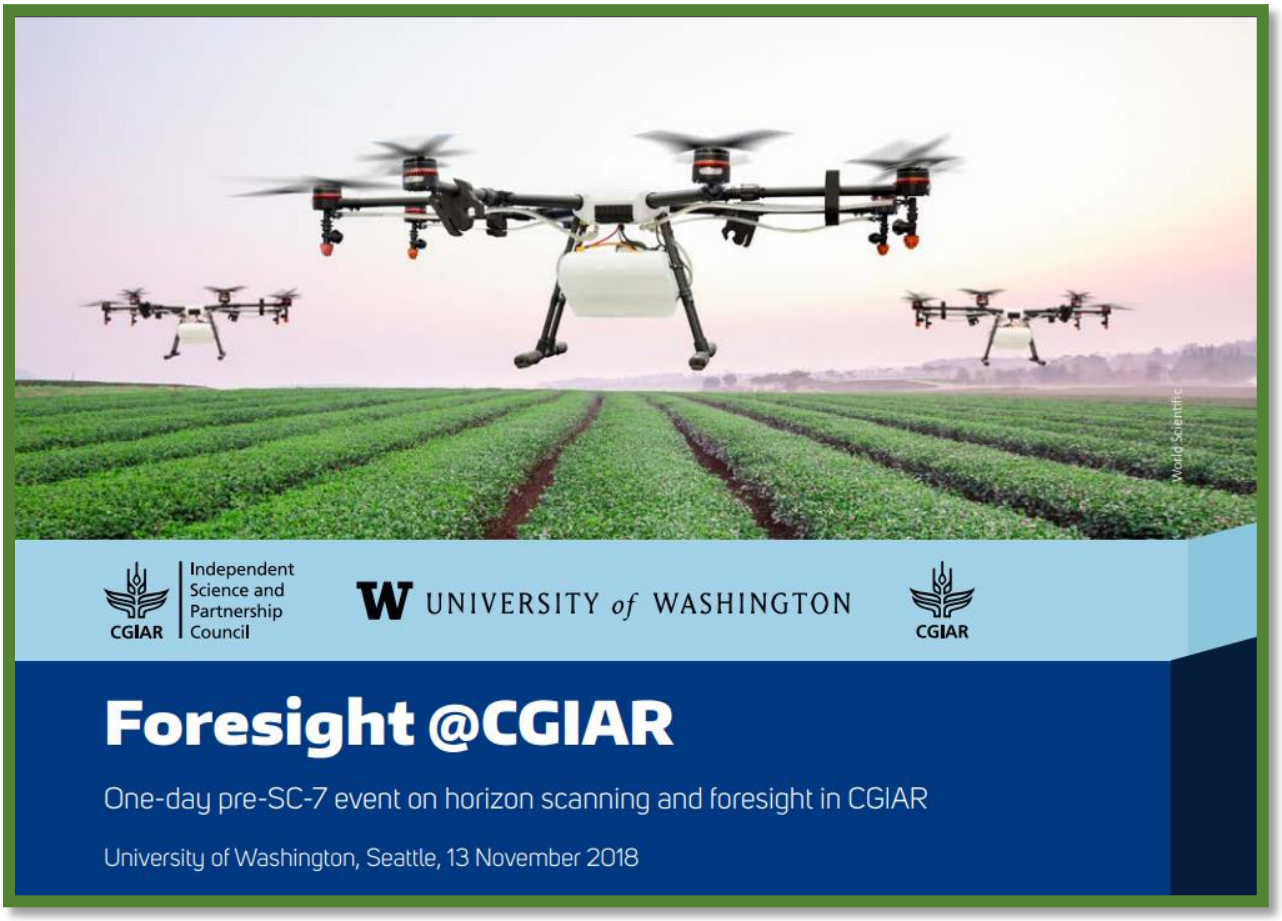
Independent Science and Partnership Council

WORKSHOP REPORT[1]



The landscape of agricultural research for development (AR4D) is evolving rapidly, as the world faces new, more complex, and interrelated challenges—such as achieving food security in the face of climate change; meeting the growing global demand for agricultural commodities while reducing deforestation, biodiversity loss, and water scarcity; creating meaningful employment for a rapidly growing youth population; and, producing not just more food, but more nutritious food, in rapidly globalizing agri-food markets serving increasingly urbanized populations. There is pressing need to respond to these new challenges and develop innovative and effective solutions.

The objective of the *Foresight@CGIAR* event was to inform the development of a process for strategic foresight in CGIAR. It aimed to: i) Synthesize results of the Independent Science and Partnership Council (ISPC) foresight exercise on drivers of change and future trends affecting the global agri-food systems, and their implications for CGIAR research agenda, and ii) Consider options for the development of future Independent Science and Development Council (ISDC) work on foresight and horizon scanning.

[1] Hosted by the Evans School Policy Analysis and Research Group (EPAR) at University of Washington. All the workshop documents and presentations are accessible on the ISPC website. Results of an evaluation survey of the event are included in Annex III.

Session 1: Introduction & Synthesis of ISPC Foresight

After welcome opening remarks by Maggie Gill, Chair of the ISPC, the first session provided background information regarding CGIAR and ISPC foresight activities and outlined key objectives of the workshop. Two short presentations informed the session, namely: a *Synthesis of the ISPC foresight initiative* including highlights of the book on *Agriculture and Food Systems to 205*0 (Prabhu Pingali, Cornell University & Rachid Serraj, ISPC Secretariat), and *Towards a framework for CGIAR foresight* (Keith Wiebe, International Food Policy Research Institute [IFPRI]; Philip Thornton, CGIAR Research Program on Climate Change, Agriculture and Food Security [CCAFS] & Leslie Lipper, ISPC Secretariat).

To encourage strong audience participation throughout the workshop, a voting question relevant to the session topic was posed in each session using Poll Everywhere, and the voting results (Annex-I) were discussed/commented upon.

Highlights from the presentations:

- This workshop is one of the many steps in ISPC's foresight activities over two years, which started with an initial brainstorming workshop (April 2017, Naples-Italy)[2] with a group of international experts and strategic thinkers on the futures around grand challenges, global trends and likely disruptions on food and nutrition security (Horizon 2050); and how the world is prepared to address them to reach the Sustainable Development Goals (SDGs) and beyond.
- The second step consisted in a workshop with CGIAR foresight practitioners and external experts on the State of Foresight in CGIAR (Aberdeen, 9-10 May 2018)[3]. One of the main objectives of the Aberdeen workshop was to take stock and synthesize recent foresight activities and findings in CGIAR, and discuss the conclusions of the independent foresight assessment led by ISPC in 2017 and their implications for the AR4D strategies of the CGIAR.
- The book on Agriculture & Food Systems to 2050 (World Scientific, 2019)[4] is a key output of the ISPC foresight exercise. It focuses on key dimensions of the 'perfect storm' of threats and facing global agriculture and food systems (changing diets, climate change, emerging diseases etc.) and the future opportunities for AR4D.
- There is a rich diversity of approaches to and work on foresight within CGIAR, (*Fig. 1*). Two examples include CCAFS, that develops explorative regional scenarios in collaboration with policymakers, and the CGIAR-wide Global Futures and Strategic Foresight project led by IFPRI, which aims to improve foresight modelling tools to inform decision making, for example through the Crops to Hunger Initiative.
- Future ISDC foresight activities should be developed in response to specific demands of System Council based on horizon scanning, draw on foresight work within the system and beyond. Horizon scanning should be carried out on an annual basis; and foresight outputs should coincide with major decision points in the business plan (every three years).

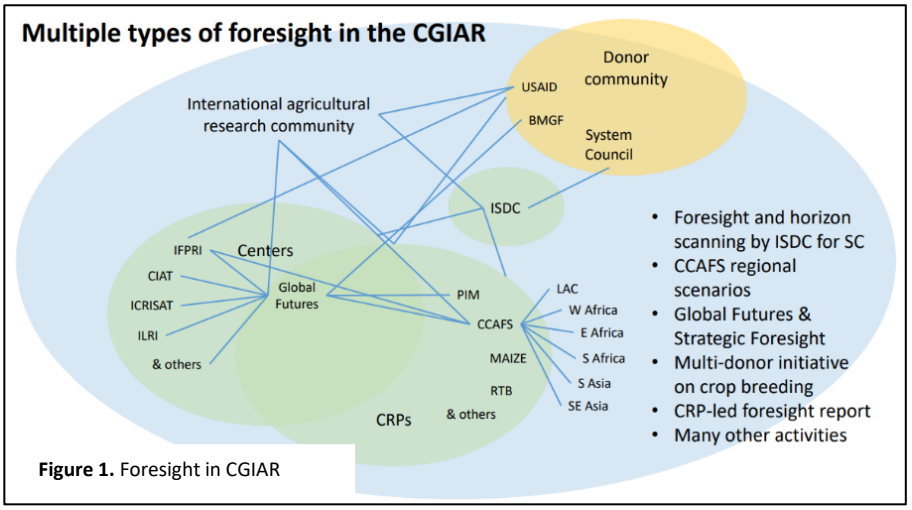


Figure 1. Foresight in CGIAR

[2] https://ispc.cgiar.org/sites/default/files/pdf/ispc_workshop_report_global_agrifood_systems.pdf
[3] https://ispc.cgiar.org/meetings-and-events/international-workshop-state-foresight-cgiar
[4] https://ispc.cgiar.org/publications/agriculture-food-systems-2050-global-trends-challenges-and-opportunities-0

- A CGIAR Research Program (CRP)-led periodic foresight report seeks to inform the broader international community, prepared in association with ISDC and other CGIAR stakeholders.
- Ongoing foresight work at individual CRPs and Centers is needed to inform decision making at CRP and Center levels, and for other partners.
- Regular foresight meetings are needed to inform decision making at various System-levels.

Main discussion points:

- Foresight requires both quantitative and qualitative tools, and one approach is not better than the other. Because models are very sensitive to assumptions, qualitative tools play a crucial role in building credible scientific evidence.
- ISPC recognizes that foresight is an iterative process, and its objective is to bring useful issues—considering CGIAR's comparative advantage—to the System Council for discussion and decision-making. However, comparative advantage is not static in nature, and it should adapt to needs.
- A periodic foresight report would be a useful input to help inform decision making by CGIAR and its partners, but further discussion will be needed to ensure it is broad-based and well-targeted.
- ISPC recognizes that, in bringing together the best available evidence, a breadth of perspectives is required. The book[4] does this by bringing in contribution from other sectors, and identifies potential directions for AR4D. At the same time, there is explicit recognition that research may not offer the best response to a global challenge, and that CGIAR needs to carefully reflect on what contributions it can make. A distinct advantage of CGIAR, beyond research, is its presence across 70 countries and its connections to policymakers.

Panel 1: International Agricultural Research for Development – the Changing Roles (Chair: Nick Austin, Bill and Melinda Gates Foundations [BMGF])

Highlights from the panel:

Introduction: A meeting on foresight in CGIAR is timely and appropriate since the Gates Foundation often grapples with foresight, and what it implies for the Foundation's priorities and investments, particularly in Africa. CGIAR's size, diversity, and other aspects of its comparative advantage should be considered when determining the role it can play.

CGIAR and alternative providers of research: At a broad level, a key question in AR4D is who should fund global public goods research. Leigh Anderson's work approaches this question from the perspective of a global social planner (GSP) who makes decisions about funding among private, public bilateral, public multilateral and philanthropic sectors, based on differences in objectives as well as comparative advantage. Using data from ASTI, US 10K tax filings, and previous published work, Anderson's work compares public sector funding with the more substantial private sector growth (between 1990 USD 5.1 billion and 2014 15.6 billion, particularly in China). This research also underlines that LMIC funding in AR4D is increasing, but the growth is primarily explained by countries like Brazil, China and India. A significant chunk of public and private sector funding is in major commercial cereals, and there is relatively very little research on orphan crops.

Role of Asian national programs: In the case of South Asia and role of IAR4D, green, blue, and white revolutions would not have been possible in the absence of partnerships. More recently, funders have lost focus on South Asia, perhaps because of the progress made in achieving food self-sufficiency and gains in poverty reduction. However, the region is still vulnerable and climate change exacerbates this vulnerability. South Asia requires a paradigm shift in doing business—a real transition from focus on genetic resource improvement to Natural Resource Management (NRM) and policy, a focus on both pre- and post-production

aspects of agriculture, and a commitment to nutrition security (not food security). This requires both new partnerships, and catalyzing and mobilizing its youth population, particularly to disseminate knowledge. Investments in AR4D have not uniformly gone up across South Asia—even India lags far behind China, and capital investments in agriculture have declined. In terms of expectations from CGIAR, there is need to revisit the Strategy and Results Framework (SRF) to evaluate appropriateness and alignment with the SDGs, to improve partnerships with National Agricultural Research Systems (NARS) (partnerships have declined post Green Revolution), and to consider having eco-regionally specific programs rather than all types of CGIAR Research Programs.

Role of African national programs: In considering Integrated Agricultural Research for Development (IAR4D) and the role of CGIAR, it is important to remember that the primary responsibility—to address global challenges or meet SDGs—lies with national governments. Since national governments require information to make decisions, and African national institutions are not well positioned to provide such support due to a variety of constraints ranging from inadequate policies to insufficient financial and human resources, NARS require strengthening. Hence, while countries engage in prioritization exercises (critical problems, solutions needed), a better-coordinated and efficient CGIAR can (and should) support those efforts and work with NARS.

View from LAC: Latin American and the Caribbean AR4D context is different from Asian and African context in that public expenditure doesn't necessarily dominate (in countries like Mexico and Chile, it is split evenly between public and private sector); investments are not oriented towards just food self-sufficiency, but also exports (e.g., the case of Brazil and Argentina); and, R4D spending is higher than 1% of GDP. Total LAC public investments are increasing, and are expected to increase further into the future. The countries with more fragile research systems are in the Caribbean. Higher level of cooperation between CGIAR and national research institutions/extension systems is needed, and CGIAR's comparative advantage lies in its scientific excellence.

Main discussion points:

- While African NARS are often small in terms of budget and do not have a critical mass of researchers, there has been experimentation around regional networks (Association for Strengthening Agricultural Research in Eastern and Central Africa [ASARECA] , CORAF, Forum for Agricultural Research in Africa [FARA] etc.) to play various roles—e.g., as producers of research or brokers of scientific innovations, and not just administrators of funding. However, these sub-regional and regional organizations are also weak, and require investments in capacity development, infrastructure etc. What is critical is that CGIAR does not crowd out NARS, leading to a situation where incentives for governments to invest in their NARS is decreased (under the assumption that regional organizations or CGIAR will take care of specific research issues or needs).
- In the case of LAC, cooperation between institutions such as the Brazilian Agricultural Research Corporation (EMBRAPA) and the Argentine National Agricultural Technology Institute (INTA) could have great impact, and CGIAR could play a role in brokering these collaborations.
- Analysis of agricultural research investment patterns has a significant gap—the data is limited to innovations in primary production (crops, livestock). Agricultural research extends to issues of nutrition and diets, climate change, environmental issues etc., and current investment analyses do not reflect this breadth of research.
- Mergers are a significant trend in the private sector, and while this does not affect how investment analysis values private sector R&D, it could affect the modelling of private sector. The top 23 private companies account for 70% of private investments, and the sector is getting more concentrated i.e., mergers are occurring both horizontally and vertically.

Panel 2: A New Green Revolution without Mineral Fertilizer? New Pathways Towards Sustainable Intensification (Chair: Mellissa Wood, ACIAR)

Highlights from the panel:

Introduction: This session shifted the focus to specific areas of agriculture, recognizing that the Green Revolution was successful and saved lives but, the current agri-food system context differs now. Agriculture depends on some finite resources (e.g., mineral fertilizers), but their continued (and excessive) use has negative implications for planetary boundaries. Hence, reflecting on whether the growing demand for food can be met without (or with less) mineral fertilizers and whether we need another Green Revolution or approach productivity issues from a different perspective is timely and appropriate.

Nitrogen scenarios: The use of Nitrogen (N) as fertilizer is said to be unsustainable, and N losses to the environment (and agriculture has a big role to play herein) has exceeded acceptable boundaries. A key research question is how best to set the limit for what is acceptable, and the kind of metrics that can help monitor and assess those limits. N models that are robust enough to predict losses from agriculture are not available, and it is unlikely that those models will be developed anytime soon. This is where the concept of N balance has a role. In terms of historical trajectories, N use efficiencies in Europe are starting to converge with the US. Unlike Europe, the US did not have as many subsidies and that prevented overuse. In other cases, for example, in China, there is inefficient use of N—a pattern of increased use of nitrogen resulting in increased yields, but driving down efficiencies. Scientists have identified scenarios to 2050 (*Fig. 2*) that result in highest N efficiency and appropriate allocation across the planet as well as those that, under business-as-usual approach, result in ever-decreasing efficiencies and increasing pollution hotspots. Research can play a significant role, in shifting trajectories towards sustainable pathways, through: identification of local and regional N thresholds that protect human and ecosystems health, better quantification of components of N balance, and improved understanding of the relationship between carbon and N cycles. Trade-offs between climate mitigation (soil carbon sequestration) and N pollution have to be managed and avoided.

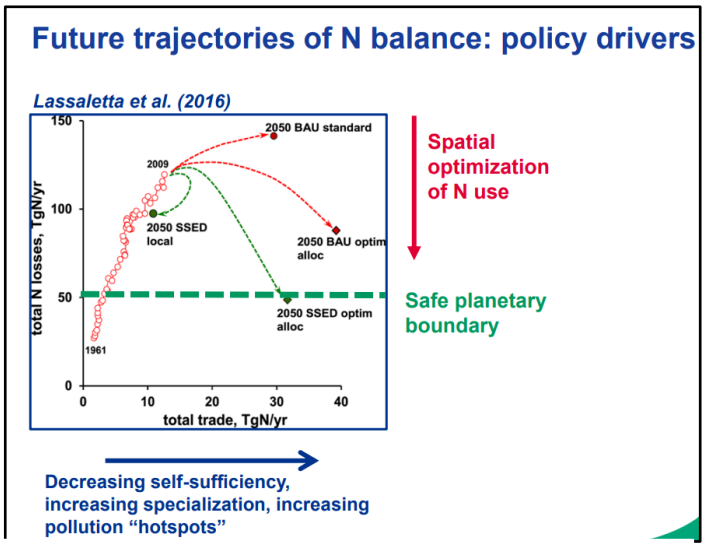


Figure 2

Phosphorus scenarios: The focus on Phosphorus (P) does conflict with the view of balanced plant nutrition because plants need about 14 essential elements. However, this focus helps emphasize that we need to produce food more sustainably and intensively. A new Green Revolution without mineral fertilizers does not appear plausible, but it is possible to use less mineral fertilizers and more bio-stimulants. P is a finite resource, but its depletion is not imminent. However, because of the water issues associated with P use, a concerted effort is needed to develop waste streams as well as recycle/recover the resource. In areas where P has been used for a long time, surpluses are accumulating (Western Europe, the US). In countries such as Brazil where cropped area is expanding and yields are increasing, surplus is accumulating even faster. It is possible to use data to convince farmers that inputs lower than crop removal are justified. But, the critical knowledge gap relates to soil fertility, and this gap is something CGIAR is well-positioned to address, in addition to enabling a better understanding of the relationship between P losses to the environment and algal blooms as well as developing technologies for P extraction (e.g., from manure).

Resource-use efficiency and the yield gap*:* The yield gap analysis estimates the difference between current farm yields and potential yield when all yield-limiting factors have been minimized through use of modern

varieties, fertilizers, soil amendments, and pest control options. Yield gaps therefore depend on factors not controllable by farmers, such as solar radiation, rainfall, and temperature. Robust yield gap analysis, because it better accounts for influences of soil properties and weather over the period of the assessment, is an essential tool for supporting impact assessment of a technology or technology packages on crop productivity (and also livestock, using similar assessment approaches) in terms of yield and yield stability. There have been major advances in the science underpinning yield gap analysis. Robust yield gap assessment requires 'bottom-up'spatial scaling based on location-specific primary data on cropping systems, soils, and climate, and innovative upscaling methods for extension to regional, national, and continental/global scales. The combination of Technology Extrapolation Domain framework plus human wellbeing and socioeconomic data within that framework would support explicit, quantitative estimation of potential impact of research investment options relevant to the SDGs and related CGIAR goals. The spatial framework also helps identify specific locations and regions for establishing field study sites for greatest impact given a specified research budget. The holy grail of agronomic research is being able to predict the performance of the system. A system where the spatial unit is defined by the agricultural technologies that will function given localized agro-ecological conditions and constraints. Production in parts of the world under irrigation, e.g., Nebraska, has high yields and low variability. This is in contrast to Sub-Saharan Africa where farmers grapple with high variability and low yields (*Fig. 3*). And yet, based on some measures of agro-ecological conditions (e.g., high rainfall), it could be the bread basket of the world. If one compares the US to West/East Africa, rainfall is high but as is Evapotranspiration (ET) because of much warmer climates in S. S. Africa. What is needed are robust crop models and a relevant spatial framework, and there are almost no climate models that account for the range of soil conditions that crops face. Overall, there are relevant frameworks and robust models available today to support good foresight analysis that CGIAR can use, but CGIAR does not yet seem to have the relevant data to appreciate local context/variations.

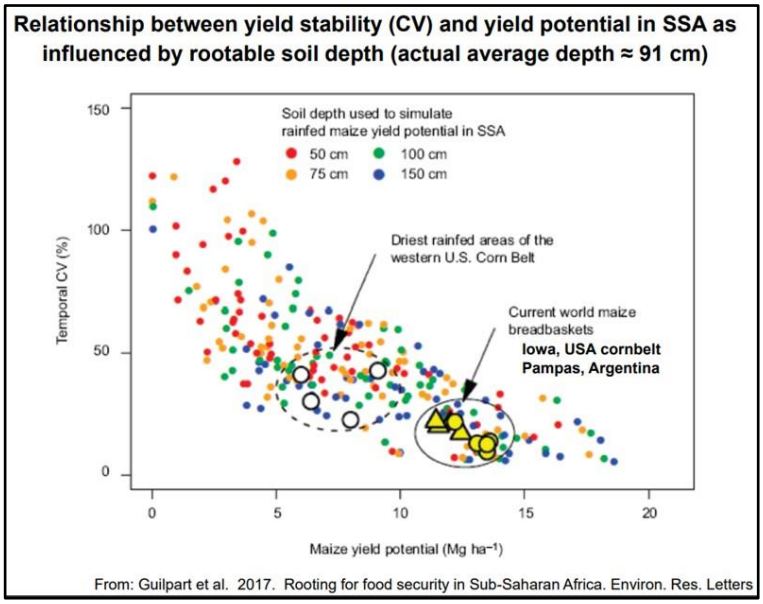


Figure 3

Natural resources and sustainable development: It is not possible to imagine a world that feeds nine billion people without fertilizer, but it is possible to imagine a world where fertilizer is used more judiciously. Nutritious diets should be at the center of how one thinks about sustainable intensification while achieving other pillars (environmental externalities such as fertilizer run-offs and GHG emissions). Because of the changes and pace of changes today, it is harder to learn about the future from the past. This is all further layered with climate uncertainties. The impact of climate change on agricultural production can be modelled but models are approximations, and there are ecological non-linearities and biological feedbacks. Therefore, an approach could be to aim at resilience in food systems, rather than just modelling the future. What then are the key steps going forward? A strong point was made about the need for regionally/locally appropriate thinking—one-size-fits-all solutions have been tried and they often come up short (e.g., in case of orphan crops). Hence, the research community should be considering what is regionally or locally appropriate in terms of fertilizer use, diversity and culture, and how people see themselves in the future. For instance, people are likely to continue (and increase) consumption of processed foods, enhancing nutritious value of these foods thus becomes a priority. In the case of fertilizers, it has to be at the appropriate scale—go beyond planetary boundaries to watersheds. Finally, it is important to have very

clear metrics that are locally appropriate on some kind of spatial scale that take into account all these complex specifications but don't get mired in complexity.

Main discussion points:

- In case of N and P, a question is on what science will deliver in the future. There is not a lot of evidence to suggest opportunities for higher efficiencies in P and N use, need for better measurement and more case studies (e.g. the case of P use in Brazil tropical red soils).
- The investment needed to bridge the gap between data and better modelling is in socio-economic-nutrition space. The spatial frameworks exist and biophysical data is sufficient to populate this initially. When IFPRI mapped crop area, the learning was on how specific crops fit with other aspects. A similar spatial framework is needed for socio-economic data, upscaled (not downscaled) data through agroecological frameworks.
- Sustainable intensification was described as aspirational, but there are some real-world examples (improvements in N use efficiencies, precision agriculture etc.)—the issue is that it occurs in bits and pieces.

Panel 3: Disruptive Technologies & Innovations; Leapfrogging for Development – Opportunities for CGIAR? (Chair: Elwyn Grainger-Jones, CGIAR SMO)

Highlights from the panel:

Introduction: The speed of change (geopolitical, scientific, etc.) is exponential, and operational environment changes quickly. CGIAR needs to adjust continuously to these conditions while designing its R4D strategies and planning the way ahead. The CGIAR System 3-Year Business Plan (2019-2021) represents a transformational moment, with CGIAR's stakeholders committing to working in an increasingly aligned and strategic manner.

Disruptive technology in agriculture: There is a distinct difference between technology and innovation. For instance, while 'technology'necessarily involves creation of new products, innovation could simply involve using an existing product differently. In identifying potential breakthrough technologies, both technological and societal/social aspects need examination. The book chapter on "Disruptive futures: prospects for breakthrough technologies"[5], drew on existing work. Using a combination of Delphi surveys and quantitative assessments, 20 technologies (e.g., bioinformatics, smart farming) were assessed on the extent to which they address societal challenges. The foresight exercise also involved development of scenarios—five visions of how future societies might look like. A key emphasis in the book chapter from a governance perspective is on social innovations.

Futures of food systems: The world will need to produce 70% more meat by 2050 to feed projected populations and meet their dietary demands. Animal agriculture, as practiced now, is associated with significant environmental and climate change impacts. The threat from antibiotic resistance is stated by scientists to be greater than climate change, and a significant amount of antibiotic use occurs in meat and dairy production. An assessment by Chatham House shows that meat consumption has to decrease, particularly in high-income countries, in order to stay within 2°C warming limit. The Good Food Institute focuses on creating alternatives—including, cellular- and plant-based meat—assuming that consumers care more about taste and texture than the source of meat. The Gates Foundation's list of five technological innovations with great potential to transform agriculture includes cellular agriculture. The first company focusing on alternative proteins started in 2015, and there are now 30 such companies. However, investment by public sector remains low, and the recognition of these options as credible alternatives to address global food security and climate change challenges, is needed.

[5] Van der Duin & den Hartog (2018)

Leapfrogging for development in Sub-Saharan Africa: Technology development and scaling is a non-linear process. "Leapfrogging" as a term, is often used to describe "game changers", sudden non-incremental leaps forward. Whereas in developed countries, the proportion of breakthrough technologies that take hold is high, the picture looks different in developing countries. There are three constraining factors: (1) gaps in appropriateness of technology – technologies require local adaptation to be successful. For example, "Uber"-ization of tractors in Nigeria; (2) infrastructure gaps – with leapfrogging, one type of infrastructure tends to get substituted for another. While the spread of mobile phones is often cited as an example of leapfrogging, that overcame traditional infrastructure constraints (cable lines), it did require a significant investment in towers and data centers; and (3) policy gaps – scaling up of innovations need to be driven by private sector investments, and for such investments to occur, regulatory and legal systems need to be in place and functional. CGIAR is not well placed to address infrastructure gaps or even policy gaps, but it is best placed to address technology gaps. In conducting this work, it should develop strong partnerships with local, regional, and global institutions.

Main discussion points:

- While CGIAR needs to be aware of and respond to the potential relevance of plant-based proteins to meet nutrition goals, it should also recognize that twice as much grazing land is available as cropland. Such pastureland cannot simply be converted to cropland and hence, the claims about low production efficiencies of animal agriculture are questionable. An area that is also under-researched is on the supply of plant-based inputs to plant-based meat production and trade-offs therein. Livestock-derived food is critical to supply of micronutrients, but one view is that plant-based alternatives are a part of the solution.
- At the household level, innovation and experimentation involves trade-offs. However, it does not necessarily have to mean that smallholder farmers are exposed to high levels of risk—mechanisms and instruments can be put in place to manage these risks. For instance, the demand for financial capital in agriculture is as much for risk management as investments. There is also potential to use experience from the past or other parts of the world to enable smallholders to leap over issues—e.g., on fertilizer overuse. The recent Chinese experience on nitrogen use efficiency emphasizes the role of institutions.

Interactive Session on Priorities for CGIAR Investments (Chair: Karen Macours, SPIA-ISPC)

The objective of this session was to engage with workshop participants in an interactive exercise, to encourage discussions around prioritization; priority "decisions" were of course illustrative and non-binding. Six topics (cards) were suggested for focusing the breakout discussion:

1. Big Data, Information and Communication Technology (ICT), and Precision Agriculture
2. Leapfrogging enablers
3. Ecological intensification
4. Gene editing
5. Alternative protein sources (including insects), In-Vitro meat
6. Food quality and safety
7. Open card

Working groups were based on geographic regions (SSA, South Asia, LAC), and were tasked with research prioritizations for CGIAR in +2^{o}C world, using the cards provided—the cards being representative of interventions or approach to solutions (list above). A set of key statistics on drivers/trends for each region was also provided to help with the prioritization exercise, and to address the questions "What are the most important technologies or innovations to invest in? What are the top two investment priorities and why? What

is the least that you are most likely to drop? Would you change your top two if you take a global perspective (not a regional one)?" Groups could use the "open card" to identify technologies/innovations that were not listed. *Table 1* summarizes the outcomes of this exercise—ranking of the different themes in the regional and global level.

Table 1. Ranking (1; 2) of the topics/research investment priorities across regions and globally

	SSA	**SA**	**LAC**	**Global**
1. Big Data, ICT, and Precision Ag.	1(broader agenda)	1	1	1, 1
2. Ecological intensification	**1, 1**	**2, 1**	**1, 1**	**1, 2, 1**
3. Gene editing	0			
4. Alt.proteins & In-Vitro meat	0	0, 0	0, 0	0, 0, 0
5. Food quality and safety	1 (with caveats), 2	2	2	2, 1
6. Leapfrogging enablers				2
7. Open card / Additional topic	Enhanced partnerships for adoption of CGIAR technical innovations	Water resources; Breeding for climate resilience?	Germplasm improvement; Agro-logistics	

Main discussion points:

- There seems to be general agreement around ecological intensification across regions and globally. "ICT" interventions listed could be a part of ecological intensification, i.e., as an enabler. An important question related to intensification is what type of investments should the CGIAR be doing?
- The private sector is best positioned to take up issues of global importance, such as alternative protein sources and leapfrogging, while CGIAR should focus on its comparative advantage.
- Food quality and safety is important globally. In the particular context of SSA, food safety issues are far more important to focus on than reducing food waste.
- The six topics/cards proposed were too broad and overlapping.

Closing Session – Lessons Learned, Key Messages, and the Way Forward (Chair: Rob Bertram, USAID)

The session chair sought views on exercises of this type; how foresight changes thinking as a team-building session; and, how to keep the momentum gained through the meeting going.

Main discussion points:

- Some participants saw this as a team building exercise, and a surprising takeaway from the day has been the emphasis placed by all groups (funders) on sustainable intensification and climate change.

- Some funders expressed interest in learning more about/discussing the book and implications for the SRF. There is also the question of how best to take it to a wider audience, for instance policymakers.
- A concern was expressed that the ISPC is sometimes not responding to demands, but in the business of supplying information. However, the onus is on the System Council to frame questions that it can provide expert views on. At the same time, ISDC (in the future) will need to balance demand and supply—it will need to retain the ability to nudge the System Council to look ahead.
- While there is a role for independent foresight of the type ISPC engaged in, these concurrent activities in CGIAR will continue. One role ISDC could play is to help frame the questions for Global Futures and other types of foresight work.
- CGIAR research developed and grew in an era where food self-sufficiency was the predominant policy paradigm, and where subsistence farming was taken as a given. This is no longer the case and CGIAR needs to evolve/make adjustments. A funder expressed concern that CGIAR is not set up to make "agile leaps"—be that radical decarbonisation or the issue of malnutrition, and that this needs to be recognized openly.
- The System Office and System Management Board (SMB) have drafted a business plan that the System Council will review in Seattle. The business plan is intended to be a planning tool that brings diverse efforts across centers and research programs together. In January 2019, a visioning exercise to 2030 has been planned, and this independent foresight exercise will feed into that internal discussion.

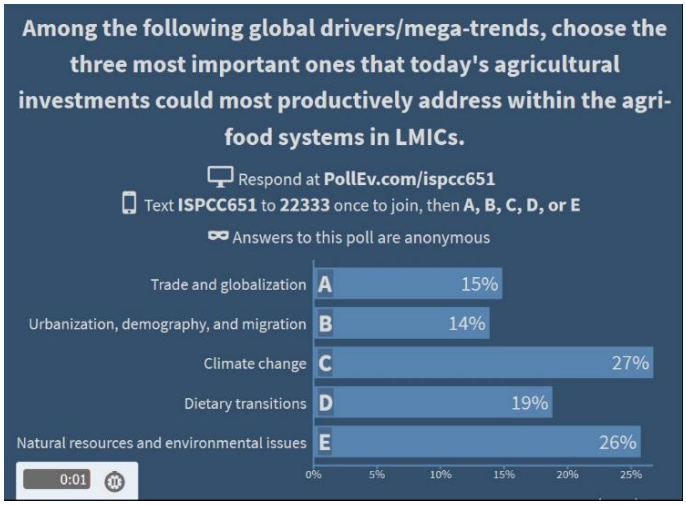
Thematic discussion:

- Modelling exercises in foresight require spatially distributed data, and there appears to be little investment taking place in biophysical and socioeconomic data. Such data gathering is expensive, but CGIAR could deploy new tools (e.g., satellites).
- The climate change community is not aware of what the agricultural sector could contribute in terms of mitigation or adaptation. But, perhaps this reflects the reorientation in thinking that is needed within. For instance, crops will not simply be produced in a different climate, the cropping zones will move and the crops will stay the same within those zones. That then leads to a question of how best to increase resilience at the fringes of crop production zones. If one were to conduct research in the harshest climates today, this provides information and knowledge to deal with climate change impacts in the future.
- While globalization is associated with free trade and movement of food, there might be sustainability trade-offs. The debate—carbon footprint of local food versus imported food—is not settled.
- The issue of climate change also affects the question of food self-sufficiency, in addition to the uncertainties associated with globalization. ISDC and CGIAR can play a critical role in helping countries think through their vision for food self-sufficiency.
- While CGIAR is focused on poverty reduction, it is not sufficiently focused on processes that will drive poverty and using that kind of foresight to frame research agendas. 'Migration, demographics, and urbanization' as a driver was not ranked as a critical driver of agricultural food systems, but these trends will drive and define where the poor will be 20-30 years from now.

Closing remarks (Maggie Gill): Foresight informs new ways of looking at global issues, and one objective of the event was to illustrate approaches to prioritization. It is clear that AR4D needs to change today to address future needs—so there is an urgent need to look at new ways of doing prioritization by using a different lens to look at how we allocate funding across research. CGIAR also needs to be more aware of what the private sector is (or is not) doing.

Annex I – Voting questions results *(https://www.polleverywhere.com/)*

Q1



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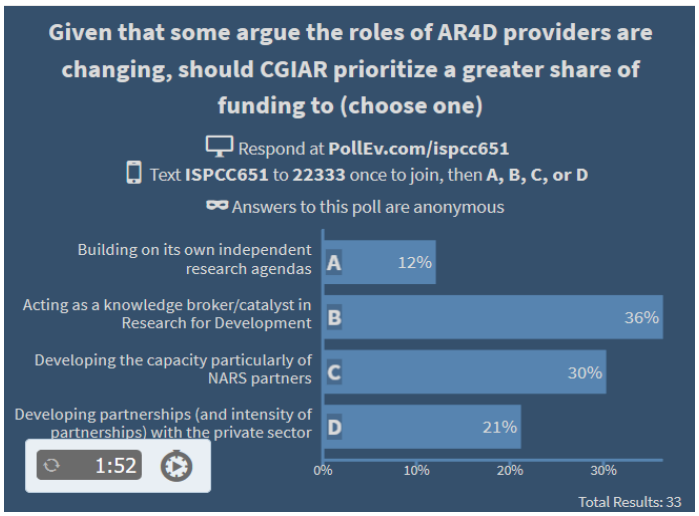

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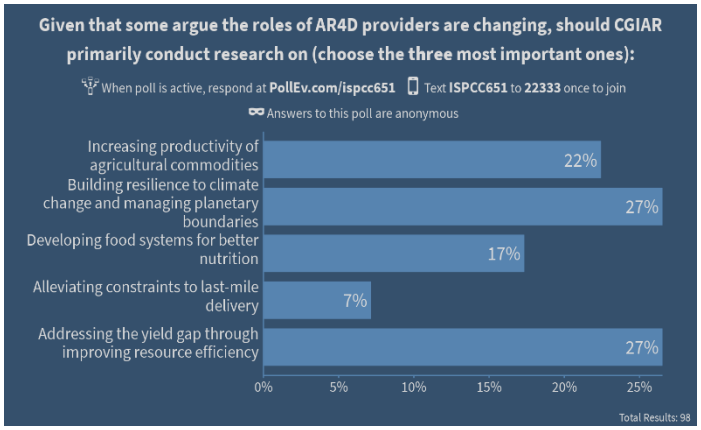
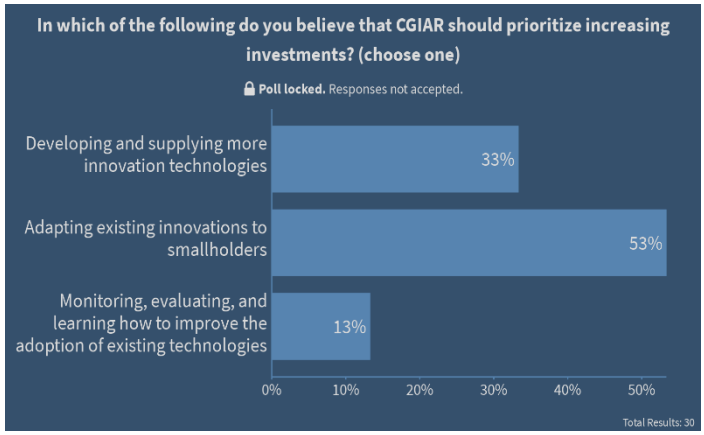
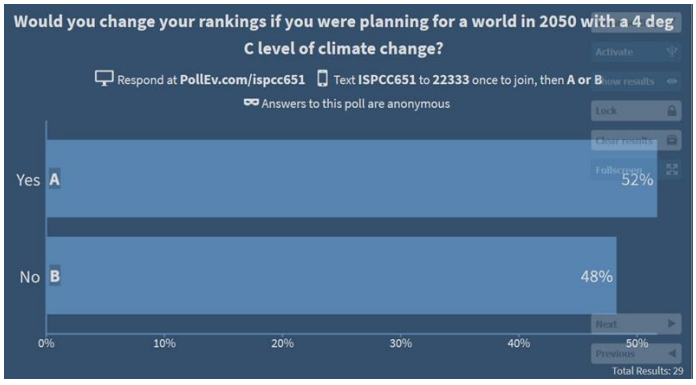


Q4



Q5



Q6

Annex II - List of Participants

	Name	Representation
1	Adil Abdelrahim	Sub-Saharan Africa (Sudan)
2	Santiago Alba-Corral	IDRC, Canada
3	Leigh Anderson	EPAR – University of W (Host)
4	Juergen Anthofer	GIZ, Germany
5	Syaiful Anwar	East Asia and Pacific (Indonesia)
6	Jenin Assaf	Independent Evaluation Arrangement (IEA)
7	Nick Austin	B&M Gates Foundation
8	Rob Bertram	USAID
9	Tom Bruulsema	IPNI, Canada (invited panelist)
10	Mark Cackler	World Bank
11	Andrew Campbell	Australia (ACIAR)
12	Ken Cassman	University of Nebraska (Invited panelist)
13	Tony Cavalieri	B&M Gates Foundation
14	Philip Chiverton	SIDA, Sweden
15	Dana Cordell	Sydney University (Invited panelist, remotely)
16	Ruth DeFries	Columbia University, USA (Invited panelist, remotely)
17	Michel Evéquoz	SDC, Switzerland
18	Marco Ferroni	SMB Chair
19	Bruce Friedrich	Good Food Institute (Invited panelist)
20	Peter Gardiner	CGIAR System Management Office
21	Nighisty Ghezae	IFS/ISPC (Invited panelist)
22	Maggie Gill	ISPC Chair
23	Elwyn Grainger-Jones	CGIAR System Organization
24	Bernard Hubert	France
25	Ken Johm	African Development Bank
26	Dougou Keita	Sub-Saharan Africa (Mali)
27	Lakshmi Krishnan	ISPC Secretariat
28	Frederic Lapeyrie	France
29	Christophe Larose	European Commission
30	Melle Leenstra	Netherlands
31	Leslie Lipper	ISPC Secretariat
32	Jose Alberto Barron Lopez	Latin America and Caribbean (Peru)
33	Pedro L.O. de Almeida Machado	Latin America and Caribbean (Brazil, Invited panelist)
34	Karen Macours	ISPC/SPIA Chair
35	Chikelu Mba	FAO
36	Eileen McLellan	EDF, USA (Invited panelist, remotely)
37	Michael Morris	World Bank
38	John Murphy	Gates Ventures (USA)
39	Yarama Ndirpaya	Sub-Saharan Africa (Nigeria)
40	Eva Ohlsson	Sweden (SIDA)
41	Raj Paroda	TAAS India (Invited panelist)

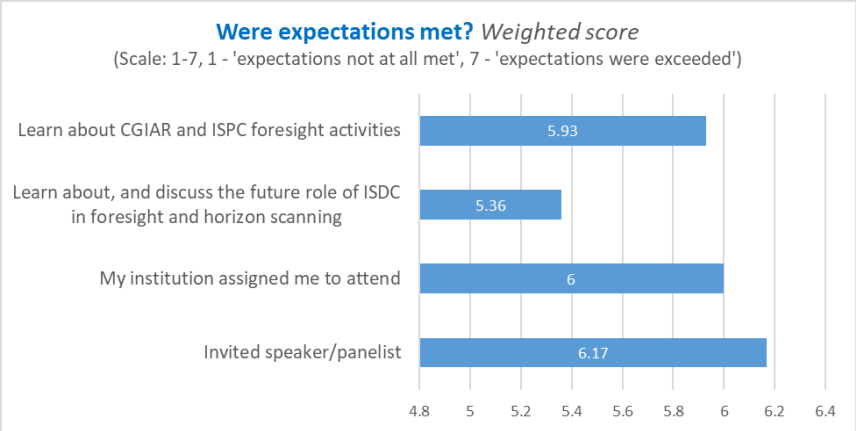
42	Prabhu Pingali	ISPC, Cornell University
43	Chhabilendra Roul	South Asia (India)
44	Travis Reynolds	EPAR- Univ Vermont
45	Rachid Serraj	ISPC Secretariat
46	Anu Kekki Svensson	Sweden (SIDA)
47	Philip Thornton	CCAFS
48	Alan Tollervey	DFID
49	Patrick van der Duin	STT, Netherlands (Invited panelist)
50	Daniel van Gilst	Norway
51	Jonathan Wadsworth	World Bank
52	Hao Weiping	East Asia and Pacific (China)
53	Keith Wiebe	IFPRI
54	Eric Witte	USAID
55	Mellissa Wood	Australia (ACIAR)
56	Stan Wood	B&M Gates Foundation
57	Rasoul Zare	Iran

Annex III – Results of Feedback Survey

Q1. Reasons for participation (16 responses)

- Participants indicated that they primarily participated to either learn about CGIAR and ISPC foresight activities (13 out of 16) or to learn about, and discuss the future role of ISDC in foresight and horizon scanning (12 out of 16)

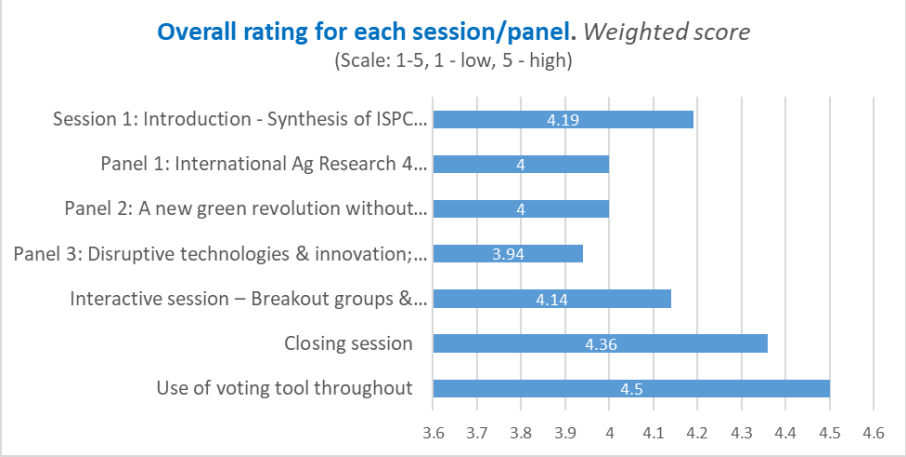
Q2. Rating of event expectations (16 responses)



Q3. One key benefit and learning from the event (13 responses)

- Consensus on priorities between breakout groups was unexpected, considering the broad group of stakeholders involved. This gives ISDC "some terra firme for moving forward with foresight."
- Role and priority placed on sustainable intensification (SI), and the opportunity to connect with organizations with differing perspectives on SI
- The need for reformation and transformation
- Opportunity for discussion with CGIAR funders and System Council about global futures of AFS
- Opportunity to learn about ISPC and CGIAR foresight activities, including the role of ISPC in CGIAR as well as the output (foresight book)
- The event took "remarkable" advantage of international experts with different skills and experiences

Q4. Rating for each session/panel (16 responses)



Q5. Summary of comments on the sessions/panels, which can explain ratings (13 responses)

- A few respondents indicated that the concept of leapfrogging was unclear, and could have benefitted from specific examples. Other respondents found the session helpful, particularly the resulting discussion on "clean meat".
- Similarly, while a few respondents appreciated the interactive exercise, others noted that the tools and approaches were mixed up.
- Real-time voting was perceived as fun and interesting—it helped trigger discussions. One suggestion was that response categories should be very clear.

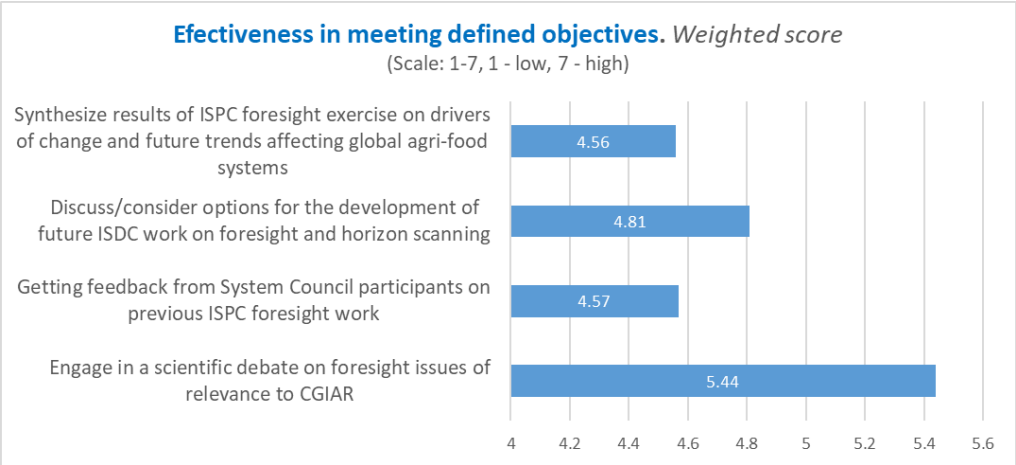
Q6. Overall satisfaction with the event

- All respondents were either satisfied (8 responses) or highly satisfied (5 responses)

Q7. What did participants *like most* or *like least* about the event? (Summary)

Liked the most (13 responses)	**Liked the least (9 responses)**
• First open discussion with CGIAR funders on strategic issues relevant to the future of CGIAR system R4D • Opportunity to gauge System Council's interest in foresight • Discussion about ecological and sustainable intensification • The fact that ISDC has made a commitment to foresight studies • The range of perspectives presented • Discussions – time given for debates, and group breakout	• Breakthrough/leapfrogging session, even if it is "in vogue" in the context of foresight • Some panelists made highly technical or narrowly focused presentations • Kick-off session was weak • Too many sessions • Substitute to chemical fertilization

Q8. Effectiveness of event in meeting stated objectives (16 responses)



Q9. Rating for various aspects of the event (16 responses)

- The *weighted score* for most aspects (program, venue, speakers and panelists, session chairs, communications leading up to the event, logistical arrangements) was above 5.5. (Each aspect was rated between 1-7, 1-low, 5-high). Only 'background documents and information provided' garnered a lower weighted score (5.19).

Q10. Sufficiency of time for discussion and networking

- Nearly all respondents (15 of 16) stated that there was sufficient time for networking / discussion

Q11. Thoughts on follow-up activities to maximize the value and impact of event

- Role of ISDC in foresight analysis needs to be formalized within CGIAR, and while CGIAR center/global programs may need to perform foresight analysis on their own, ISDC must play a system-wide role. Specifically in "establishing an underpinning spatial framework that is effective for supporting research prioritization and the foresight analysis that goes into it."
- ISDC should make this an annual event
- Strategic foresight and scenarios should contribute to the development of new SRF
- Insufficient time was allocated to summarizing the messages from the foresight book, and the dissemination of key messages needs to occur, including at national level

Q12. Topics for future ISDC foresight events

- Overall, need in-depth and more focused horizon scanning / strategic foresight
- Various proposed topics: genetic improvement, NRM and agronomy, big data and ICT, ENSO cycles, gene editing, meat demand in India and SSA, prospects for globalization (or de-globalization), aligning CGIAR research and strategies with demands of partner countries, indicators and metrics for agricultural sustainability—their connection to SDGs, climate change, roadmaps and transition management in food and agriculture, role of consumers
- "How should countries in SSA and low-income countries more generally, evaluate options and comparative advantages relative to capacity to be self-sufficient in one or more staple food crop or livestock product?"

Q13. Respondent characteristics

- Only 1 out of 15 respondents is female. (1 other respondent preferred not to state)
- 8 out of 16 respondents were System Council members, 7 respondents were invited speakers/panelists