Where Can Agricultural Research Most Contribute to Winning More, and Losing Less?

Key Insights and Implications for CGIAR from Science Forum 2018

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Could we win more benefits for smallholder farmers and lose less nutritional quality in diets if we shift the focus of plant breeding programs?

How can agricultural research help win more benefits from livestock intensification and lessen the negative environmental impacts and increased risks from zoonoses?

Where are the key opportunities to increase energy and water efficiency while improving our food systems?

These are some of the questions posed at the recent Science Forum 2018 (SF18), held from October 10-12 in Stellenbosch, South Africa[1]. The event was designed to take a close look at the interactions, i.e. synergies and trade-offs, that may be a by-product of too narrow a focus on individual Sustainable Development Goals (SDGs), and how agricultural research can play a role in effectively meeting multiple objectives.

SF18 focused on the interactions that are present in three primary areas of CGIAR agricultural research: 1) breeding improved crop cultivars, 2) livestock and aquaculture intensification, and 3) complexity in food systems. It also tackled the question of how to strengthen the science-policy interface when dealing with these complex systems and multiple objectives.

The background papers, presentations and discussions in plenary and breakout sessions yielded a rich set of issues, arguments, recommendations and questions. This brief summarizes discussions at SF18, organized around four main building blocks[2] that the Forum participants were asked to consider in every session.

1. Did the discussions/analysis indicate a need to change research design?

SF18 participants agreed that it is important to consider explicitly the potential for positive and negative SDG interactions in the design of agricultural research programs in order to be effective in supporting the 2030 agenda. The first keynote presentation made it crystal clear that the 1.5 degree climate change objective cannot be met without major transformation in agricultural and food systems, and much greater attention to reducing trade-offs between emissions and economic growth. There are also significant opportunities for increasing synergies between measures designed to avoid climate change and sustainable development such as health co-benefits from pollution reduction, energy independence, and opportunities to shift the tax burden away from labor to fund sustainable development.

> *"The challenge is huge: transform the world in a few decades so that the whole world activities are decarbonized, while poverty and hunger are eliminated. It opens many economic opportunities, and opportunities to address in a synergistic manner other societal goals[3]."*

What was perhaps surprising was that the discussion and papers indicated that there is a lack of information about when, where and how many interactions between the objectives considered actually exist, and in particular what the critical interlinkages are. There are also many cases where common perceptions are not supported by robust evidence. In the case of agricultural biodiversity and plant breeding, for example, no evidence of either a positive or negative impact was found, despite widespread perception of a trade-off between them[4]. We can however,

1 https://www.scienceforum2018.org

2 1. Research design; 2. Prioritizing activities; 3. Measuring success; and, 4. Demonstrating impact

3 https://www.scienceforum2018.org/sites/default/files/2018-10/SF18_VanYpersele_keynote_0.pdf

4 https://www.scienceforum2018.org/sites/default/files/2018-10/SF18_Smale_topic1_0.pdf
https://www.scienceforum2018.org/sites/default/files/2018-10/SF18_ppt_MBanziger.pdf

identify some key gaps in the understanding of interactions that need urgent attention. One of the background papers on the water-energy-food (WEF) nexus points out that the process of mapping and modelling interactions within and between sectors is incomplete, and the specific entry points for policy interventions to achieve synergistic outcomes are poorly understood.

"We are still "ill-equipped to develop an efficient societal response – and articulate agriculture's role"[5]."

Interactions may flip from positive to negative in different contexts. As pointed out in the livestock session, increased supplies of animal source foods (ASF) can be a very effective way of meeting nutritional deficiencies in low-income countries, but demand growth and the concomitant intensification of production can result in competition with humans for cereals. In addition, intensive livestock and aquaculture production systems increase human health risks related to zoonoses and AMR, however, if highly stringent controls developed in the context of industrialized systems are implemented in emerging value chains, the gains in health and well-being achieved could be offset by the losses in nutritional gains.

Finally, it is imperative to consider that other, non-farm, non-agricultural based interventions may be more effective at achieving the desired objectives.

Bottom line: The basis for determining potential trade-offs between SDGs in the agricultural and food system space remains quite poor and yet understanding this is essential for effectively achieving the 2030 sustainable development agenda.

Immediate entry points:

Systematically incorporate the measurement of positive/negative interactions that can arise between SDGs in agricultural food systems in the development of the CGIAR 2030 strategy and use the analysis to prioritize and focus CGIAR research in areas in which the System's comparative advantage in research can make a significant contribution to achieving the SDGs.

Explore whether more investment in minor cereals is warranted to simultaneously increase nutrient supply, climate resilience, and increased water use efficiency.

Research on animal sourced food chains could contribute strongly to an improved understanding of the importance of zoonotic diseases and their epidemiology and AMR, and to the development of cost-effective mitigation measures.

Research on the sustainable intensification of livestock feed production is high priority: Demand for feed resources is projected to quadruple by 2050[6].

2. What are the methodological implications if we want to effectively deal with synergies and trade-offs?

One of the most consistent recommendations on how to effectively consider synergies and trade-offs in research was through their explicit recognition in the research program's theory of change (ToC) and impact pathways. Nonetheless, these interactions do not need to be included in every research activity, and in fact that could be counter-productive. This issue came out clearly in the *Breeding for Multiple Objectives - Crops to End Hunger Initiative* breakout group. During these discussions, it was pointed out that there are more effective ways of improving diets and nutrition than including nutritional traits in crop breeding programs. Cramming too many objectives into one breeding program can reduce the effectiveness of all of them. In addition, taking nutritional interactions into account in the theory of change for breeding programs could equally imply changes in the crops focused upon[7].

"We need strategic simplification." - Panelist comment

Complex modelling approaches will not necessarily give any greater insights on synergies and trade-offs and in many cases, more simple conceptual approaches might be better. In fact, the need for simplification and focus only on the most important points of interaction was raised several times.

The keynote presentation on the *Economics of Ecosystems and Biodiversity (TEEB) for Food* proposed a way of achieving strategic simplification through the TEEB methodology[8]. This calls for evaluating the full value chain from production to consumption, measuring stocks of all four types of capital (natural, social, economic and produced) and measuring all classes of flows or 'impacts', including agricultural output, purchased inputs, ecosystem services and pollution and waste. The TEEB approach is already being applied in the context of agricultural research and the World Agroforestry Centre (ICRAF) has generated an exploratory study using it, with case studies from Ethiopia, Tanzania and Ghana.[9]

5 https://www.scienceforum2018.org/sites/default/files/2018-10/SF18_synopsis_topic%203_0.pdf
6 https://www.scienceforum2018.org/sites/default/files/2018-10/SF18_Herrero.pdf
7 https://www.scienceforum2018.org/sites/default/files/2018-10/SF18_ppt_defries.pdf
8 https://www.scienceforum2018.org/sites/default/files/2018-10/SF18_Hussain_keynote_TEEB_0.pdf
9 http://www.teebweb.org/wp-content/uploads/2016/11/FeederStudyAgroforestry_web.pdf

The foresight session highlighted its key role for visioning, strategic management and policy coherence, as well as in exploring the interaction of key trends in alternative futures. What are plausible futures the CGIAR may be operating under in the future? And how does that affect research design?

The agricultural research community has conducted a considerable amount of work on methods and applications, but much less on integration across disciplines (hydrology, economy, agronomy, industrial ecology).

Geography, scale and the context-specificity of the challenges was raised as a key issue to address in developing methods to confront synergies and trade-offs. It is important to tailor approaches and solutions to problems of specific contexts. In doing so, we must anticipate who the winners and losers will be, who will support change and who will obstruct it.

Bottom line: The agricultural research community should avoid blanket recommendations to include trade-offs/synergies in every research activity, but at the same time, do a better job at identifying key interactions and include them in the theory of change and impact pathways. This implies the need for research skill sets that focus on transdisciplinarity.

Immediate entry points:

Experts on nutrition and climate should be interacting more with traditional agricultural researchers in designing and implementing research programs.

Adaptation to climate change is a fundamental element for prioritizing plant breeding with implications for both crop and cultivar selection.

Nutrition objectives in plant breeding programs should be considered against the potential of alternative approaches to achieving the same objectives.

3. Did the discussion indicate the need to change approaches to measuring success and prioritization of activities?

The overwhelming response was yes, but the ways to do that were quite varied in the recommendations. One issue raised was that designing indicators of success would require better recognition of the problems of current agricultural food systems.

"There is complacency at this meeting about how broken the global food systems is. We are feeding people, but not well." - Panelist comment

To this end, it was suggested that CGIAR should think much more seriously about what agricultural research should be doing to support a radical transformation of food systems, and this should be better recognized in the indicators of success and approaches to prioritization. Since CGIAR does not have the comparative advantage to contribute to the achievement of all SDGs, prioritization should consider the extent to which CGIAR is well-placed to deliver on particular SDGs. In-depth analysis of potential impacts across this set of SDGs where CGIAR is active should then be a key criteria in prioritizing funding.

As for the indicators themselves, there was considerable discussion about fixing current food metrics. For example, crop yield is not the only or even best measure of the potential impacts of interventions on nutrition, since the magnitude of income increases that small farmers can get from higher yields will generally not be big enough to generate a positive impact on nutrition. Recognition of the need for prioritizing metrics and ensuring their compatibility with local circumstances was also raised. Metrics have varying importance across stakeholder groups, there are regional discrepancies - standards in developed countries are often not suitable for developing countries, and metrics of success are often strongly politicized.

Multidimensional indicators are a possible solution although they can also be problematic – they are complex and rely on detailed, validated and widely-available data. The development of a composite indicator to measure waste-water reuse in the context of achieving SDG 6[10] was one example presented. The use of multiple indicators is another possibility – this was also illustrated in several of the case studies.

Data at the global level may be dominated by data from a few large countries; similarly data from some countries may be unreliable - these issues need to be discussed openly and deficiencies in data reliability highlighted. Efforts should be made to identify which data are of most use to decision-makers.

Bottom line: Recognition of synergies and trade-offs in research program theories of change and impact pathways should be a factor in prioritizing funding. Metrics of success should recognize the potential impacts of research across multiple objectives. This can be done through the development of composite indicators and/or multiple indicators.

Immediate entry points:

Energy requirements in agricultural food chains need updated, fine-grain data.

A comprehensive inventory and assessment of water use is needed across agricultural chains in terms of input, use

[10] SDG6: Ensure availability and sustainable management of water and sanitation for all

and discharge.

Developing open source software to support visualization, benchmarking and scenario analysis tools to enhance integrative monitoring of socio-ecological systems to help agricultural researchers develop ToC in the context of complex systems.

Explore the potential value to CGIAR of utilizing the concepts and methods of the TEEB agri-food approach.

4. Did the discussion indicate the need to change how we demonstrate impact and respond to demand of our clients?

The consensus at SF18 was that communication is a much more fundamental part of the agricultural research work than is currently recognized, and perhaps we need a major rethink of what it means in the agricultural research for development (AR4D) context. We need to understand and communicate complexity much more effectively to a range of audiences – when there is so much information and data across so many variables "*clarity is power*". In the same vein, we need to be cautious about "*slipperiness*" of terms and the words we use since they can be interpreted differently by different audiences. Complex problems and complex institutional arrangements need to be made simple, not simpler.

The discussions around impact indicated the need for advances on measurement and validation. There was a strong call for staying away from blindly trying to measure impacts on too many things at once, but rather using ToC to focus on key aspects; and making sure that impact evaluations focus on measuring and communicating key trade-offs. The importance of setting realistic expectations on which impacts can be demonstrated and over what time frame was also reiterated throughout the impact discussions.

"*We need to change our attitudes and expand our means of cognition.*" - Panelist comment

One of the problems identified was that at present, agricultural research focuses more on diagnosing problems, rather than developing solutions and indeed many research papers do not give recognition to the solutions that already exist. To be policy-relevant, much greater emphasis on solutions is needed.

Knowledge translators/brokers are key to having policy impact. Knowledge brokers could be embedded in agricultural research programs or acquired through partnerships and working through national systems of innovation.

However, we cannot just assume that policy-makers can clearly express what they expect to get from agricultural research. We need to be able to identify and address issues that are an unfelt need. That requires capacity development of the potential users of agricultural research to articulate and express their demands, as well as the suppliers of research to understand users' needs. It also requires developing relationships - identifying potential users of the research early on in the research design process and working with them. A potential user group of research are the multi-lateral banks such as the African Development Bank and the International Fund for Agricultural Development (IFAD).

Engaging with the private sector is also important because of the leverage effect of speaking directly to influential players. However, a large part of the private sector is interested in protecting the goods of its shareholders, not goods with high social returns. Addressing this conflict of interests and ensuring that the public interest is served when partnering with the private sector is necessary.

The science and policy communities have different languages, different cultures and work to different timescales. Evidence needs to speak to policy-makers, using a variety of conduits including the social occasions where they interact. How to do that? One way is to use a 'storytelling' approach – putting the agricultural research work in the context of the people whose problems we are attempting to solve. Finally, researchers need to better demonstrate the economic benefits of research to policy-makers.

Bottom line: Research managers should familiarize themselves with the differences in language, culture and timescales with the policy community – and that will take dedicated capacity building.

Immediate entry points:

Evaluate current mechanisms and capacity for knowledge brokering in CGIAR, and address gaps through capacity building or partnership strategies.

Work with multilateral banks in the development of their lending programs to identify where research can add value is a clear opportunity to strengthen the science-policy interface.