that evidence is certainly something that will help us grow the portfolio. We want to see that also as part of the new endeavour to develop long-term partnerships with a broader array of partners that are funding international agricultural research, and not only the top five funders that you have seen mentioned previously today.

Figure 3 also shows another study, ‘Projected benefits of CGIAR research’, that focuses on the effectiveness of the CGIAR’s strategy. This is an example of research related to the area that I am in charge of at IRRI. These kinds of socio-technical innovations are providing bundles that are taken up by countries. For example, core CGIAR technologies such as genetic improvements and enhanced agronomic practices that are bringing additional benefits to countries; it also includes technology and systems that support these core contributions as well as additional functionality such as digital capabilities and financial instruments; we also focus on building institutions, which may benefit from capacity building and enhanced collaboration and foresight; and finally we are interested in the enabling environment for innovation uptake so that individuals and communities can derive advantages from better policy, stronger institutions, and broader inclusion.

The study found that these bundles are strategically integrated through sets of activities in the six CGIAR regions where we aim to achieve beneficial outcomes and impacts and that over time they have the potential to result in substantial benefits to both people and planet. I don’t have time to elaborate on all their merits, but we certainly have this information available to all of you if you want to dig into it and learn more about the returns that investment – in genetics in particular – is actually providing in terms of public goods.

I will now give specific illustrations in relation to the five impact areas that I mentioned before. First, some examples that relate to climate adaptation and mitigation.

### **Our efforts and investment in terms of climate adaptation and mitigation**


Over the years we have seen the growing importance of integrating climate change into everything we do. It is now more pressing than ever. This climate crisis is no longer looming. It is here, and it is already affecting the outcomes of agriculture. Food systems suffer directly and indirectly and increasingly from climate change (Figure 4). But agriculture and food systems are also among the main causes of climate change: food systems produce nearly one-

third of the world's greenhouse gas emissions. Fortunately, agriculture can also be part of the solution because it has the potential to act as a global carbon sink. This again is about investment and policy.


We need to bring together innovations, investments and policies, and make sure that this happens, and happens now. Maintaining agricultural systems and guaranteeing food and nutrition security depends on assisting the most vulnerable farmers, the ones that are unfortunately the most exposed to climate change effects. Some of the work that CGIAR has done is listed in Figure 4, just for the Asian region.

You are probably aware of the climate-smart varieties (Figure 4) that have been developed not only by IRRI, by CIMMYT and by other CGIAR centers to make sure that we have these varieties that farmers need for adapting to climate change effects including salinisation, fighting drought, and other stresses, and that we deliver them through efficient food systems. That research is related to helping farmers continue to do their business and maintain yields, which means incomes.

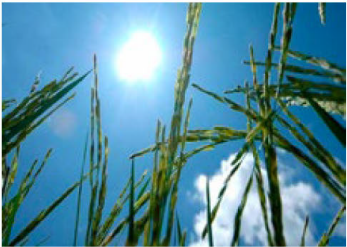
We also have other initiatives, and here I mention only one: the Asian Mega Deltas Initiative, which is about securing the future of some very specific areas upon which the livelihoods of farmers and communities depend (Figure 4). The Mekong Delta and also other deltas are the food baskets for many countries, and so this program, along with other programs on climate change, tries to harvest the collective knowledge we have created. And there is already knowledge and scientific evidence available to tell us what needs to be done. The next task is to mobilise investments and bring along policy makers to make sure that in, for example, Asian Mega Deltas, the 4.8 million people that are projected to benefit from these kinds of measures can finally get sustainable solutions for improving their livelihoods.



## Climate adaptation and mitigation



Climate change poses major risks for food production, livelihoods and nutrition through high temperatures, erratic rainfall, drought, flooding, and sea level rise.



**Climate-smart rice:** Rice varieties that are resilient to stresses such as **drought, salt, flood, and temperature tolerant**

**Asian Mega Deltas:** **Securing** the Asian Mega-Deltas from **sea-level rise, flooding, salinization** and **water Insecurity**

- Around **4.8 million people** will benefit from climate adaptation through use of digital climate advisory services, improved agronomic practices, and income gains derived from use of these innovations.

[www.cgiar.org](http://www.cgiar.org)

Figure 4.




Still on climate change and adaptation (Figure 5), there are vulnerable small-scale producers that need to adapt to climate change and that are also increasingly concerned about some of the effects of their own production systems.


In Vietnam, for example, we are trying to bring together solutions to address climate change at the farmer level, and at the same time mitigate it. Rice is the second most important emitter of methane after livestock. We now have practices that allow for reduction of the carbon footprint of rice fields. This is known as Alternate Wetting and Drying. It is a technology that is already available, that has been scaled in many countries. By controlling irrigation, we can significantly reduce methane emissions by an average of 48% and reduce water use by at least 30%. That's significant, and it goes together with a reduction in pumping costs, all without reducing yields. These are attractive solutions for farmers.

Another technology that illustrates the efforts we are currently putting in on climate change is what we call Direct Seeded Rice (Figure 5). This means planting rice seed into the field but avoiding the stage of transplanting. This is an innovation that can be adopted in many locations. And direct seeding can also reduce water use by 40%, and greenhouse gas emissions associated with rice cultivation, as I was saying, by at least 47%.

These are examples of the kinds of programs that we are trying to disseminate throughout Asia and also increasingly in Africa to show that we already have potential for reduction of the carbon footprint of the rice sector. In other areas, we are working closely with the livestock sector to make sure that we also provide integrated solutions there.



## Climate adaptation and mitigation



Supporting vulnerable small-scale producers to adapt to climate change and reducing greenhouse gas emissions from agrifood value chains are essential for sustaining food systems and ensuring food and nutrition security.

### Greenhouse gas (GHG) mitigation in rice


- Covers rice management practices, data on biophysical and socioeconomic suitability of farming technologies and practices, and policy actions in Bangladesh, Colombia, and Vietnam.

#### Alternate Wetting and Drying (AWD)

- More controlled irrigation strategy that can significantly **reduce methane emissions** (average of 48%) as well as **water consumption** (up to 30%) and pumping costs.

#### Improved direct seeding

- Reduce water use by 40% and GHG emissions by 47%**, and lessen cultivation time, labor, and cost of production.




[www.cgiar.org](http://www.cgiar.org)

Figure 5.


## Environmental health and biodiversity

Moving on to the second topic I was asked to discuss: environmental health and biodiversity. I think it is common knowledge that agriculture is the biggest driver of forest and biodiversity loss, unfortunately, and including diversity is crucial to a healthy diet and nutrition.

A third of the world's soils are degraded. Agriculture accounts for about 70% of global freshwater withdrawals (Figure 6). This certainly is not sustainable. The CGIAR has provided, and continues to provide, models to safely reuse wastewater and its nutrients, to treat and re-use septic waste and wastewater for irrigation, and create safe fertiliser pellets for crops, and briquettes that can be burned for energy. These models provide guidelines and pathways to change the way we do business and transform the current practices into more virtuous agricultural practices.



## Environmental Health and Biodiversity



A third of the world's soils are degraded, and agriculture accounts for about 70% of global freshwater withdrawals

**Models to safely reuse wastewater and nutrients**


- Will benefit **885 million urban residents** exposed to food produced with unsafe irrigation water

**Fertilizer Microdosing**

- Can result in crop yield increases ranging from **43% to 120%**

**Water pricing**

- In India, **pricing of irrigation water** was implemented to conserve water resources.
- This policy remains a challenge, yet, CGIAR research is positioned well to lead discussions on refining water policy and economics taking into consideration the social and economic factors of water pricing.



[www.cgiar.org](http://www.cgiar.org)

Figure 6.

Another example is fertiliser micro-dosing (Figure 6). It is about precision agriculture by which we increase fertiliser use efficiency, and reduce investment costs for farmers by a significant percentage that varies, depending on the locations, by between 15 and 40%. At the same time, crop yields increase by 43% to 120%. There are, of course, growing concerns about the depletion of water reserves, and we need to move to more efficient use of water throughout the agricultural sector.

The third point in Figure 6 is about a discussion that we have started in India about a policy on water pricing for irrigation water. Water can no longer be considered a free resource; it has to be priced. The CGIAR is starting conversations – which are often difficult and sensitive – to increase the awareness of policy-makers, trying to make sure that we gradually integrate or re-internalise the so-called negative environmental and social ‘externalities’ associated with water use in agriculture. Although it’s very promising, it is also a challenge that we need to clearly communicate with the policy-makers.

I think this is a fundamental function of the CGIAR based on our ‘vision’, and we are looking forward to having these kinds of fundamental discussions.

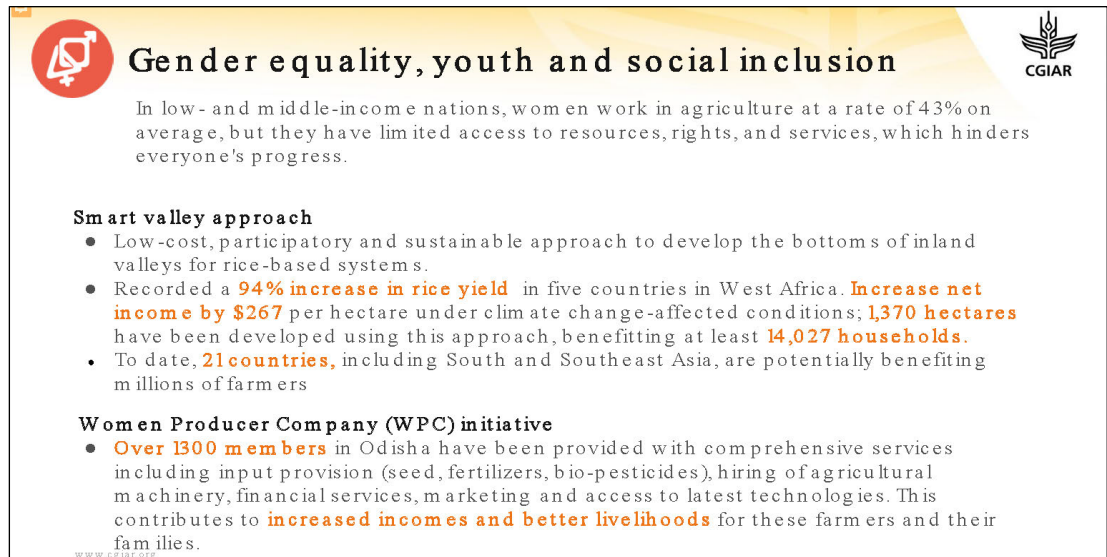


Figure 7.

## Gender equality, youth and social inclusion

In relation to Figure 7, I want to emphasise some of the points that I was making on the growing inequalities and recall that we have programs to address that, especially the gender dimension of our work. We cannot internalise one type of 'externalities' and not others. These kinds of inequities between gender and youth are part of the social aspects or market failures that we need to fully internalise in everything we do.

The Smart Valley approach is a good example that has been used in Africa and in Asia. Also very recently, the Women Producer Company initiative in Odisha, India, is bringing massive benefits to over 1200 members of these cooperatives, helping women to become entrepreneurs and agents of change. Through this project, we are making sure they can access the same level of knowledge and credits as their male counterparts, and that they are empowered to grow their businesses. This is something that we are certainly proud of.

## Poverty reduction

Poverty reduction is the fourth impact area. In this audience, you are all aware of the very close correlation between poverty and food insecurity. Food insecurity is essentially an income and access issue. Lifting people out of poverty is certainly the fastest way to improve food security, but still more than 3 billion people cannot afford healthy diets; so it's not only about getting food, it's about getting *healthy* food. Twenty-five per cent of the world's population is living on less than \$3.20 per day (Figure 8).

The world needs to be able to feed this growing population with healthy and affordable diets, and that basically means helping national food systems to transform in a way that can deliver



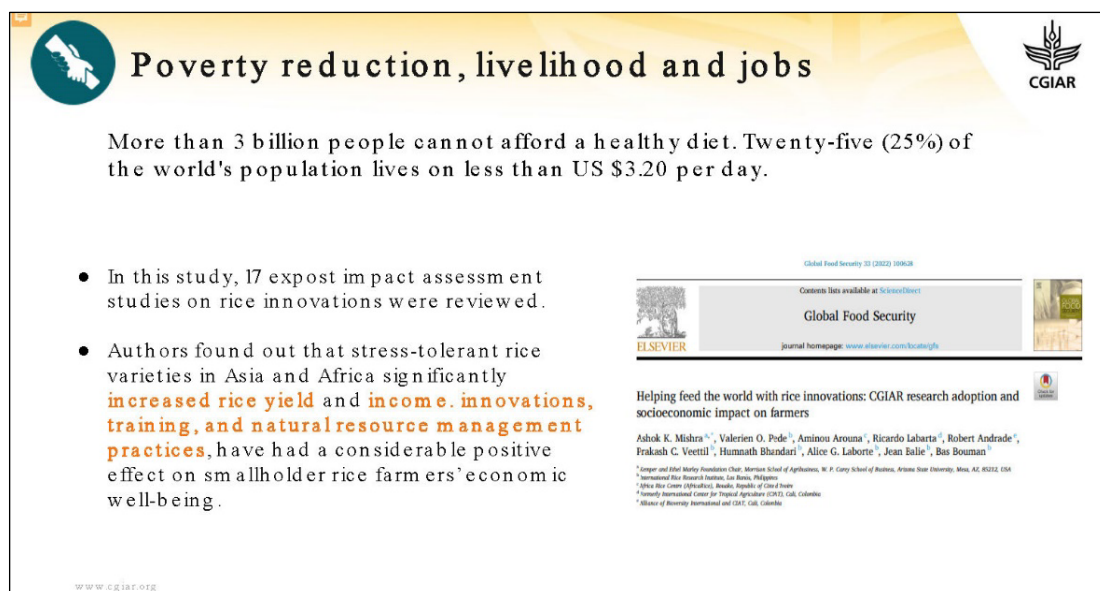


Figure 8.

healthy diets out of sustainable landscapes, within the planetary boundaries. This is something that the CGIAR is doing. It is described in one of the recent studies published in *Global Food Security* (Figure 8: 'Helping feed the world with rice innovations: CGIAR research adoption and socioeconomic impact on farmers'), which you might be interested to look at.

## Nutrition and health

The CGIAR is known for its work on food security and nutrition. As I said in the introduction, unfortunately the number of people who are undernourished is now rising instead of falling, and that is a major source of concern, along with our concern about food safety and food quality. Figure 9 shows several examples of the benefits of research for development and its achievements, to address this challenge. Every CGIAR center has food and nutrition security at its core, as part of its DNA, and it is where the CGIAR's work has produced the most benefits throughout the years and where I think Professor Pardey would agree that the benefit–cost ratio is the highest.

In IRRI for example, we have a two-pronged approach. It is about improving the quality of grain, by fortification for example, so we deliver rice grain of enhanced quality with more iron and zinc content. And we also work on diversification of production and of diets. We aim to deliver healthy meals where rice continues to be the key staple with a number of other foodstuffs available on the same plate, having been produced in the same landscape or elsewhere in the local economy.

This is something that we are working hard to deliver throughout Asia, and governments have become very receptive to this thinking.



Figure 9.

## The challenge for the future

Most issues that I have discussed so far are current challenges that are here to last. Now I want to highlight the need in the very near future to address what I think are the root causes of failing food systems. We all agree on the diagnostic; we have heard that several times today. But we do not yet all agree on the scale and the depth of the changes that are required.

I believe that there is a need for a paradigm shift, a conscious effort to transform the way we view and operate our food systems. We collectively need to shift from the agricultural productivity paradigm that characterised the Green Revolution, often based only on one metric: land productivity. We increasingly need to think in terms of food system efficiency as a new paradigm, making sure that we integrate other metrics to measure the contributions that the sector is making.

It also means thinking more in terms of food policies and food outcomes, and less in terms of agricultural policies, agricultural output. That is, focusing on food outcomes as opposed to agricultural output and so on. While the Green Revolution was characterised as producing cheap and abundant food, we now need to reinvent ourselves and promote a new 'green revolution' that would be around food system needs, with the goal of delivering nutritious, diversified food and sustainable ecosystems.

This means, of course, revising our metrics and making sure we can compare the benefits of various food systems across countries and within countries with comparable metrics.

<b>Agricultural productivity paradigm</b>	<b>Food system efficiency paradigm</b>	<b>Possible implications of the evolution</b>
Farm systems focused on agricultural production	Food systems focused on healthy and sustainable diets	Need to look beyond the agricultural sector. Involve several institutions beyond ministries of agriculture.
Agricultural supply/availability	Food demand, access, quality, safety, utilization	Shift from a primary focus on production/producer welfare to a primary focus on consumption/ consumer welfare.
Cheap & abundant staples	Nutritious & diversified foods	Higher prices are likely for consumers. They may require safety nets for the poorest households. Small farmers may get higher prices and become more competitive.
Calories, proteins	Macronutrients, micronutrients, & vitamins	Methods, tools and mechanisms to measure and monitor nutrition performance of food systems would need to adjust.
Crop productivity	Sustainable intensification, Total factor productivity	More complex management of the farm environment with multiple and sometimes competing performance indicators.
Mono-cropping	Farm diversification	Less control of agribusiness in the short term. Likely more diversified foods and biodiversity.
Economy of scale	Value addition, quality	Change in performance measurement with a focus on value addition per unit of labor as opposed to yield.
Land access	Land restitution	Possible negative consequences for marginal farmers relying on marginal land. Likely increase of land price and speculation on land markets.
<b>Feeding people</b>	<b>Nourishing people</b>	Change in quality and price of food.

Figure 10. A paradigm shift to food system transformation. *Source:* Balié (2020).

The table in Figure 10 results from the discussions we had at EAT Lancet, on the ways to think about future challenges and the fundamental issues that we need to courageously address in the near future. I am convinced that the CGIAR can help broker these kinds of discussions.

Figure 11 shows the partnerships needed to address these challenges. I emphasise the importance of the CGIAR working with national and other international partners, like NARES [national agricultural research and extension system], representatives from natural systems and all the CGIAR centers. This is critical to make sure that we progress these transformational changes that can have lasting effects.

The integration of centers into One CGIAR really puts partnerships at its core. It is about a demand-driven approach to our research that is driven by collaboration.



Figure 11.

Finally, I want to thank the Crawford Fund and ACIAR for all the support they have been providing us over the decades. The CGIAR, as I said, has a renewed focus on food systems, but it is also because we have this intellectual dialogue with the Crawford Fund, in this year and other years, that we are actually progressing this thinking; and so I want to finish by thanking you for that.



Figure 12.

## References

- Alston J.M., Pardey P.G., Rao X. 2021. Payoffs to a half century of CGIAR research. *American Journal of Agricultural Economics* **104**(2): 502–529. <https://doi.org/10.1111/ajae.12255>
- Balié J. 2020. The trade-offs of healthy food from sustainable agriculture in the Global South. *Global Food Security* **26**: 100384. <https://www.sciencedirect.com/science/article/abs/pii/S2211912420300389>
- Mishra A.K., Pede V.O., Arouna A., Labarta R., Andrade R., Veettil P.C., Bhandari H., Laborte A.G., Balié J., Bouman B. 2022. Helping feed the world with rice innovations: CGIAR research adoption and socioeconomic impact on farmers. *Global Food Security* **33**: 100628. <https://doi.org/10.1016/j.gfs.2022.100628>
- Prager S.D., Kruseman G. 2022. *Projected benefits of CGIAR research*. CIAT Publication No. 529. Cali (Colombia): International Center for Tropical Agriculture (CIAT) 60 p. <https://hdl.handle.net/10568/120302>

Jean Balié has over two decades of experience in leadership and expertise developing policies for agriculture, food, and rural development. Dr Balié is currently the Director General of the International Rice Research Institute, and the Regional Director for South East Asia and the Pacific of the CGIAR. As Director General of IRRI, he sets the global strategic direction of the institute and manages its affairs in accordance with the policies and decisions of the IRRI Board of Trustees. He joined IRRI in 2018 as Head of the Agri-Food Policy Platform and, before becoming Director General, served as Research Director – External Engagement and Deputy Director General for Research. Prior to IRRI, Dr Balié worked as a Policy Officer, Senior Economist, and Program Manager at the Food and Agriculture Organization of the United Nations (FAO). He earned his PhD in agricultural economics at the University of Göttingen in Germany, and has a Masters degree from Montpellier SupAgro, École Nationale Supérieure Agronomique de Toulouse (ENSAT) and the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM).