Innovation Gaps and Smallholder Farmers: Opportunities for Action

A Report on Interviews with Global Thought Leaders and Practitioners

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Introduction

Background

The Bill and Melinda Gates Foundation’s (the Foundation or BMGF) Agricultural Development Strategy is premised on a hypothesis that it is possible for smallholder farmers to double and in some cases even triple their yields in the next 20 years while preserving the land. Increased productivity growth will contribute to overarching goals of hunger and poverty reduction. A key element of the strategy is to leverage innovation to address productivity constraints across the entire impact pathway. The strategy presumes that a better understanding of: the major gaps in innovation across the impact pathway; the types of innovations that may have the greatest potential to overcome productivity constraints and increase farmer profitability; and the approaches most effective for fostering innovation and successful farmer adoption will be required to achieve the goals.

The Foundation requested that Meridian Institute conduct seventy-eight off-the-record interviews with thought leaders and practitioners from diverse sectors and areas of experience around the globe. The purpose of this effort was to help inform the foundation’s understanding of critical short- and long-term innovation gaps effecting smallholder farmers as well as the challenges and opportunities facing innovation partners along the agricultural value chain. The Meridian team also explored a broad definition of “innovation platforms” with interviewees – that is the means to encourage, develop, and/or deliver innovations to smallholders.

The goal of this work is to inform the Foundation’s understanding of near- and long-term challenges and opportunities facing smallholder farmers, explore the roles that formal and informal institutions could play to better deliver benefits to smallholders in the future, and help improve decisions about Foundation investments. This effort supplements and builds upon Foundation agricultural initiatives focused on science and technology, integrated delivery, policy and advocacy, market access, and emerging work related to a digital revolution in agriculture.

Report Overview

This report summarizes common themes and trends from the 78 interviews and is intended to provide a broad look at agricultural innovation systems (formal and informal), and the efficacy of these systems and various players within those systems, in delivering innovation to and in support of smallholder farmers. Innovation was defined broadly encouraging those interviewed to identify and discuss the most critical short- and long-term gaps in their judgment including areas such as: science and technology, policies, market access, information needs, and institutional and organizational interventions. The structured interviews were conversations intended to engage a broad assessment of gaps and opportunities system-wide, not an evaluation of the Foundation’s grant making and activities. Appendix A includes interview questions and other guiding questions that were used to guide the conversations.

Interviews

Meridian conducted 78 in-depth interviews with experts and practitioners based in 29 countries. Eighty-two people participated in the interviews as some organizations had more than one person participate in an interview. Interviewees had wide-ranging expertise in science, information technology, applied agricultural research, plant breeding, international development, agribusiness, food manufacturing and retailing, crop extension, youth engagement, national and international policy, and advocacy, among other areas of experience and expertise. Those interviewed ranged from senior executives and leaders to young people just beginning their careers. This was by design to ensure a range of perspectives were captured and considered. Twenty-three interviewees were based in Africa and 13 were based in Asia. 24 were women and 58 were men. Appendix B contains the list of

1 The impact pathway is a broad series of activities that span agricultural research institutions to the farmer to the ultimate consumer of a commodity or good; synonymous with “ag value chains” that encompass the full range of players necessary to ensure successful development, delivery, adoption, and market access for a given crop variety, including any ultimate commercial use.
those interviewed. The appendix is not a complete list of those interviewed. Two interviewees are not listed, either because they preferred to remain anonymous or because they could not be reached to provide permission to include their name in the list of interviewees. Interviewees participated in an individual capacity and were not asked to speak officially for their organizations.

The distribution of interviews was as follows:

**Interviewee Stakeholder Group**

- Other (1)
- Regional Organization (2)
- Government (3)
- Donor (5)
- National Research Institute (7)
- Farmer Organizations (7)
- CGIAR (8)
- International Organizations (10)
- Academic (11)
- Private Sector (11)
- NGO (13)

**Interviewee Geographic Distribution**

- North America: 28%
- Europe: 22%
- Africa: 29%
- Asia/Pacific: 17%
- South America: 4%
Major Influencing Trends

Many of those interviewed prefaced their remarks with an overview of key trends they believed were shaping the environment for smallholder farmers. They stressed that their opinions about high-priority innovation gaps need to be understood in the context of these trends since the trends help to shape the nature, extent, and importance of the gaps. Key trends consistently mentioned by interviewees included the following:

**Climate Change** – Almost to a person, interviewees mentioned climate change, weather variability, and increases in the frequency and severity of extreme events as challenges affecting smallholders that should be prioritized in almost any strategy going forward. Adaptation strategies frequently mentioned ranged from technological approaches (e.g., stress tolerant varieties, micro-irrigation, and better information aggregation and delivery through ICT) to risk management (e.g., crop insurance) to basic agronomic practices (e.g., diversification). There was also acknowledgement that the issue is as complex and difficult as improving smallholder productivity and profitability.

**Water Scarcity and Other Natural Resource Constraints** – Many interviewees mentioned the challenge of growing more food with increasingly scarce natural resources. Timely access to water for agriculture is already a challenge, especially in areas that have been dealing with increasing weather variability. Interviewees anticipate increasing pressure for water, soil health, and other natural resources, as smallholder farmers and others intensify production.

**Energy** – Interviewees frequently mentioned the increasing need for access to energy in rural areas. This includes fuel and electricity to enable mechanization and small business development in rural areas and energy for cooking and heating.

**Demographics and Urbanization** – Many interviewees pointed to the predicted population growth, in particular in sub-Saharan Africa (131 percent growth expected by 2050; about 1 billion people) and South Asia (47 percent growth expected by 2050; about 700 million people). At the same time, urbanization will continue with rural to urban migration anticipated as people seek greater economic opportunities, but also due to loss or degradation of farmland and pastureland, pollution, land grabs, and/or conflict (the United Nations estimates that 93 percent of urban growth will occur in developing nations). It was noted that these trends will create opportunities and challenges for smallholder farmers. Local and regional urban markets may create opportunities for smallholder farmers who are able to access them and produce the crops that meet urban consumer preferences. However, population growth and urbanization that are fueling high global demand for land and resources are also driving a pattern of large-scale land acquisition, which at the moment does not seem to be benefitting smallholder farmers.

**Farmer Demographics** – Several interviewees quoted data about the high average age of farmers in developing countries (60 years old in some countries) and the predominant ownership of agricultural land by this aging farming population. They noted that young, talented people are leaving rural communities. As a result, rural areas are suffering a brain drain, but could also be seeing labor shortages (Brazil and India already report a shortage of farm labor). Many interviewees mentioned the importance of making agriculture an attractive profession for smallholder farmers as well as larger commercial producers and entrepreneurs.

**Dietary Changes** – Some interviewees raised concerns about health impacts in some parts of the world where people are shifting away from traditional crops and diverse ingredients to a diet that is less nutrient rich. Several interviewees pointed out that with rising incomes, diets are shifting to include more animal protein. In many regions, these dietary changes are a major driver behind land conversion and the growing of crops not for human but for animal consumption. Many interviewees pointed to the challenge of increasing production on agricultural lands to meet these changing consumer demands. In some regions, this is leading to consolidation of farms. A number of
interviewees questioned how smallholder farmers can gain the economies of scale and the access to technology required to be competitive. Others pointed out that yield gaps (the difference between actual farm and research farm yields) in Africa and South Asia are high, suggesting that there is potential for smallholders to achieve higher yields when a supportive enabling environment is in place.

**Trade and Globalization** – Interviewees referenced the ongoing globalization of markets and international trade, noting that many value chains have become global. Global food companies are much more active in developing countries today than a decade ago. Several interviewees expressed concern that smallholder farmers continue to struggle to find a place in these global markets and value chains. Several interviewees spoke about the rise of supermarkets in Africa. This may be creating new opportunities for smallholder farmers, but the challenge remains for smallholder farmers to work with supermarkets or intermediaries in order to create stable, high quality production of varieties preferred by these emerging markets.

**More Diverse National Systems** – Interviewees described how the national food and agriculture systems, especially in Africa, have become increasingly diverse and complex. Due to lack of resources and other constraints, national government institutions and extension services are unable to reach many farmers. Many other organizations have stepped in to fill the gaps, including a diverse range of local and international NGOs, local and international businesses, and farmers organizations. The complex landscape of organizations and ad hoc roles they play in national food and agriculture systems creates potential challenges and opportunities for smallholder farmers as well as national governments and donors.

**Science and Technology** – Many interviewees mentioned the leaps in science and technology that are creating tremendous opportunities in agriculture, including for smallholder farmers. The leaps include spatial data tools, information and communication technologies (ICT), and genomics. At the same time, the pace of scientific discovery is creating challenges for research institutions and others that feel overwhelmed by the fast pace of discovery and the difficulty of knowing what information and innovation is relevant and how to apply it to their work.

**Proliferation of Information and Communication Technologies (ICT)** – Almost all interviewees mentioned the widespread and increasing acceptance, availability, and use of ICT and the opportunities it creates to improve bi-directional communication with smallholder farmers. ICTs are seen as an important tool that can help improve access to information, including market information, weather information, and technical information and advice. ICTs are also seen as an enabling platform for providing improved access to services (e.g., financial services, insurance) that may have been difficult to access before. But, interviewees cautioned that ICTs are not a panacea and that much hard work is needed to support smallholder farmers in improving productivity and incomes.

The pressures and challenges smallholder farmers face are unprecedented – climate change, rapid urbanization, changes in consumer preferences and needs, etc. The opportunities, however, are also numerous, but it will take a concerted effort to overcome long-standing hurdles that stand in the way of advancement. Interviewees overwhelmingly agreed with the importance of a continued focus on smallholder farmers, noting agriculture’s important role in alleviating food insecurity and poverty and contributing to rural economic development. There are roughly 400-500 million smallholders in the world, heavily concentrated in developing countries. Many of the world’s poor are smallholder farmers and smallholders will have an important role in meeting global food needs by 2050. A much larger effort is needed in developing countries to promote smallholder innovation and smallholder inclusion in increasingly longer, more anonymous, and more demanding value chains.
Overarching Observations

In analyzing the interview transcripts, Meridian was struck by a number of broad, cross-cutting themes that recurred throughout our interviews. We highlight these here, and the reader will see them reflected in the context of the thematic areas used to describe the interview results in more detail.

Disruption as a Norm – With the advent of major disruptive trends such as climate change, increasing scarcity of natural resources, population growth, and impacts of events on global food prices, interviewees assume that there will continue to be disruptions that disproportionately impact smallholder farmers.

Increasing Complexity – The proliferation of information, technologies, and actors involved in national, regional, and global food systems create an increasingly complex landscape for smallholder farmers and those who work in their service. It also creates opportunities for improved bi-directional information flows that could benefit smallholder farmers.

Systems Approaches – Throughout our interviews, interviewees spoke about the importance of taking a systems approach to innovation. Interviewees mentioned the need for innovation to be context-specific, take into account broad sustainability factors (i.e., with regards to natural resources as well as financial, economic, social, and cultural factors), and account for the policy and institutional environment. To some this meant the creation of more “farmer-centric” approaches to innovation in the context of the range and diversity of farming systems.

Importance of the “Enabling Environment” – Interviewees did not identify science and technology as an innovation gap per se, but they generally felt that issues around access, appropriateness, adoption, ability to scale, and institutional and policy barriers were more important. Many of the challenges related to dissemination and adoption of technology, for instance, have long been known, but little progress has been made to overcome those challenges. These challenges are complex, but are not impossible to solve.

Local Access to Global Public Goods – Interviewees emphasized the need to better link and improve synergies between upstream research and development, including the creation of global public goods (GPGs), and the development or adaptation of products that are useful locally. Interviewees mentioned the challenges of strengthening linkages between the global scientific community and ever more dynamic and diverse national systems. At the national level, there continues to be a need to strengthen capacity and to learn how to strengthen linkages between formal and informal systems. In this context a number of those interviewed stressed the importance of better understanding the involvement of an increasingly diverse set of actors from the public and private sectors in many countries and the implications for smallholders.
Themes

Following a careful analysis of interview data, Meridian organized the report along the six themes below. These themes provide a framework to organize and assess the range of gaps and opportunities in innovation for smallholder farmers that were described by interviewees.

1. Data and Information
2. Science and Technology
3. Farmer-Centric Farming Systems
4. Finance
5. Risk Management
6. Policy

Theme 1 – Data and Information

The acceleration of information technology (IT) and information communication technology (ICT) was frequently referenced as an important trend by those interviewed. This includes hardware (e.g., mobile phones, smart phones, tablets), software, the data itself (big data, geospatial data) and delivery and storage mechanisms (cloud computing). Interviewees noted that there is tremendous potential to harness the power of real-time information to benefit smallholders, but cautioned that smallholders need trusted and timely information that is targeted to their specific circumstances. Beyond smallholders, other stakeholders, such as policymakers, donors, NGOs, the private sector, and larger farmers, also need access to data and the associated applications (geospatial mapping) that can be powerful tools to aid decision making. Interviewees concurred that the potential is vast, but cost effective collection, analysis, and delivery mechanisms are not yet in place to benefit smallholders at scale. Interviewees discussed a number of important gaps related to data and information.

Basic Agriculture-relevant Information – Despite the proliferation of data globally, interviewees cited agriculture-relevant information as a key gap.

This is information that can inform planning and investment by smallholder farmers and anyone in the agricultural development arena – government officials, scientists, donors, private sector representatives, NGOs, etc. – and includes both the existence of data and access to it.

A number of those interviewed noted that basic information about crop plantings, soils, population demographics, market conditions, etc. is either outdated or missing entirely in many developing countries. This varies by country, but was viewed as fundamental to decision making. Some interviewees mentioned that many of the trends described above (e.g., market demands, changing weather patterns) are resulting in changes regarding where crops are planted. For example, the area planted in maize in West and Central Africa increased from 3.2 million hectares in 1961 to 8.9 million in 2005. A private sector interviewee noted the importance of demographic data to show where future calories will be needed to guide investments, as well as data to track and understand changes over time. Interviewees were cognizant of the cost of data collection and acknowledged the human inclination that “more is better” but noted that in many important cases, the underlying and basic data that will assist policy makers, donors, and other investors, and ultimately benefit smallholders, is not available to anyone.

Development and Donor Landscape Information – Interviewees referenced the need for better information about the landscape of development and donor investments to better understand what is happening on the ground, who is supporting those activities, and what is being learned that may be transferrable to other places. Several people shared a sense that philanthropic foundations and other donor investments can at times be ad hoc. Greater visibility into the investment landscape, combined with the basic data referenced above, might lead to different investments that are better informed, better aligned or complementary for greater overall impact and mutual learning for improved future investment.
Real Time Information – Virtually everyone interviewed mentioned the importance of real time information to support smallholder farmers and noted that many smallholders have limited to no access to timely information that could improve their harvests and profitability. This includes information about weather, market prices, and pest outbreaks. Interviewees noted how traditional extension systems in developed countries, the Internet, and fee-for-service models are in many places delivering time critical information to farmers to aid their planning and ability to successfully grow and harvest their crops and deliver them to markets. A key gap is providing this information more broadly to smallholder farmers across the developing world.

Trusted Sources of Information and Advice – In addition to timely information to support smallholders, interviewees stressed that the information must come from a trusted source. This was often shared as a caution and caveat to their observation about the potential for ICT advancements to benefit smallholder farmers. Many interviewees noted that traditional extensions systems in developing countries are either defunct or severely limited in scope, and while there is a role for ICT to fill that void, the information must come from someone the farmer trusts. This can be done through a variety of means (e.g., farmer-to-farmer through a farmer leader or farm school model; farmer organizations; NGOs) and may be enhanced by ICT, but trusted relationships remain an important element of information delivery. While there was not consensus, it was strongly suggested that human intermediaries and physical proof (demonstration plots) are still very important components of farmer outreach that complement the proliferation of ICT.

Bidirectional Information Flows – In addition to making timely and trusted information available to the smallholder, interviewees stressed the importance of two-way information flows so that information about smallholder needs and preferences can be used by groups such as research institutions developing new crop varieties, government ministries considering infrastructure investments, and private sector investors contemplating new processing and storage facilities. Ideally, data should flow two-ways. Several interviewees were familiar with models where data collection from smallholders (e.g., by ICT-enabled community-based extension workers) was a revenue stream that helped to fund agriculture extension projects (because international and multilateral donors are willing to pay for good data about smallholders and poor rural communities). But there were also strong cautions about data ownership and access to ensure that there are no misuses of the data collected from farmers that would disrupt smallholders’ operations.

Data as a Global Public Good – Aside from ensuring that comprehensive, accurate, and timely data is collected, a number of interviewees stressed the importance of open data (that which currently exists and that which might be collected in the future). Several people referred to open data and robust agriculture-relevant information as an important and missing “global public good.” They noted that it is challenging to amass useful and practical information that a diversity of “decision makers” can readily utilize, but underscored the importance of sound information for decision making in agriculture.

One of the big missing pieces is a deeper understanding of individual farmers. We can create tremendous information and learning systems. Transaction costs are not that high to engage with huge numbers of households (e.g., 200,000 farmers). This creates feedback loops that are farmer driven. NGOs and community-based organizations (CBOs) can be information disseminators to governments. And this information collection and management improves the NGO/CBO’s own decision-making capacity.

-International NGO

Future solutions will be based on having an eye in the sky and an eye on the ground. The real power is not the eye in the sky…the real value is when you take that information and expose it to members of the community.

-Development and Technology Specialist
Theme 2 – Science and Technology

Interviewees noted that the challenges facing smallholder farmers are well-known and perennial; what is needed are technologies to remove the barriers that persist. Three technologies were frequently referenced as having strong potential – 1) spatial data tools that can help decision makers understand land use trends, ecological factors, water constraints, transportation opportunities and the like; 2) ICTs to reduce transaction costs for banking and farm credit services, deliver timely market information (especially if combined with commodity exchanges), etc.; and 3) genomics to provide improved crop varieties that are salt-tolerant, water efficient, and disease or pest-resistant, among other traits. Many of those interviewed noted that these characteristics will be increasingly important for smallholders to be able to adapt to climate change, extreme weather events, and weather variability. Several interviewees expressed feeling overwhelmed at the fast pace of discovery, noting that it is hard to know where certain technologies are headed or how to apply them. It is interesting to note that most of these observations came from the leadership of premier technical and scientific institutions, not from those within the non-scientific community. While most if not all interviewees referenced the important role of science and technology as a global driver and tool with great potential to assist smallholders, it was the enabling environment of human and institutional capacity that interviewees flagged as the stumbling block impeding farmer access and adoption.

Technology Constraints Not the Limiting Factor
– On the whole, it was stressed that technology constraints are not the central issue, rather it is a capacity gap that is limiting smallholder adoption of new technologies – such as the capacity for national researchers and plant breeders to take advantage of existing advanced agricultural technologies (both conventional and molecular) by incorporating them into locally accepted varieties. A number of the scientists interviewed didn’t focus their remarks on technology and the scientific potential, which they underscored as being large. Instead, they wanted to talk about the technical capacity that is needed at the national level, particularly in Africa (ranging from scientists to the farmers themselves); the need for institutional culture change to shift mindsets towards more farmer-centric innovation; a need for partnerships and collaboration across a range of institutions to incorporate broader perspectives into the R&D design phase and downstream to help deliver innovation to farmers; and the need for incentives to bring about this change. An NGO that works closely with farmers stressed that it is the capacity to innovate – the ability to adjust to changing conditions, interact with diverse stakeholders, seize new opportunities, and develop new skills – that must be strengthened. This observation was focused particularly on farmers, though it is also applicable to many interests working in agricultural research and extension. However, the recommendation was that the farmer must be included in the innovation process and not be merely the recipient. Another interviewee mentioned the need to strengthen capacity in developing countries to organize research and innovation, so that it is aligned with development objectives. Many countries lack organizations (so called “innovation intermediaries”) whose mandate is to bring together stakeholders for the creation of shared visions and strategies for research, innovation, and development.

There is no substitute for creating human institutional capacity. We can bring in outside technology, but it can only go so far if we don’t engage on-site institutions in the process.

-Donor

Plant breeding capacity is a serious gap. Each country needs one breeder per agro-ecology per crop. So for maize, this might mean that four to eight breeders are needed per country given the variable soils. The problems are local and NARS [national agricultural research system] scientists are needed to translate the technology to the local level.

Who can strengthen the NARS? It has to be local talent and we need a pipeline from high school to university to post graduate education to tackle this pressing need.

-African Researcher
Strong National Agricultural Research and Extension Systems\(^2\) (NARES) – A large number of people stressed the importance of strong national research and extension programs as a conduit for technology innovation and its ultimate dissemination to smallholders through outreach and delivery mechanisms. This involves developing and retaining talent within the NARES in each country, so the capacity exists to translate global breakthroughs into local benefits. This will require determining the incentives that will help keep researchers “in country”; several interviewees suggested that stronger donor investment (either directly or through collaborative project-based arrangements) would be one incentive for retaining competent technical people within the NARES. Donor investment could also support audits within national institutions to help clarify priorities and determine if the needed infrastructure and human resources are in place. Several people spoke about practical training needs on topics such as leadership development, program and research-based management, grant writing, and monitoring and evaluation. This was shared with the recognition that capacity building isn’t as attractive to donors as new technologies, but many felt strongly that it is what is most needed.

Several interviewees referenced the success of the AWARD (African Women in Agricultural Research and Development) program to foster the technical and leadership capacity of African women researchers and suggested that a similar program is needed in Asia. These respondents pointed to the important role that women researchers can play in building linkages to the large numbers of smallholder farmers, particularly in Africa, who are women and ensuring that research is demand driven to address farmer needs and improve livelihoods.

In addition to underscoring the important role of women researchers in agricultural research for development, a number of interviewees, across geographies and sectors stressed the importance of country-level ownership of agricultural research for development. One African scientist suggested that the “buy America” provisions of U.S. foreign assistance programs are shortsighted, particularly with respect to research investments. Donors need to take a long-term view and invest in the technical capacity of the NARS if they are going to see tangible results that include smallholder adoption, poverty alleviation, and rural economic development.

CGIAR-NARES Linkages – There was a general view that the Consultative Group on International Agricultural Research (CGIAR or CG) System is doing a good job on research and development (R&D) but that it needs stronger linkages to be locally relevant and supportive of country-level efforts. A number of interviewees stressed the critical role the CG plays in delivering agricultural innovations, especially global public goods, that can benefit the world’s poorest farmers and there was strong appreciation for the work the system is doing and recognition of the complexity of the problems it is working to address.

One person reflected on the “innovation value chain” – the idea that R&D often begins upstream in the CG and other international research centers and then innovations “flow” to the NARS/NARES and then ultimately to farmers. They remarked how a lack of adoption by farmers is not necessarily due to poor practices upstream in the system, but is likely indicative of a value chain that is not well coordinated, may not understand who “the customer” ultimately is, may not be making use of feedback loops to inform upstream R&D (because the process is not always linear), and most likely is not being evaluated based on impact and farmer needs and preferences on the ground. They noted that this is not the CG’s fault, per se, and that the CG’s

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2 We are using the terms “NARES” broadly to include the National Agricultural Research System plus the range of downstream partners necessary to ensure outreach to farmers, delivery, and adoption of agricultural innovations. While the NARES traditionally has meant government research and extension systems, we are using the term loosely to also include farmer organizations, NGOs, and the private sector who are increasingly taking over traditional extension responsibilities from government agencies.

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Kenya has a developed seed system, but we still use 30-year old hybrids. How is it possible that CG hybrids are not reaching markets? Seed research institutions need to collaborate with practitioners and businesses on the delivery of technology.

- Development NGO
success ultimately depends on a host of actors over which it has little control. This suggests that increased partnerships and collaborative approaches to more farmer-centric and value chain-oriented R&D are needed to ensure impact.

A number of interviewees noted that strengthened national systems as strong partners are in the CG’s best interest in terms of ultimately accomplishing its mission; however, several African researchers described a research “caste” system that positions international centers in a dominant position related to funding and project support and that collaboration and coordination with the NARES are often viewed as optional or a “box to be checked.” Many of those interviewed who discussed this topic noted that this is unfortunate given the importance of bidirectional information flows to ensure that farmer and value chain needs and perspectives are factored into the innovation process, the need to address critical capacity gaps that exist in many of the NARES through partnerships and collaboration, and import linkages to local conditions (e.g., agro-ecologies) that could be better serviced by in-country researchers.

A number of interviewees from diverse sectors and locations stressed the importance of incentives and metrics to measure the local impact of the innovation value chain and ultimately the contributions of the CG System and individual NARES. Several interviewees from scientific institutions talked about the need to think about organizational culture, relationships, and incentives that would orient the CG system and NARES institutions to pursue stronger partnerships and open up bidirectional information channels. They indicated that a very useful innovation might be clear metrics for impact that could be incorporated into research institutions’ monitoring and evaluation frameworks – namely improvements to food security and the livelihoods of smallholder farmers. A number of people suggested that donor funding with appropriate strings attached could facilitate this change in mindset and organizational culture. More thinking is needed about how to transform a culture from one where status and advancement are often linked to publications and conference presentations to one focused on downstream linkages and delivery and adoption by smallholders.

Global Public Goods (GPGs) – A number of interviewees discussed the importance of global public goods in agriculture and the need for continued investment to deliver them to populations for which there is currently no private market willing to underwrite the cost of their development. Several interviewees noted that the need for local customization of crop varieties and other technologies make agricultural GPGs distinct and perhaps more challenging than those in health that are more inherently universal (e.g., vaccines). Questions were raised about what is an appropriate role for the private sector in the development of GPGs, particularly upstream R&D that may involve
proprietary technology and downstream outreach and extension that has historically been the domain of government. It was noted that private sector involvement signals a potential for market development which may be a natural progression away from GPGs into market-based varieties and innovations.

A number of those interviewed noted that an important innovation gap worthy of further exploration is whether and how the public sector and those working to create solutions for smallholder farmers (global public goods) can more readily access or partner with the private sector which may have developed or own critical tools and techniques. These interviewees pointed out that the kind of innovation possible with the surge in breakthrough science and technology must of course be appropriate. They also indicated that it will not just be the private sector but also universities and advanced research institutes who could more broadly be engaged in efforts to improve the productivity and livelihood improvements for smallholders in developing countries in partnership with those more attuned to these needs.

Looking out 15 years, the biggest challenge will be the capacity of institutions (e.g., government ministries, research institutions, NGOs) to work across disciplines and sectors. Problems such as drought are going to require diverse collaboration among institutions with diverse missions.

- International Food Security Expert

Many interviewees kept returning to the same question – how to connect and incentivize a complex system to innovate across the entire value chain with the end user in mind? Better linkages between the research community, as described above, would be an important step, but the innovation value chain and farming system involves many other actors, including governments, farmer organizations, the private sector, and civil society. As was echoed throughout the interviews, people were clear on the important role of science and technology in developing new technologies including global public goods but noted the equal and perhaps more pressing need to deliver innovations (both new and existing) in a timely and culturally appropriate way. Interviewees stressed that delivery and adoption are critical gaps and the agricultural research for development community must partner with appropriate stakeholders to create robust value chains that can cost effectively deliver whatever is required to smallholders across the developing world. Given the growing complexity and increasing demand globally for safe and affordable food, a number of interviewees suggested that it might be useful to map and engage the key players in regional and national food systems to clarify goals, challenges, and opportunities.

**Theme 3 – Farmer-centric Farming Systems**

Perhaps one of the more universal themes among the 78 interviews was that agricultural research and development institutions must become more “farmer-centric” and focus on the farming system – not just R&D and not just the farmer. It is about responding to and incorporating farmer needs and preferences versus a preconceived attribute focus on improved yields or specific traits. It is critical to understand the differences between the needs of women and men farmers and youth, as well as the potential differences in impacts of innovations on women, men, and youth. One example that was repeatedly shared was labor savings. What can genomics or mechanization offer to maximize smallholder labor potential across the year, and how would the innovation be different depending on whether women or men are considered end users?

Those new biotech tools being used to solely increase yield are missing the point. They should use the tools to create a crop that never needs weeding. Another way would be to engineer plants so that they can have a longer shelf life, a longer market life [to reduce postharvest loss]. We should look to the farmer to understand what they value.

- International Donor
Enabling Environment for Innovation – With a focus on farmers and the farming system, interviewee’s comments reflected a notion of innovation that went beyond science and technology to include the enabling environment – interwoven support, services, inputs, information, market access, and policies – that allows farmers to make sound decisions and reduce their risk as they plan, grow, and harvest their crops and take them to market. As noted above, science and technology were viewed as important but not sufficient, and in many cases not the bottleneck impeding farmer progress. Some interviewees specifically felt that lasting solutions require a systems mindset to ensure that the multifaceted components of the value chain are laced together to enable farmer decision-making and support. Several suggested that engaging these diverse actors in a systematic fashion at the country or regional levels could be useful and contribute to creating an even more effective enabling environment.

Realistic Farmer Segmentation – Many interviewees suggested there is a gap in understanding smallholder needs and conditions and a lack of sophistication about the specific needs that vary among diverse farmers. They underscored that smallholder farmers are not homogeneous and need to be segmented according to their differing aspirations, circumstances and abilities. It was noted that there are early adopters/model farmers and farmers of last resort who only farm because no other option is available to them. A number of interviewees cautioned that development institutions need to be realistic about the segment of farmers who have the ability to improve their productivity and profitability. If some segment of farmers can improve their profitability, this has community implications for those who might wish to leave farming and can be employed as truck drivers, processors, cooks, etc.

We focus on the smallholder farmer as if they were a homogenous category but many rural households have diversified incomes… The opportunity cost of farming is increasing. Which do you choose – to educate your child or buy fertilizer? …This is a reality. Many people are keeping the farm as a retirement strategy – not to be productive farmers.

Senior Agriculture Scientist

Several interviewees talked about a prevailing mindset that idealizes smallholders for their simple lifestyles and focuses on them as aid beneficiaries. These interviewees felt strongly that research and development organizations need to think about farmers as small business people who are trying to maximize their return on investment. They suggested that such a shift in mindset will improve how research and development organizations approach innovation for smallholders.

Everyone seems to be operating under the assumption that increasing production will increase profitability, but the reverse is actually true. If you increase profitability, then production will go up. It is all about net value. This is what motivates farmers. They are business people. Don’t forget that.

Farmers Organization Leader
Bundling as a Customer Service Model – It was noted that segmentation allows for a greater focus in delivering “bundled” services to farmers – input; credit; information about weather, pests and prices; market access via roads or transportation. Private sector interviewees remarked that certain segments of smallholders are viable markets for new practices and technologies if the support is there (ICT, farmer-to-farmer extension, government, NGO, etc.) and there are important lessons to be captured about targeting key segments, delivering integrated solutions, and maintaining clear and constant objectives (e.g., a customer focus).

Institutional Support – As traditional extension systems wane, interviewees noted that there are a number of groups who might be poised to play expanded and perhaps new facilitative roles with smallholders in supporting outreach and the adoption of new/existing technologies and enhanced farming practices:

- Farmers Organizations – Given the need to be more farmer-centric, farmers organizations are naturally an important player, though their influence varies by country. In terms of gaps, interviewees questioned whether farmers organizations are adequately equipped to serve this role. Do they have the tools and information they need? Are policies in place at the national level to support their formation? Are organizational design models readily available and do they have guidance on how to grow into organizations that will allow them to be an effective voice for smallholders? Is data being collected so their impact can be studied?

- NGOs – Nongovernmental organizations are good at taking a systems approach (e.g., some are focused on global sustainability challenges) and could play a useful role in linking farmers with new technologies and helping them to experiment. However, it was suggested that NGOs need incentives to collect and share lessons learned from their working with farmers on technology transfer and adoption. One interviewee suggested that global development NGOs that have decades of experience in the field have tremendous institutional knowledge about successes and failures in helping smallholder farmers increase productivity and incomes that needs to be more shared more broadly.

- Private Sector – As discussed previously, their customer service focus and broad experience with commercial farmers make them a strong potential partner, provided the economics work for their involvement and the services that are offered are beneficial to smallholders. One interviewee referenced an extension model in India – Dr. DeKalb – where farmers are willing to pay for extension support as part of the inputs they purchase.

Theme 4 – Finance

Many of those interviewed indicated that access to finance continues to be an impediment to agricultural growth in developing countries. Farmers who want to increase production or access new markets need loans in order to be able to adopt the technologies and practices they consider appropriate for their circumstances. Interviewees noted that experience indicates that smallholder farmers will invest in new technology and practices if they have access to markets and finance, prices are high, and they are able to manage risks. Unfortunately, it was noted, it is still very difficult for smallholder farmers in developing countries to access credit, loans, and other appropriate financial tools. Some felt that this partly explains the lack of farmer adoption of new technologies.

Barriers to Access – Interviewees mentioned a number of barriers that are preventing formal financial institutions from lending to smallholder farmers. Banks and other finance institutions often perceive the cost of making small loans to smallholders (who may be perceived as having little or no collateral) as too high (i.e., the costs outweigh the revenues). Banks may also lack sufficient knowledge of the sector to understand the risk – whether a loan will be used for investments that will result in revenues to repay the loan. As a result, when banks do provide loans to smallholders, they often charge prohibitively high interest rates. Interviewees suggested that finance organizations need different incentives to provide access to credit to smallholder farmers. They pointed

In rural Sri Lanka, one of the most important constraints to entrepreneurial development is the cost of credit.

- Global Development Expert
out that many banks in Africa, for example, are still mostly focused on urban areas and do not view smallholder farmers in rural areas as a viable market.

Interviewees who commented on finance tended to focus on the role of formal finance institutions. However, there was a sense that innovation is needed in both the formal and informal sectors to overcome current challenges for smallholder farmers to access capital.

**Capital Markets** – A number of interviewees, for example from farmer organizations, national governments, companies, and non-governmental entities, indicated that even organizations and businesses with a track record of successful agricultural projects (commercial investments, supply chain projects with smallholders, etc.) have difficulty accessing working capital, which limits their ability to expand and take successful enterprises to scale. Some funders and investors suggested that debt capital markets, especially in Africa, are underdeveloped and that neither governments, donors, nor development banks are providing the necessary capital that will allow banks and other finance institutions to increase lending and credit to smallholder farmers. They pointed out that without private sector debt capital markets, working capital is not forthcoming for those organizations that are providing loans, credit, and other financial services to smallholders in Africa. It appears that strengthening capital markets will be a key element to help take successful agricultural investments to scale and improve their long-term sustainability.

**Information and Integration for Access to Finance** – A common theme among interviewees who spoke about finance was the important role information plays in creating incentives, reducing the risk of lending to smallholder farmers, and creating appropriate finance tools. Bankers need information to understand the investment decisions farmers are making and whether those investments are supported by sound agricultural knowledge that will deliver productivity increases, quality increases, or other desired improvements that will generate positive returns. They also need to understand how finance contributes to and can be integrated with the delivery of a complementary suite of services that can help farmers increase productivity and profitability and reduce lender risk. Alongside loans or lines of credit, farmers need extension support, market information, and business training to help ensure that they use financing to make sound investments that result in positive returns and creditor repayment.

**Improve Information Flows** – Several interviewees described efforts to improve information flows between bankers and smallholder farmers. Many of these examples focused on the role of intermediaries to organize farmers and create effective means to engage finance institutions and integrate finance with other services. For instance:

- Village associations in Bangladesh meet monthly to share information with lenders. This allows lenders to know how farmers are investing and what is working with regards to increasing their productivity and profitability. The associations also provide extension knowledge.

- An agricultural “franchise” model in Nigeria is being developed to provide integrated services to farmers through a farmers organizations model, including organizational development (e.g., organizational, leadership, business, and agronomy training), credit, inputs (e.g., farm and soil analysis, mechanized soil preparation, seed, crop protection, fertilizer, mechanized threshing), and output marketing services. The franchise business has strong profit motives to ensure that all requisite “services” are provided; their business is to make sure that their growers have productive and sustained businesses.

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**To illustrate the inertia in agricultural finance, in Nigeria for example, agriculture contributes 40 percent of GDP but constitutes only 1.5 percent of commercial debt.**

- *Entrepreneur*

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**Appropriate Financial Tools** – Several interviewees mentioned that smallholder farmers need targeted financing tools to match their business or income models. Smallholder farmers’ investments may take several seasons to pay off, for instance, due to small surpluses generated each season, or seasonal and irregular cash flows. Loan cycles, therefore, may need to be longer and offer flexibility in case of unforeseen or seasonal impacts.
Interviewees mentioned additional approaches to link bankers to relevant agricultural information, such as lists of recommended crops for certain geographies and agro-ecologies (provided by a national agricultural research organization). Some interviewees suggested that ICT can help by providing lenders with real-time information about farmer choices such as crop selection and input practices (e.g., fertilizer and pesticide applications). Experiences in Kenya and Uganda are showing that financial services can be enabled by mobile phones so it should be possible to provide agricultural financing over the phone to enable more farmers to access loans and credit schemes.

**Theme 5 – Risk Management**

A large number of interviewees focused attention on the need to improve risk management by smallholder farmers in relation to a wide range of disruptions and stresses. For smallholders, they noted that changing their current practices or markets presents risks that may be difficult to overcome or are perceived as difficult to overcome. Farmers may be reluctant to change their practices or buy technical solutions given the perceived risks.

**Use Business Tools for Risk Assessment Management** – Interviewees mentioned that farmers who are interested in accessing new markets may find it too risky if they cannot fully assess risks or access tools to manage them. Some interviewees mentioned increasing market demand for vegetable protein and fish; for smallholder farmers to supply these markets, infrastructure investments and investments in improved harvesting, storage, and handling technologies are needed. Farmers organizations mentioned that they see a need to build or enhance capacity to conduct market research, conduct analyses to understand what would be involved for smallholder farmers to supply these markets, and support farmers in taking the steps needed to supply to new markets. Interviewees from farmers organizations /federations and the private sector noted that smallholder farmers should be viewed as small business entrepreneurs. Market research, marketing strategies, finance, and risk assessment and mitigation are common tools used by businesses, but rarely used by or in support of smallholder farmers. These tools are key catalysts for entrepreneurship and create opportunities for increasing production and incomes, and they should be included in integrated programs to support smallholder farmers.

**Vanilla was introduced in Uganda in the 1980’s & 1990’s. It was a big success because it was a high price market. Despite the laborious and completely new methods of farming, peasant farmers took it on and high production levels were achieved. Unfortunately, the market collapsed suddenly, which hurt a lot of smallholder farmers. Thereafter, other crops have met the same fate. A lack of diversification and a failure to guarantee at least a minimum price has been major contributors. Are there tools or schemes that smallholders can use to better manage these risks?**

- **African Entrepreneur**

**Insurance** – In order to invest in improved inputs and enter new markets, farmers need access to integrated solutions to help mitigate risk (e.g., access to inputs and extension support; flexible loan payment arrangements; weather index insurance). As described above, interviewees described examples of intermediaries who are organizing integrated service packages that contribute to “de-risking” the farmer.
The integration and delivery of such services are part of effective risk management approaches. Included in these integrated packages may be a range of specific risk management options, including weather and crop insurance. Farmers are generally unable to hedge against weather or price risk. There are examples of index-based insurance that can help farmer decision-making (e.g., in Ethiopia and Thailand), but several interviewees suggested that there is a need for more evidence about their effectiveness. Some Japanese insurance companies are working in Thailand with weather index-based insurance, which may provide an example that could be studied more closely.

**We have not figured out how to cover the cost of crop insurance. When does it make sense to have crop insurance? How will it work? Does it need to be part of a larger safety net? Recently, there has been a big push for cash transfer programs to provide a social safety net for the poor. But, we need to understand how such a system may impact farmer behavior and production.**

- **International Policy Expert**

**GIS and Insurance**—A few interviewees mentioned that weather indexing could benefit tremendously from GIS systems. Much remote sensing data is freely available and with current software technology, easy to use devices, and training, governments may be able to provide much more effective insurance schemes. Remote sensing imagery can determine the biomass in the fields and observe from space how crops are developing. This can be helpful to insurance schemes to assess where damage has occurred that can trigger claims. GIS mapping and remote sensing can also be used to create early warning systems. This data would enable governments to estimate whether crop yields are sufficient to feed the population, predict potential famine areas, and take appropriate measures. One interviewee mentioned that in Kenya, an interesting technique is emerging to calculate rainfall. Given that rain interferes with cell tower transmission, the amount of interference can be used to calculate rainfall. This data could be used to support farmer information and risk management systems.

**Infrastructure to Mitigate Risk**—In Ethiopia, organizations are experimenting with offering weather indexed crop insurance to the poorest farmers in exchange for donated labor during the off-season. Off season labor is used to create infrastructure that allows farmers to farm more days per year and increase their resilience to climate change by building water catchments, reforesting, constructing small scale irrigation systems, etc. Some interviewees suggested that broader investments in water infrastructure (e.g., to alleviate the impacts of drought and erratic rainfall patterns), processing infrastructure (e.g., to access higher value markets and reduce dependency on more volatile commodity markets), and other infrastructure investments would have advantages over more traditional insurance schemes because of cost, sustainability, and the potential for co-benefits (e.g., local employment).

It appears that current efforts to understand risk management by smallholder farmers are ad hoc with limited coordinated efforts to learn and share information. Interviewees suggested, given the importance of risk management to smallholders, that institutions involved in this work better link and coordinate their efforts and share lessons broadly.

**Theme 6 – Policy**

It was striking how often interviewees from all sectors (scientists, companies, donors, government, farmers and farmers organizations, and NGOs) stressed how critical a lack of coherent policies and a predictable, enabling policy environment are in undermining smallholder advancement. Many reflected upon their experience watching excellent programs and projects fail because they were subverted by poor policies or policy uncertainty. Interviewees underscored that it is critically important for agricultural scientists, farmers and farmers organizations, companies, and others to engage in politics and policy making processes in order to advocate for a coherent and supportive policy environment that will attract and encourage investment by the private sector, including farmers themselves. They acknowledged their own and others’ great frustration with trying to affect positive
policy changes that benefit smallholders in developing countries. And yet, these same individuals stressed that this frustration and challenge does not warrant a lack of attention to this critical issue.

**Policy Disincentives for Agricultural Investment** – Those interviewed identified a number of specific examples to illustrate how poor or inconsistent policies can create disincentives for agricultural investment. They emphasized that these are not unique to any particular country or region.

Inconsistent policies were often mentioned as a major problem affecting smallholders. Interviewees pointed out cases where governments promote fertilizer use through public investments while at the same time harming the long-term sustainability of crop output markets with sudden policy shifts. For instance, a country may impose food crop export bans when poor rains cause concern about food security. Depending on the country and conditions, such a sudden policy shift may have a cascade of unintended effects: an export ban may result in a suppression of output prices; this in turn may render fertilizer use on food crops insufficiently profitable; and, if these policy shifts cause smallholder farmers to retreat from commercial production and the use of commercial inputs such as fertilizer, this creates uncertainty for the network of rural agricultural input traders.

**Land Rights and Land Tenure** – Interviewees also referred to the lack of clear land ownership and land rights as important policy issues affecting smallholders. Many of those interviewed emphasized the importance of land rights and land ownership as a factor that influences investments in agriculture. Lack of clear land rights may have a range of negative impacts on smallholder farmer productivity and incomes. For instance, it may be more difficult to access credit and farmers may not want to make investments due to the risk of being removed from the land. In some cases, agricultural laborers or sharecroppers may feel that they have less or no stake in the outcome of their crop management. Therefore, they may manage crops less carefully and obtain lower yields.

**Food Safety and Quality Standards** – While interviewees underscored that addressing counterproductive agricultural policies could significantly contribute to improving the livelihoods of smallholders, several also provided examples of policies that create incentives for innovation and investment in agriculture. They noted, for instance, that there has been tremendous expansion of technical regulations and standards related to food safety, animal and plant health, and quality-related attributes. Although there are concerns that these regulations and standards create barriers for smallholder farmers, some interviewees mentioned examples of projects that actually created incentives for smallholder farmers to adopt good agricultural practices, improve the implementation of food safety regulations, and participate in strengthened food safety monitoring systems. In Jilin, China, for instance, a program to build capacity for implementation of food safety regulation and standards resulted in a de facto extension system as a result of improved communication between farmers and agricultural and food safety advisors/supervisors, and better infrastructure for monitoring and testing.
Policy Support from Other Sectors – In addition to the examples described above, interviewees who mentioned public policy gaps also mentioned a broad range of additional policy dimensions of issues that create limitations for smallholder farmers. For instance, they mentioned that policies are needed to improve farmers’ access to education, which will improve smallholder farmer capacity, their understanding of technology, and creates opportunities for current and future generations to generate income outside agriculture. Policies are required to encourage investment in infrastructure, including roads, storage, and processing plants. Some interviewees mentioned that human rights need to be better protected, including labor laws to prevent forced labor, and access to justice to ensure enforcement of land rights. Intellectual property rights continue to play a role in access to technology, although few interviewees mentioned this as a big barrier. Subsidies, levies, and other barriers to trade continue to affect global commodity prices and the ability of smallholder farmers to participate in formal markets.

Pan African Policy Efforts – In Africa, interviewees noted the significant progress through the CAADP framework in developing agricultural development plans and investment plans. However, several interviewees expressed interest in seeing greater action to implement these plans. They identified a number of possible gaps, including: the need for context-specific information to inform policies or other measures that would contribute to outcomes described in the investment plans; the need to strengthen capacity to monitor as well as policy development and implementation; and the need to strengthen capacity among public interest groups and stakeholders to advocate for policy implementation. Several interviewees suggested that grounded multi-stakeholder conversations about national and regional food system goals and opportunities within the CAADP process would be useful to help catalyze and guide implementation.

Policy Analysis – Even where there is a more favorable policy environment, the gap between policy and implementation remains significant. Several interviewees identified a need to support policy-makers in developing policies that are informed by sound science, good data, and grounded in the political and economic realities of the country and larger market forces. Policy analysis is challenging because it has to be context-specific and results can often not be generalized. Several interviewees signaled a real need to expand and strengthen policy analysis capacity in developing countries.

Policy analysis is among a range of tools that can be used to better inform policy. Some interviewees suggested that systems for monitoring and evaluating the impact of agricultural policies are critical. Private sector interviewees described engagement with government policy-makers to help them use market research and analysis to better understand potential agricultural markets (global and regional) they could target for improved market access by farmers in their countries. One interviewee described that differences in how government and private sector policy-makers make decisions doesn’t necessarily mean that government policy-makers will act upon sound market information. They may need to take other public and political interests into account.

Advocacy – Civil society and advocacy organizations can play an important role in enhancing transparency and accountability for policy change, as often occurs in more developed economies. However, in many developing countries, there is a lack of capacity to track and advocate effectively for sound policy. A number of interviewees referenced the important role of Bill and Melinda Gates and others as advocates with heads of state for policy reform and encouraged their continued advocacy for policy coherence and policy change, as appropriate.
Concluding Comments

This report draws upon the insight and experiences of a strong set of knowledgeable individuals from around the world. It is based on in-depth and interactive interviews (not surveys) with 82 people from very different walks of life, areas of experience and expertise, and organizational backgrounds and affiliations. Their reflections provide a nuanced image of the short- and long-term innovation gaps that are critical to enhancing the lives and livelihoods of millions of smallholder farmers in developing countries. These were not academic or theoretical conversations but were rich discussions that drew upon thoughtfully prepared and fully engaged individuals speaking freely without attribution.

It is noteworthy that some interviewees are already known as innovators in business, science, or public policy but new in their careers and recognized as bringing fresh perspectives. This is the new generation of thought leaders. Others have long-established careers many of which span decades working at the local level “in the field” (in science, business, or policy) to significant responsibilities at the national and international levels. Certainly, this group of 82 is nowhere near a complete list of thoughtful actors relevant to the world of agriculture, food systems, and efforts to help improve the lives of smallholders. Nevertheless, it is a robust and diverse set, with experiences and perspectives that justifies a close read and reflection on the innovation gaps identified and discussed.

One of the goals of this effort was to uncover an as objective as possible assessment of critical innovation gaps from an informed point of view. That is, a perspective on current reality. As the research team for this effort, our guess is that very few of the issues identified will surprise those active in this area of work – that the innovation gaps will be well recognized and understood. What might make this interesting and worthy of note is the level of convergence the team found among the innovation gaps identified. And, we think it is important to recognize that current systems of innovation do not reflect the shared understanding of these gaps. Much work has to be done to adjust, enhance, or reform existing systems or create new systems where they are lacking. Also of note, the interdependent nature of many of the gaps is such that not taking action may suppress progress or result in negative implications across the entire system, and conversely, taking action could achieve enhanced and integrated solutions and progress.

We think this report will be most helpful to those who are looking for a description of the broad landscape of innovation gaps and opportunities for smallholder farmers.

We believe that for those with missions focused on improving productivity and the lives and farming systems of smallholders, this report and a compilation of themes and issues would benefit from a landscape analysis by donors at a minimum – philanthropies, bilateral and multilateral, private sector foundations – to better understand where current investment priorities lie vis-à-vis these gaps, where there may be complementary opportunities, and perhaps where there is great need for attention and action.
Appendix A – Guiding Interview Questions

Meridian Institute used the following questions to guide the interviews. These questions were useful to initiate discussions, and Meridian staff used follow-up questions to understand each interviewee’s views in detail.

1. What are the gaps that are limiting smallholder farmer productivity (improvements in lives and livelihoods)?
2. What are the types of innovations needed to address these gaps and how should global players who care about smallholders (Gates being one of many) rework R&D/delivery/market access/etc. “systems” to better deliver what smallholders need to be successful (producers)?
3. Are there illustrative examples of successes or failures? Why did they succeed (or fail)?
4. Do you have thoughts in particular about any of the following (as time permits):
   - Formal Institutions (national programs, international centers, multilateral institutions, the private sector, research centers, bilateral donor partners, and NGOs)
   - Informal organizations and systems (NGOs, cooperatives, etc.)
   - Science & technology (biotech, digital solutions, ICT, etc.)
   - Markets (formal, informal, local, regional, and international)
   - Systems to support technology dissemination and adoption
   - Policies, regulations, and laws (international, regional, national)
   - Grades and standards and their enforcement
   - Ongoing need for global public goods
   - International trade policies and negotiations
   - Large-scale infrastructure investments

In addition, Meridian sent interviewees the following questions that were also of interest to staff of the Bill & Melinda Gates Foundation.

1. Based on your experience, when you consider the current needs of developing world smallholder farmers, what are the biggest gaps currently and how do you anticipate these changing over time? What is impeding smallholder farmers from living healthy and productive lives? Are there innovations (practices, information, technologies) that can help address these gaps? [An innovation can be lots of different things: well-timed and/or trusted information, a policy change, seed and grain storage, quality control (including improved grading, standards, and/or testing, access to inputs (fertilizer, improved seed, credit, irrigation), transport, financing, services, a predictable market for surplus, etc.) If so, what are the most significant types/categories of innovations that are needed? Can you share an example of an innovation that reached farmers and had an impact? What is it, when and how was it introduced, and why do you feel it was (and still is) successful?
2. Conversely, can you think of a great innovation or idea that did not reach or was not adopted by farmers? What was it, and why did it fail?
3. What do these successes and failures tell us about what is working/not working in today’s systems and institutions?
4. If you think about how smallholder needs may change over the next 20 years, what are the key characteristics of organizations or innovations that can deliver productivity and livelihood improvements. Can current systems and institutions, or some version thereof, deliver those characteristics? If not, what might new approaches look like? [We are interested in discussing WHAT is done as much as WHO does it and recognize that innovation may also come from outside the agricultural sector.]
5. What role, if any, should the following elements play in fostering new innovation?
   - Formal Institutions (national programs, international centers, multilateral institutions, the private sector, research centers, bilateral donor partners, and NGOs)
   - Informal organizations and systems (NGOs, cooperatives, etc.)
   - Science & technology (biotech, digital solutions, ICT, etc.)
   - Markets (formal, informal, local, regional, and international)
   - Systems to support technology dissemination and adoption
   - Policies, regulations, and laws (international, regional, national)
   - Grades and standards and their enforcement
   - Ongoing need for global public goods
   - International trade policies and negotiations
   - Large-scale infrastructure investments
Appendix B – Interviewee List

The individuals listed below agreed to be interviewed in their individual capacity and the results would be shared without personal attribution. They shared their personal views and did not speak officially for their organizations. Titles, affiliations, and locations are included to show the depth and diversity of experience reflected in the report.

**Tara Acharya**
Senior Director, Corporate R&D
PepsiCo
United States

**Akinwumi Adesina**
Honourable Minister of Agriculture and Rural Development
Federal Ministry of Agriculture and Rural Development
Garki Abuja
Nigeria

**Richie Ahuja**
Regional Director, Asia
Environmental Defense Fund
United States

**Irene Annor-Frempong**
Director, Capacity Strengthening Forum for Agricultural Research in Africa (FARA)
Ghana

**Jim Baker**
Director, Global Carbon Measurement Program
The William J. Clinton Foundation
United States

**Chris Brett**
Senior Vice President and Global Head Corporate Responsibility and Sustainability
Olam International
United Kingdom

**Virginia Cardenas**
Professor
University of the Philippines Los Baños
The Philippines

**Edward Carubis**
Principal Consultant and Senior Program Manager; and
**Peter Eredics**
Forestry Solutions Manager
ESRI
United States

**Marty Chen**
Lecturer in Public Policy
Harvard Kennedy School; and
International Coordinator
WIEGO (Women in Informal Employment: Globalizing and Organizing)
United States

**Kevin Cleaver**
Associate Vice-President
International Fund for Agriculture Development (IFAD)
Italy

**Chris Cochran**
Manager, Sustainability
Walmart
United States

**Sir Gordon Conway**
KCMG, HonFREng, FRSE Professor of International Development
Imperial College London
United Kingdom

**Malavika Dadlani**
Joint Director, Research
Indian Agricultural Research Institute
India

**Eric Danquah**
Professor
University of Ghana; and
Director
West Africa Centre for Crop Improvement
Ghana

**David Edelstein**
Director of the Grameen Foundation Technology Center
Senior Vice President, Global Programs
Grameen Foundation
United States

**Javier Ekboir**
Coordinator
Institutional Learning and Change (ILAC)
Italy

**Saleem Esmail**
CEO and Breeder
Western Seed Company
Kenya

**Ilana Faber**
Independent Consultant
United States

**Dick Flavell**
Chief Scientific Advisor
CERES
United States

**Stephen Goff**
Project Director
iPlant Collaborative
United States

**Daniel Gustafson**
Deputy Director – General Operations
Food and Agriculture Organization of the United Nations (FAO)
Italy

**Michael Hermann**
Global Coordinator
Crops for the Future
Malaysia
Moses Musaazi  
Head of the Department of Electrical Engineering  
Makerere University  
Uganda

Charles Mutagwaba  
Immediate Past Registrar and CEO (retired)  
Tanzania Dairy Board  
Tanzania

Luciano Nass  
Knowledge Exchange Coordinator Secretariat for International Affairs  
Embrapa  
Brazil

Trevor Nicholls  
CEO  
CAB International  
United Kingdom

Aboubakar Njoya  
Director of Programmes  
CORAF/WECARD  
Senegal

Ruth Oniang’o  
Executive Director and Founder  
Rural Outreach Program  
Kenya

Walter Oyhantcabal  
Policy Advisor to Minister of Livestock, Agriculture and Fisheries and Group Director of Climate Change, and Country Negotiator in UNFCCC  
Government of Uruguay  
Uruguay

S. Parasuraman  
Director  
Tata Institute of Social Sciences  
India

Sanjiv Phansalkar  
Program Leader  
Sir Dorabji Tata Trust  
India

Frank Rijsberman  
CEO  
CGIAR Consortium  
France

Amitabha Sadangi  
CEO  
International Development Enterprises (IDE)  
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Beth Sauerhaft  
Senior Director, Global Environmental Sustainability  
PepsiCo  
United States

Eva Schiffer  
Leadership and Governance  
World Bank Institute  
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Idah Sithole-Niang  
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Ishmael Sunga  
CEO and Board Secretary  
Southern African Confederation of Agricultural Unions (SACAU)  
South Africa

Gary Toenniessen  
Managing Director  
Rockefeller Foundation  
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Alan Tollervey  
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Ann Tutwiler  
Special Representative of the Director General to the UN and the World Economic Forum  
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Juergen Voegele  
Director, Agriculture and Rural Development Department  
The World Bank  
United States

Jonathan Wadsworth  
Executive Secretary of the CGIAR Fund Council and Head of Fund  
CGIAR Fund  
United States

Sophie Walker  
Regional Africa Advisor, COP AlfaSTOP  
ACDI/VOCA  
Kenya

Ann Waters-Bayer  
Chair  
AGRECOL Association for AgriCulture and Ecology  
Germany; and  
Agricultural Sociologist  
ETC Ecoculture  
The Netherlands

Tim Wheeler  
Deputy Chief Scientific Advisor  
Department for International Development (DFID)  
United Kingdom

Andrew Youn  
Founder  
One Acre Fund  
Kenya

Robert Zeigler  
Director General and CEO  
International Rice Research Institute (IRRI)  
The Philippines
Meridian Institute is a not-for-profit organization whose mission is to help people solve problems, make informed decisions, and find solutions to some of society's most complex and controversial issues. Meridian's mission is accomplished through applying collaborative problem-solving approaches including facilitation, mediation, and other strategic consultation services. Meridian works at the local, national, and international levels and focuses on a wide range of issues related to natural resources and environment, science and technology, agriculture and food security, sustainability, global stability, and health. For more information, please visit www.merid.org.