

Agriculture for Improved Nutrition: A Future Research Agenda

Introduction

Undernutrition remains one of the world's greatest human and economic development challenges. Undernutrition comes in many forms, and is not always visible. One in four children under 5 years of age suffers from stunting, or chronic undernutrition, which is caused by diets of insufficient quality and quantity, inappropriate care and feeding practices in early life, and high rates of infectious disease. Wasting, or acute undernutrition, can be the result of seasonal changes in diets or infectious diseases. And micronutrient deficiencies are associated with a multitude of poor health and development outcomes.

Improving nutrition requires a multi-sectoral approach that brings together the health, agriculture, education, environment, water, sanitation and hygiene and social protection sectors. Food systems, defined as the production, marketing, transformation, and purchase of food, and the consumer practices, resources, and institutions involved in these processes (Global Panel 2015), can play an integral role in multiple nutritional outcomes. A functioning, healthy food system should deliver equitable consumption of a safe, affordable, diverse diet year-round. It should do so sustainably, with respect to both environmental considerations and food systems viability over the long-term, especially in the face of changing environments and the demand for foods from increasingly urban populations. These food systems, which interface with both rural and urban populations, and producers and consumers alike, provide key opportunities for improving nutritional outcomes.

There is a clear potential for the agriculture sector to play a critical role in enhancing nutrition and health especially for women and children. A well-developed agriculture and fishery sector can deliver increased and diversified farm outputs (crops, livestock, fish, non-food products) that may enhance food and nutrition security directly through increased access to and consumption of diverse foods, or indirectly through greater incomes to farmers and increased national wealth. Indeed, agriculture is a significant source of livelihoods in many poor countries and, in these settings, is also a major employer of women. Furthermore, the links between agriculture and nutrition work in both directions in that better nutrition and health of farmers can increase their agricultural and economic productivity. However, agriculture also carries risks to nutrition and health outcomes, for example, through zoonotic and other agriculture-related diseases, through the impact of agriculture on women's workload and time for child care and feeding, and through the impact of agriculture on major environmental determinants of health including climate, groundwater availability, air quality and biodiversity.

There is some evidence that certain agricultural interventions can enhance dietary intakes and improve nutrition and health outcomes (for example summarized in: Carletto *et al.*, 2015; Masset *et al.*, 2012; Ruel *et al.*, 2013; Webb Girard *et al.*, 2012). Currently however, the evidence base for the potential of agricultural strategies to improve the nutrition and health of women and children is mixed, based on a relatively small number of heterogeneous studies, and generally constrained by methodological limitations. **There is a need for a broader set of robust and large-scale evidence to guide global program and policy efforts in nutrition-sensitive agriculture.** Here, we report on the findings of a brief literature review and a consultation process with experts to identify critical gaps in the evidence base

linking agriculture with nutrition. We present this as a discussion paper to solicit feedback from researchers, program managers, and policy makers, and to frame an upcoming request for applications on these topics.

BOX 1: Global Research Agenda for Nutrition

1. Identify entry points for change
2. Make more data on diets widely available
3. Agree on what constitutes a healthy diet
4. Tackle different forms of malnutrition simultaneously
5. Understand the role of chain length
6. Analyze business incentives
7. Account for climate
8. Study supply and demand
9. Identify the economic levers for change
10. Fix metrics

(Haddad *et al.*, 2016)

Approach

To construct a forward-looking research agenda, we first reviewed the existing evidence of agriculture-nutrition linkages and explored research that is currently underway to identify research topics and questions being addressed. We then had consultations with leading researchers in the field to solicit their ideas of where knowledge gaps still exist. Now, we seek to share these findings with the global community and with program and policy experts to confirm these priorities.

Based on previous reviews of the evidence and some recently proposed research priorities for nutrition (Haddad *et al.*, 2016 - see Box 1), we attempt to scope areas where the UK Department for International Development and the Bill & Melinda Gates Foundation might play a role in advancing a research agenda.

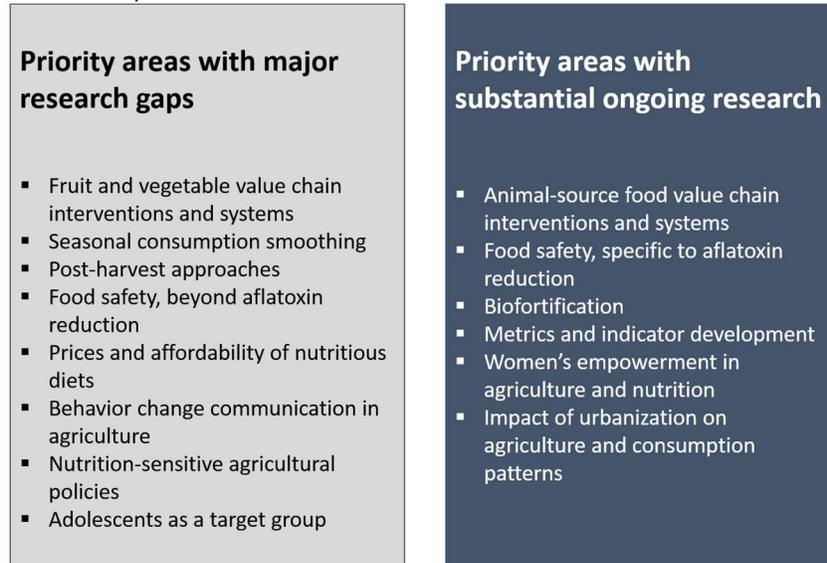
We approached the development of this agenda with four core questions in mind:

1. Research questions: What are the key research questions that are relevant now—and which ones will still be relevant in five or ten years?
2. Methods: What types of study designs and methodologies are most appropriate to answer the key research questions?
3. Outcomes: What outcomes are most feasible and informative for determining the nutrition-related impacts of agricultural programs and policies?
4. Program and policy uptake: What type of evidence will most effectively inform program design and policy making and how should this information reach decision makers?

Findings

Over the last five years there has been a major increase, albeit from a low baseline, in research focused on agriculture-nutrition linkages. When taken in combination with ongoing research (which is still active and where findings will be available in the next few years) and expert consultation, several topics emerge as knowledge gaps and opportunities for consideration for future efforts.

Figure 1: Priority research topics



1. Research Questions

The proposed future research agenda on nutritious food systems is one that moves away from the traditional focus on household-level interventions and single value chains towards a more holistic exploration of systems interventions at the market level. Research, grounded in how people engage with markets, and focusing on the food purchased by rural and urban producers and consumers, will be particularly important. As agriculture transforms in developing countries, there will be shifts towards commercialization, urbanization, and improved infrastructure: these trends have the potential to affect nutrition both positively and negatively. A deep focus on both programmatic and environmental sustainability is also needed to ensure lasting impact.

Based on the review of evidence and researcher consultations, the following research questions have been prioritized:

- Agricultural research has typically focused on improving the productivity of staples such as maize, rice and wheat. Other diverse nutrient-rich commodities like fruits, vegetables, eggs, dairy and meat are more perishable than staples, and system-wide interventions in fresh food supply value chains could potentially improve their access and affordability, and thereby increase their consumption. Evening out the strong seasonal fluctuations of food availability may be a major contributor to prevent acute undernutrition. *How can market interventions in the fresh food supply chain reach the places where the poor are purchasing their food? How do these interventions affect the seasonal availability, consumption and safety of perishable foods? Do these interventions differ in urban, peri-urban, and rural populations?*
- Access or proximity to markets has proven to be one of the greatest modifiers of agriculture's impact on nutrition, and today the majority of smallholder farmers are net purchasers of food. Yet typically, agriculture-nutrition research has focused on what is being grown by smallholders, and has prioritized direct pathways from smallholder production to consumption. A shift in research focus is needed that more fully recognizes the role markets are playing in consumer's lives and consumption

decisions. *How do market infrastructures, food processors, agro-industries, traders, and food retailers influence consumption decisions of food buyers? Can supportive market infrastructure (such as roads, storage, etc.) or finance mechanisms enhance access to nutritious diets and help smooth seasonal food consumption patterns?*

- Many agriculture-nutrition service delivery programs rely heavily on behavior change communication to increase knowledge of nutrition and nudge household consumption behaviors towards more nutritious diets. But many behavior change interventions in agriculture for nutrition are not backed by rigorous formative work, and consequently program implementation and impact suffers. In addition, some of the proven behavior change approaches that have worked in the health sector for nutrition have not translated with success in agriculture. The application of state-of-the-art work on behavioral science, combined with rigorous formative and implementation science research, could set these programs up to achieve better success. *What behavior change interventions within agriculture programs are most impactful and most cost-effective to change dietary practices at scale? What drives consumer choices about what they eat?*
- Transforming agriculture and food systems is not a short-term endeavor. A future research agenda therefore needs to have a long-term view, and be informed by historical trends, programs, and policies. Analyses are needed that explore multiple dimensions of sustainability, including temporal, institutional and environmental. Retrospective studies are needed to identify places or platforms where program impacts have been sustained over the long-term. *How can research inform program and policy makers about which interventions or programs can be sustained over time? What approaches are the most cost-effective? What are the environmental issues that must be considered when designing nutritious food systems for of the future?*

2. Methods

Experimental designs, such as randomized controlled trials, may work well to assess the impact of single interventions, but more complex market-level interventions can be difficult to randomize with a clean control group, and furthermore it can be particularly hard to identify net impacts. It is also likely that experimental designs may be unable to address many of the research questions listed in section 1, and therefore the field must be innovative in the types of methods used to advance the proposed future research agenda.

In order to address the prioritized research questions and to measure relevant outcomes (see section 3), we need the ability to: explore outcomes across countries with a standardized approach that allows for attribution and comparison; retrospectively explore existing data and mine it for crucial information on trends that may not have been previously explored with a food systems or nutrition lens; learn lessons from systems research in other sectors, such as health; take contextual and mediating factors into account; and engage multi-disciplinary researchers across sectors.

As such, we propose that a future research agenda should employ a variety of approaches to deliver novel empirical work that addresses the complexities of food systems. There remains a need for high quality randomized controlled trials when establishing proof-of-concept or documenting the causal impact of new products and approaches. But in addition, new methods should be supported, that include:

- Secondary analysis, to utilize existing data to investigate, for example, linkages (or leakages) in the agriculture-nutrition pathways;

- Comparative analysis, to compare, for example, multiple country experiences and identify successes, failures, and entry points for a food system that promotes healthy diets;
- Intergenerational longitudinal panel studies, to enable, for example, long-term perspectives to be drawn on sustainability and trends;
- Quasi-experimental approaches that may be more conducive to measuring market-level interventions, to investigate, for example, the impact of real-world policies or programs.

In addition, a new era of food systems research should draw from other disciplines with systems-level challenges and their research methods, such as health systems research and econometrics.

3. Outcomes

A lack of validated metrics and common approaches to measurement has been a challenge for researchers working in agriculture for nutrition. The agriculture-nutrition community largely agrees that

BOX 2: Recommended outcomes for agriculture-nutrition research

Individual-level

- Women's diet quality and diversity, including the new Minimum Diet Diversity-Women indicator
- Micronutrient intakes, especially iron, zinc, and vitamin A
- Women's anemia, both as an outcome for women's nutritional status and as an input for agricultural labor
- Women's Empowerment in Agriculture Index

Market-level

- Cost of a nutritious diet or the price of nutrient-rich foods
- Seasonal availability of nutrient-rich foods
- Prevalence of contaminated food, including but not limited to mycotoxin contamination

high-level impact measures of nutritional status, such as the prevalence of stunting, may not be appropriate metrics of the impact of agriculture programs on nutrition. It has been a struggle to find common ground on other possible metrics given the typically public-health focus of nutritionists, and the more economics and markets focus of agriculturalists.

In recent years, there have been significant efforts to

define better metrics to assess food systems, and there is also extensive work underway to develop indicators and collect data at a population-level on linkages between agriculture and nutrition. Some currently prioritized SMART (specific, measurable, achievable, relevant, and timely) indicators are listed in Box 2.

Much progress has been made, but major gaps and challenges remain. For example, as we take a system-level view, we require metrics that assess the net impact and costs of programs and policies. We also need a better understanding of the role of one food or commodity vis a vis others, i.e. if consumption of one nutrient-rich food increases does that result in a net improvement in nutrition? More research is needed using other indicators of the food environment including proximity and access to markets and prices. For anthropometry, the prevalence of stunting may not be a sufficiently sensitive indicator, but alternative measures including absolute linear growth from age 6 to 23 months might be more suitable for longer-term programs and policies. Whether it is possible to cluster diverse anthropometric outcomes related to growth and whether it is feasible to collect these data in agriculture programs also requires research. Lastly, the lack of a cumulative outcome indicator to capture the multiple possible impacts (positive and negative) of agriculture and food systems interventions has been a consistent challenge. The global community and particularly policy makers need measures of cost-effectiveness in order to know which interventions to prioritize, but without a cumulative outcome indicator it is difficult to tackle this important question.

4. Program and policy uptake

Lack of robust evidence and data on the effectiveness and scalability of agricultural interventions for nutrition outcomes, combined with the inherent complexity of food and health systems, has resulted in limited uptake from policy makers. Some food systems interventions that affect nutrition, like large-scale food fortification, have been gaining traction with policy makers and have begun to reach scale. But many agriculture-nutrition interventions have remained at small-scale, and have been labelled “niche” programs because of their inability to achieve effective levels of coverage and to document their true cost at scale. Poor program implementation has also led to a lack of impact in many cases. The evidence is thin on long-term programmatic sustainability of interventions that work, particularly when considering the environmental challenges of the future.

While it is difficult to assure policy uptake, there are a few principles that should be part of any future research agenda. First, a longer-term time horizon of five to ten years will be needed to design and implement programs, gather evidence of impact, disseminate findings, and see a translation of this research into shifts in policy or practice. Second, policy makers will require evidence of how to effectively scale up small pilot programs and the true cost of reaching large-scale impact. Third, policy uptake works best when policy makers are involved from the outset, and when researchers understand the relevant policy concerns in a specific country or region. Fourth, looking at complex food systems dynamics affecting consumers necessitates the involvement of private sector actors that are deeply engaged in markets and consumer choices. Achieving uptake through the private sector at scale may be as relevant as influencing a national-level policy, and research should be encouraged to engage these actors, particularly small and medium-sized entities.

Conclusion

As we advance this future food systems research agenda, we aim to solicit feedback from researchers, policy makers, and program implementers. We welcome your comments on the prioritization of research questions, methods, and metrics, and your feedback on how to improve the research to policy uptake pipeline. This white paper will serve as the basis for a soon-to-be-announced Request for Applications from the UK Department for International Development and the Bill & Melinda Gates Foundation.

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