



# AGRICULTURAL TECHNOLOGY ADOPTION & FOOD SECURITY IN AFRICA EVIDENCE SUMMIT

EVENT BRIEF

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## TECHNOLOGY AND AGRICULTURAL PRODUCTION IN AFRICA

### **Derek Byerlee (SPIA)**

This lecture was intended to be an overview of the relationship between technology and agricultural productivity, setting the tone for the Evidence Summit. In the lecture, Byerlee spoke about how little evidence there is of a productivity take-off, and that the scale of technology adoption is often quite small and localized. Byerlee noted that it is important that efforts are not solely focused on food staple technologies or on yields. Rather, Byerlee said, the focus should be on labor productivity, like labor saving mechanization, and a diversity of conditions and technologies. Furthermore, Byerlee said that investments should be made in generating more and better technologies along with enabling policies and institutions for promoting adoption. These types of technologies, according to Byerlee, hold the potential for socio-economic transformation of Africa's agricultural sector.

## BARRIERS AND CONSTRAINTS TO AGRICULTURE TECHNOLOGY ADOPTION IN AFRICA

### **Chris Udry (Yale)**

This lecture revisited the question at hand, "Why has agricultural technology adoption and diffusion in Africa lagged behind that of other areas in the developing world?" The lecture served as a lead-in to the panels of the Summit, explaining that presenters would propose a new path for accelerating adoption and diffusion of technologies. In the lecture, Udry used the example of organic and inorganic fertilizer to illustrate ten barriers and constraints of agriculture technology adoption in Africa. The barriers include:

1. Risk
2. Lack of complementary inputs/systems
3. Social/cultural constraints
4. Weak supporting markets
5. Poor information/training
6. Dilluted yield/profit shared among many people
7. Lag of yield/profits distributed across time
8. Negative spillovers
9. Variability due to microclimate/agro-ecological characteristics
10. Lack of cooperation

## PROFITABLE AGRICULTURAL TECHNOLOGIES: EVIDENCE FROM THE FIELD

The purpose of this first panel was the presentation and discussion of selected technologies with demonstrated impacts on increased productivity and income among African farmers.

### **Michael Kremer (Harvard)**

Michael Kremer presented on fertilizer technologies implemented in Kenya. Kremer began by explaining the two views on fertilizer: the agricultural expert view and the "Chicago view". According to Kremer, the agricultural expert view contends that fertilizer is critical to productivity and that many developing-country policymakers see heavy fertilizer subsidies as critical to raising agricultural productivity. Alternately, Kremer noted, the "Chicago view" contends that farmers are rational and profit maximizing, that the

conditions on test plots are not realistic, and that the overuse of subsidies induces serious distortions. The Chicago view has long been dominant in causing the rollback of fertilizer subsidies, however, as Kremer noted, there has been a resurgence of the agricultural expert view. Kremer then explained that in the Kenya study area, only 20-40% of farmers used fertilizer in any given season and although the farmers said they wanted to use fertilizer, they lacked the money to purchase it. Kremer presented two technologies tested in Kenya: SAFI fertilizer and the “BlueSpoon,” a kitchen measuring spoon—painted blue—that helps farmers use the optimal fertilizer quantity of half a teaspoon per planting hole. Kremer explained that the experiment also encouraged farmers to share agricultural practices in cooperative meetings, thus reducing the cost of communication. The evidence from Kenya, according to Kremer, suggests that

- small, time-limited discounts are better than large persistent subsidies,
- the cost of holding meetings is very small (an alternative is radio announcements), and
- by sharing knowledge at community meetings, adoption will spread.

### **Shawn Cole (Harvard Business School)**

Shawn Cole presented on innovative financial products and services, specifically indexed insurance. His presentation included evidence from India on microinsurance (rainfall insurance) and household risk management. Cole explained that when returns are properly adjusted for risk, index insurance is (or can be) a profitable agricultural investment. Additionally, Cole noted that index insurance may also facilitate other profitable investments, in particular those whose returns co-vary with rainfall. Cole reported that research conducted in India confirmed the hypothesis that farmers are less likely to invest in cash crops due to rainfall risk. This shows, according to Cole, that rainfall insurance increases small farmer investment in cash crops. Cole listed three research questions for the field experiment conducted in India that are important in determining the profitability of new technologies and innovations:

1. What key frictions/factors constrain widespread adoption of this type of index insurance product?
2. How does insurance affect household decision-making and risk-taking (investment, crop mix, etc.)?
3. How well does the insurance help smooth consumption ex-post after a bad outcome (i.e. a severe drought)? Does formal insurance crowd out informal risk-sharing?

### **Dan Gilligan (IFPRI)**

Dan Gilligan presented on measuring the nutritional impacts of biofortified sweet potato in Mozambique and Uganda. He presented evaluation findings for a project to disseminate provitamin-A-rich orange-fleshed sweet potatoes (OFSP) to reduce vitamin-A deficiency, specifically the scope of OFSP adoption, the share of planted SP area, the impact on dietary intake of vitamin A, and the role of social networks in OFSP adoption/diffusion. Gilligan also discussed the implications for cost effectiveness and scaling up. According to Gilligan, the project was successful in promoting OFSP in Mozambique and Uganda; it also increased the share of OFSP cultivated in sweet potato areas, and many households substituted OFSPs for white or yellow SP. Gilligan said that the project successfully increased vitamin A intake of young children. Additionally, Gilligan noted that social networks played an important role in diffusion of the OFSP technology beyond treated households, as neighbors of treated farmer group members were 23% more likely to adopt OFSP if there was at least one treated farmer in their social network.

### **Bekele Shiferaw (CGIAR) on behalf of Marianne Banziger (CIMMYT)**

Bekele Shiferaw presented on behalf of Marianne Banziger on the evidence that is necessary in determining the profitability and adoptability of new technologies. Although there is some evidence on the profitability of maize and other crop varieties in Africa, Shiferaw noted that there is a need for a broader view of profitability, looking specifically at ‘adoptability’. According to Shiferaw, reliable evidence needs to

be generated on the profitability and adoptability of agricultural technologies, as well as the constraints upon adoption. The current challenges in estimating profitability of new technologies, reported Shiferaw, are that yield and cost estimation are dependent on cross-sectional small sample and recall surveys; there is no actual measurement of land area, yield, and input use; there is poor representation; and the data on risk and inter-seasonal yield variation is poor. Shiferaw presented some solutions that have been suggested: panel surveys with repeated visits; actual measurement of land area, yield, and key inputs (e.g. fertilizer); representative sampling to capture variation in agroecology, markets, etc.; and capturing the effect of weather and growing conditions. Shiferaw also presented ideas for generating reliable evidence on the adoption constraints for new technologies such as conducting regional on-farm trials for promising varieties, and conducting technology adoption and impact studies.

## PROMISING AGRICULTURAL TECHNOLOGIES: WHAT EVIDENCE DO WE NEED ON THE PROFITABILITY OF NEW TECHNOLOGIES?

The second panel presentation and discussion focused on how to generate more evidence on the profitability of new technologies. It also addressed the question of what evidence is necessary for decision-making, as well as the issue of how the heterogeneity of local agro-ecologies can be incorporated into decision-making.

### **Rachel Glennerster (J-PAL)**

Rachel Glennerster introduced the topic of the panel and the panelists. She mentioned what each of the panelists would be presenting on, and how these presentations not only linked together under the topic of evidence need for the profitability of new technologies but also their importance in the larger topic of agricultural technology adoption in Africa.

### **Florence Kondylis (World Bank)**

Florence Kondylis presented on The World Bank's AADAPT Project—a network of policymakers and researchers that works with operations at scale using country systems, covers a wide range of themes, and mobilizes large numbers of stakeholders who have adopted evidence-based policymaking. According to Kondylis, the project has an open platform for partners to join in. Kondylis said that AADAPT can also mobilize governments on key development issues/innovations because it has convening power, it is present on the ground, and it provides a bridge between research and policy. Additionally, Kondylis said, in working to design, implement, and test alternative interventions to narrow the gender gap, the AADAPT project covers the thematic areas of access to better technologies, rural infrastructure management, access to land, access to markets, rural livelihoods, and local governance. Kondylis also talked about the multiplier effect of AADAPT on the gender experience: designing and testing strategies, and scaling up what works for men and women, allows for higher gender inclusion in Development Impact Evaluation (DIME)-supported projects like AADAPT.

### **Jeffrey Ried (Gates Foundation)**

Jeffrey Ried presented on the role that evidence on the profitability of new technologies plays in the decisions of donors. Ried explained that the Gates Foundation's work is guided by a few core principles:

- Farming is a way to address both hunger and poverty
- Put small farmers—most of whom are women—at the center of efforts
- Focus on crops and livestock of greatest need
- Focus relentlessly on results
- Build strong partnerships

- Work across the full agricultural value chain

According to Ried, the Gates Foundation follows a process of

1. **Understanding** the problem; understanding success – *From vagueness to a common perspective*
2. **Discovering** potential solutions – *From no or few options to many options*
3. **Identifying** solutions with the right characteristics – *From many options to rational selection*
4. **Interacting** between components – *From simple understanding to understanding complexity*
5. **Simplifying** the solution – *From complexity to predictable outcomes*
6. **Replicating** the solution – *From predictable outcomes to building success*

### **Bekele Shiferaw (CGIAR)**

Bekele Shiferaw presented on the evidence needed for determining the profitability of new technologies; he emphasized the importance of reliable evidence generation. Shiferaw noted the current challenges in estimating new technology profitability which include: small sample sizes for cross-sectional and recall surveys; no actual measurement of land area, yield, and input use; poor representation of agro-ecology, markets, etc.; and poor data on risk and inter-seasonal yield variation. To more accurately estimate profitability, Shiferaw explained that panel surveys and repeated visits need to be utilized, actual measurements need to be taken, the sampling must be representative, and data should be recorded on the effects of weather and growing conditions on the variation. Additionally, adoptability is not simply dependent on profitability, but rather it is a function of market value plus other factors valued by farmers. Other non-market traits noted by Shiferaw as important in determining profitability and adoptability include: risk (stress tolerance and stability of yield); taste and nutrition; grain color; storage pests and storability; value of stover for feeding livestock; and soil fertility restoration (e.g. legumes). Responding to the question of how to generate reliable evidence on the profitability of new technologies, Shiferaw proposed the implementation of regional on-farm trials for promising varieties. Shiferaw explained that with a randomized control trial design—using local varieties as checks, testing representative systems, and taking actual measurements of yields, crop area, and inputs—we can generate more reliable evidence of profitability. In instances where technology has already been adopted, Shiferaw suggested collecting panel data (at the plot, household, and village levels) by using regional on-farm trials, and gathering a representative sample on a much larger scale.

## **GENDER AND AGRICULTURAL TECHNOLOGY ADOPTION**

The third panel focused on the role of women within African agricultural systems, discussing the role of gender in technology adoption and diffusion.

### **Nava Ashraf (Harvard Business School)**

Nava Ashraf gave an overview of the role of women within African agricultural systems. Ashraf noted the disparity between women's responsibility for food production and actual female ownership of land, women's lack of access to resources as inhibiting efficiency, and the lack of female authority in household agricultural decisions. Ashraf used the example of contraception adoption to illustrate the interaction between information and technology adoption in the household and how it can result in female empowerment. Ashraf also touched on the topic of microfinance and savings also playing a role in the empowerment of women.

### **Barbara Bamanya (AGRA)**

Barbara Bamanya presented on the access to information and inputs of women in African agricultural systems. Bamanya talked about the unlevel field for women farmers, uneven incentives, and gaps in development assistance to women farmers. Bamanya noted that women farmers have smaller plots of land than men, they are less likely to use advanced technologies, they are less likely to purchase inputs (e.g. fertilizers), there is less incentive for them to invest in soil fertility, and they may obtain less output than men. According to Bamanya, there are several things to be done in order for circumstances to improve for women farmers in Africa:

1. Improve access to resources (land, fertilizers, improved seeds, extension and financial services)
2. Improve incentives – put the income into women’s hands
3. Advocate for increased investments in women and smallholder farmers
4. Conduct better baseline surveys of households and communities before introducing new technologies to help predict how they may be affected
5. Address both gender-specific bottlenecks and gender neutral obstacles incurred during the provision of extension services
6. Consider the local cultural norms that influence the male-female interaction
7. Schedule extension services that take into consideration women’s childcare and housework schedules

### **Cheryl Doss (Yale)**

Cheryl Doss presented on the issue of land rights, women’s access to assets, and technology adoption. She presented two sets of issues with technology adoption. The first issue Doss presented was that of adoption: Who adopts? How do we promote good technology and its adoption? The second was about the effects of technology adoption: How do we make sure that new technologies do not leave groups worse off? It is possible that they may not adopt the technology and additionally may lose access to resources. A theme interwoven into the two issues presented by Doss was how these issues differ for men and women. Doss reported that in Ghana, interviews conducted of maize farmers revealed that fewer women than men adopted improved technologies (seed and fertilizer). Doss noted that although women have claims to land and are reported as owners, they have fewer rights over this land (rights to sell, bequeath, or rent), are less likely to have their names on ownership documents, and are more vulnerable to losing their claims to land if the household dissolves. Doss then explained the importance of collecting more data on the individual level rather than the household level, as well as the need for more information on women’s claims to land in order to predict and evaluate impacts of new technologies.

### **Emily Hogue (USAID)**

Emily Hogue presented on a tool for measuring women’s empowerment, the Women’s Empowerment in Agriculture Index. According to Hogue, the index will be ready to launch by early 2012, with performance monitoring in all Feed the Future countries for impact evaluation. Hogue explained that the first-level objective of Feed the Future is inclusive agricultural sector growth; “inclusion” then means “empowered.” Hogue explained that because empowerment is a multi-dimensional concept, the tool measures several dimensions. Hogue listed the five domains to be measured by the index:

1. Women’s role in household decision-making related to agricultural production
2. Women’s access to productive capital, such as credit or land
3. The adequacy of a woman’s income to feed her family an adequate diet
4. Women’s access to leadership roles within the community
5. Women’s and men’s labor time allocations

## STRATEGIES FOR INCREASING ADOPTION OF PROFITABLE AGRICULTURAL TECHNOLOGY: RISKS, SAVINGS, AND FINANCE

The fourth panel discussed evidence on the role of financial services access in technology adoption and diffusion.

### **Michael Carter (UC Davis)**

Michael Carter presented on the use of savings, credit, and insurance to bridge yield and income gaps of small farms. His presentation included ideas and evidence from Mozambique, Ethiopia, and Mali. Yield and family income gaps remain a predominant feature of the small farm landscape. Carter spoke about index insurance in the adoption of agricultural technologies, using evidence from the BASIS program in Mozambique. Carter noted that index insurance does not make payouts based on specific individual losses. Rather, payouts are made when a triggering event, which is correlated with losses, occurs. These triggers, according to Carter, include: (1) average yields falling below 80% of the long-term average, (2) satellite images showing poor vegetation growth and/or predicting crop (or livestock) losses below the critical level, and (3) rainfall patterns indicating significant decline in crop yields. According to Carter, index insurance preserves effort incentives as 'delinquent' behavior does not increase the likelihood of insurance payoff, additionally an adverse selection does not matter as the likelihood of payouts is not influenced by the riskiness of those who buy. Carter also spoke about securing finance for technology adoption in Ethiopia, and moving forward from protection to growth in Mali. While it is very important to invest in new agricultural technologies, Carter explained that it is crucial to find ways to realize the underutilized potential of already existing agricultural technologies.

### **Xavier Giné (World Bank)**

Xavier Giné presented on the commitment to savings, specifically a field experiment from rural Malawi. According to Giné, the motivation for commitment savings is that the returns to saving and investment are high in many developing countries. Giné gave the example of sub-Saharan Africa where fertilizer is one of the highest-return and most under-exploited investment opportunities for smallholder farmers. The hope, Giné said, is that by insuring farmers against adverse events through rural finance, farm output will increase. Giné explained that insurance against adverse events includes: (1) providing insurance against poor rainfall, (2) facilitating credit for agricultural inputs, (3) improving repayment via biometric identification, (4) encouraging farmers to save for their own input purchases, and (5) facilitating access to ordinary and "commitment" savings accounts. Giné noted that although in practice commitment savings allow customers to put funds into a special account where their access is restricted for a defined period (and customers can choose the "release date" of funds), these households are then less able to respond to shocks. Giné added that it is unknown what the net impact of commitment facilities is on household well-being. Giné explained that findings from Malawi were that the offer of commitment savings accounts has substantial impacts on both savings prior to the next planting season and key outcomes in and after the next season (agricultural inputs applied, crop output, household expenditures). According to Giné, in the Malawi experiment, commitment savings offered positive implications for welfare impact, since households had funds available to cope with shocks. Giné ended by explaining that the demand for commitment may actually stem from a desire to shield funds from one's social network.

### **Michael Kremer (Harvard)**

Michael Kremer presented on the topic of collateralized loans. Kremer spoke about new credit approaches to encourage technology adoption, specifically in the case of rainwater harvesting in Kenya.

The study Kremer cited was undertaken near Nyahururu, in the Central and Rift Valley provinces of Kenya focusing on rainwater harvesting and its economic benefits on the dairy industry. Kremer noted that the dairy industry accounts for 3.6 percent of GDP in Kenya and involves about 1 million small scale farmers. Fifty six percent of milk is produced by small holders with one to three cows. Kremer then explained the benefits of tanks and rainwater harvesting, noting that they are important for both cows and people, and that they save time—especially for women. Additionally, Kremer said that water tanks make good collateral because they are extremely large and hard to move or hide, they are only useful to people at their homes, and they are very durable with a good second-hand market. Kremer also noted that with support from the financial sector—working closely with banks to improve financial access—deepening, Heifer International is scaling the Nyala dairy cooperative model across East Africa. Kremer concluded that technology is in extremely high demand, but it is very expensive, and while farmers do seem to be credit constrained, they have a strong preference for collateral that is not social (i.e. not through guarantors). This preference for non-social collateral, Krmer reports, points to the potential for collateralized loans within the arena of technology adoption.

## WORKING GROUP I: EVIDENCE

The first working group was centered on the topic of evidence; participants discussed new and ongoing programs of USAID mission staff and other practitioners in the group, and identified specific technology adoption (or profitability) challenges in the field including key questions that needed to be answered.

## STRATEGIES FOR INCREASING ADOPTION OF PROFITABLE AGRICULTURAL TECHNOLOGY: ROLE OF POLICIES, INSTITUTIONS, SOCIAL NETWORKS, AND INFRASTRUCTURE

The fifth panel discussed evidence of various policy, institutional, and community-based strategies for increasing the rate of technology adoption and diffusion in Africa. Evidence was drawn from both the public and private sectors.

### **Mywish Maredia (Michigan State University)**

Mywish Maredia presented on technology supply vs. effective demand, the facts, and reality. Maredia noted that in many African countries, the increasing supply of new technologies meets decreasing acceptance by producers, and the growing evidence of profitable returns to research investments is increasingly countered by studies that show that technologies are not profitable to end users. Maredia also noted that in recent years, as a result of the growing donor pressures to demonstrate impacts of agricultural research, several studies have been conducted to document impacts and estimate rates of return (ROR) for research investment in Africa, and with the exception of a few cases, most impact studies report high ROR (above 12%) to agricultural research investments in Africa. However, Maredia said that low effective demand for technology by African farmers implies that a technology developed by the research system does not reach the end users, is not affordable to them, and has not proven profitable for them. The influences on “expected profitability” of technology, Maredia said, are the uncertainty of variables that determine the profitability outcome (e.g. input and output prices), and the probability that the technology will yield a minimum level of net revenue. Both technological considerations (e.g., performance and adaptability of technology) and non-technological considerations (institutions, policies, infrastructure, social networks, etc.) play important roles in the realization of profits

and the decision to adopt or not to adopt a technology. MareDia concluded that improved policies, infrastructure, and institutions minimize risks/uncertainty and increase the probability of realizing higher profitability from adopting a technology.

### **Duke Burruss (DAI)**

Duke Burruss presented on market development, supply chains, and private sector linkages. According to Burruss, the relationship drivers to market access, supply chains, and private sector linkages are demand, capacity/scale, mutual benefit/value, mitigating risk, and service/technology. To illustrate how innovations like 'commercial frameworks' that link farmers with private sector partners and associated infrastructure development help in mitigating risk and technology adoption throughout the value chain, Burruss used a case study from Ghana. The Ghana project, Burruss explained, was designed with 3 grower/exporter-operated regional packhouses and a vetting process up front, as well as 10 Agribusiness Centers with firms (active in the value chain) as operators. The project attracted the private sector and leveraged irrigation investment where VegPro (Kenya) co-located and the packhouse equipment loan program attracted Chiquita. Some key success factors Burruss mentioned were: willing stakeholders, a demand driven value chain, viability, land conveyed, shareholders agreements (private sector and smallholders), and good business relationships. In terms of timing, Burruss noted that the commercial framework (the soft side) needs to be in place first for sustainability, and then the works (the hard side) will fall into place.

### **Norman Uphoff (Cornell)**

Norman Uphoff presented on experience with multi-sectoral strategies for disseminating a proven agricultural technology, using the example of the System of Rice Intensification (SRI) in Madagascar. Uphoff explained that leadership in dissemination strategies can come from many different sectors with other sectors then drawn into a collaboration. The sectors Uphoff mentioned include: government agencies, research institutions, NGOs, universities, the private sector, farm/village groups, international institutions, and individuals. According to Uphoff, the dissemination of SRI has been an unusual and unprecedented innovation. SRI is often hard to accept because it does not require any change in the rice variety used or an increase in external inputs. Uphoff explained that SRI methods improve the yields of all rice varieties evaluated so far: modern and traditional, improved and local. Uphoff used the Initiative in Kenya as an example: SRI use expanded from 2 farmers in August 2009 to 264 farmers in March 2011, with growing farmer demand for training; yields were raised from 5-6 tons/ha to 6-8.5 tons/ha; water use was reduced by 25 percent; and the net income/ha of farmers was 28 percent higher. Lastly, Uphoff explained the principles guiding the multi-sectoral approach to technology dissemination which include: more flexible funding, inclusiveness (integrating those who want to work along with the innovation), knowledge of the terrain (who is already working there/what are they doing?), investing in collaboration with government services, identifying complementarity with others, and expecting accountability for results instead of preoccupation with process.

### **Ruth Vargas Hill (IFPRI)**

Ruth Vargas Hill presented on cooperative insurance and informal groups. The presentation included evidence from a field experiment in Ethiopia. Using the example of Ethiopia, Hill explained that risk is prevalent in rural Africa and seems to constrain technology adoption. Because of uninsured weather risk, insurance innovations offer potential, and one such innovation is weather index insurance that pays on the basis of an observable index rather than on losses and individual experiences. According to Hill, by linking insurance payments to an easily observable index, index-based insurance avoids adverse selection and moral hazard problems and has lower administrative costs. However, early field experiments so far have not lived up to expectations as there has been a low demand for insurance likely largely determined by basis risk, particularly for farmers that are risk averse, and basis risk reduces the

quality of the products, making them expensive for what they promise. Hill brought up the question of whether index insurance can be used as a tool to transfer large covariate shocks (like extreme shortfalls in rain) away from groups, and still encourage group members to share smaller agricultural risks among themselves. Hill explained the findings of the study in Ethiopia that introduced individual index-based rainfall insurance in rural Ethiopia, wherein policies were marketed through pre-existing risk-sharing groups (primarily funeral societies called *iddirs*) and selected leaders were trained in general concepts of insurance and the details of the products. In looking at the impact of training allocation on demand within the group, groups with trained leaders were 78 percent more likely to purchase an insurance policy, and the average number of insurance policies purchased per person increased from 0.36 to 0.77. Hill concluded that the study suggests that there is substantial potential for using index insurance to insure groups, especially when groups are cohesive and high-functioning.

## STRATEGIES FOR INCREASING ADOPTION OF PROFITABLE AGRICULTURAL TECHNOLOGY: EXTENSION, TRAINING, AND INFORMATION INNOVATIONS

The sixth panel focused on the role of public and private sectors in extension and discussed the potential of modern approaches to promoting new technologies.

### **Paul Hixson (University of Illinois)**

Paul Hixson spoke briefly about the USAID-funded Modernizing Extension and Advisory Services project (MEAS) and about how effective extension programs work. Hixson explained that effective extension programming begins with effective communication, and that following the communications chain from sender to message to channel to audience and finally to the effect is not a sufficient communication process. According to Hixson, adding feedback from the effect back to the sender is critical and completes the communication cycle, creating a circle of successful communication. Hixson spoke about some of the major lessons learned:

1. It is important to always put audiences (farmers) first: listen to them – discover what they want to do and what they want to learn, discover what gaps exist in their current knowledge, discover their preferred methods of communications, and lastly, discover who they trust.
2. Base all plans and actions as an information provider from the point of view of being a helpful, respectful partner in a 2-way communications process – farmer audiences will sense the difference and respond accordingly.

Hixson concluded that the ICT landscape is changing rapidly and that although new ICT tools may be in use, it is important to still engage in good communication principles.

### **Jeremy Magruder (UC Berkeley)**

Jeremy Magruder presented on an extension experiment, specifically about choosing extension partners. Magruder's presentation addressed the question: Can extension leverage peer learning? Magruder reported that farmers learn about technologies in several ways, including direct trainings and conversations with extension agents, and by learning from peers who have tried new technologies or have at least been trained to use them. It is evident that training one farmer has the potential to influence many, the question to research is at what point this multiplier is the highest. On the issue of integrating networks into extension, Magruder notes that there are two important factors that determine which farmer partners will induce the greatest adoption, however there is little knowledge on them. The two factors Magruder spoke about were: which peers farmers actually learn from, and how the farmers learn.

Magruder presented results from the project in Malawi where social connections were mapped out through a census, then the “best” partners were chosen to work with, and finally adoption with the “best” partners was compared with partners chosen by pre-existing extension methods. The project found that success is a very persuasive factor in adoption, however persuasion is difficult. Magruder touched on the issue of breadth vs. depth, which depends on both technology and context: is the goal to expose many people slightly, or a few at a great intensity? For the future, Magruder spoke about learning whether academic results on social learning (and general intuition) can be leveraged by policy.

### **Paul Roberts (ForgetMeNot)**

Paul Roberts presented on information and communication technologies and whether they will really meet expectations. Roberts reported that basic interactive information messaging is making a difference in some areas. The examples Roberts used include: agricultural market price information via SMS, medical information via mobile phone, and mobile financial services. According to Roberts, Ghana National Association of Farmers and Fisherman (GNAFF) extension officers have been able to share information with farmers through two-way instant communication. Roberts noted that there are real savings in cost and time through the usage of mobile phones for transferring information because at present, many people wanting access to the trove of information found online must use cafes because internet access around Africa is unreliable and expensive. The demand for simple products and services that can potentially make a difference in agricultural communities is huge but Roberts notes two problems: little awareness of alternative products and tools for self-help, and little access to information to be able to make informed decisions. Roberts explained that providing access to the service may be more valuable longer term than the immediate outcomes of the service itself. Additionally, when the end user individual or group takes ownership of the process for interacting, sustainability may be increased. Roberts concluded that the potential exists to merge hands-on, face-to-face interaction with communications technology to reinforce and efficiently enable the diffusion of information and activities that can improve farm incomes.

### **Burton Swanson (ATMA)**

Burt Swanson presented on modernizing extension, specifically transforming extension systems within a rapidly changing global economy. According to Swanson, the key functions of an effective comprehensive agricultural extension system are:

1. Maintaining national food security – transferring technology, especially for staple food crops
2. Improving rural livelihoods – training farmers how to intensify and diversify their farming systems; increasing farm-household income by helping small-scale farmers (both men and women) learn how to produce and market high-value products; and training rural women how to improve family nutrition and use improved family planning, hygiene, and health care practices
3. Process innovation – training farmers how to organize into producer and self-help groups, building social capital
4. Product innovation – training farmers how to use sustainable natural resource management (NRM) practices

Additionally, Swanson said that keys to helping small-scale farmers increase their farm income are: expanding high-value markets, identifying innovative farmers, organizing self-help groups, conducting farmer-to-farmer assessment, training interested farmers, and developing market chains. According to Swanson, public extension should give higher priority to process innovations that will enable small-farm households to increase their household income. Public extension must also give high priority to NRM practices. Swanson explained that to make these institutional changes, public extension systems must become more decentralized, farmer-led, and market-driven, and to make this transformation, strategic

investments in public extension will be needed. Finally, Swanson said that public extension systems must also become financially sustainable (different alternatives are possible).

## WORKING GROUP 2: TECHNOLOGY ASSESSMENTS TOOL

The second working group consisted of a review and discussion of the Technology Assessment Tool. The questions addressed by groups were:

1. Is this tool useful?
2. How would you use it?
3. Does it deal adequately with local context and agro-ecology?

## STRATEGIES FOR INCREASING ADOPTION OF PROFITABLE AGRICULTURAL TECHNOLOGY: INTERVENTIONS FOR WOMEN AND GIRLS

The last panel discussed the evidence on strategies to enhance women's technology adoption and access to information.

### **Markus Goldstein (World Bank)**

Markus Goldstein presented on the disadvantages of women in agriculture and what can be done about gender inequality. Goldstein explained that there are several disadvantages to women that affect their adoption of technology, including: less access to land, uncertain land tenure, less access to fertilizer, less access to labor, less human capital, less access to credit, and less access to extension. Goldstein noted that it is not completely clear whether or not women and men are benefitting equally from technology adoption because most studies do not have enough statistical power to give adequate results.

### **Roger Salway and Andrea Brovold (Compatible Technology International)**

Roger Salway and Andrea Brovold presented on a technology that speeds the work of women and girls. Salway explained that technologies that are affordable use local parts and labor, are manually powered, culturally compatible, and sturdy, are appropriate for the developing world. Technologies that use diesel or electric power, are built for large farms, need maintenance, and are expensive are inappropriate technologies for the developing world. According to Salway, experiments show that CTI Grain Processing Prototypes are extremely effective in eliminating much harvest millet loss; they decrease the harvest millet saved to lost ratio from 42:58 percent to 92:8 percent, but there are challenges to introducing the new technology. The challenges that Salway described include:

- post harvest implications – coming up with a plan for the challenges that farmers face after harvest is necessary
- cultural/social acceptability – training farmers and collaborating with communities

Salway also noted the issue of funding in order for the technology to proceed on its way to adoption. This funding will allow the following order in the lead-up to adoption of the technology: assessment, idea and prototype development, field testing and a pilot program, training development, follow-up and data collection, business model development, establishment of manufacturing/distribution, and finally deployment to development programs.

### **Chris Udry (Yale)**

Chris Udry presented on high value crops as a valuable technology for women and girls. Udry noted that because both adoption choices and welfare outcomes are consequences of household processes, the question of equilibrium is unavoidable, especially with regards to how resources are allocated within the household. Udry then compared the differences between “efficient” and “inefficient” households: “efficient” households are sensible – they don’t waste resources, are compatible with bargaining, have complex power dynamics, have strong implications for adoption, and will use a technology if it makes their household better off as a whole. However, Udry noted, these points do not necessarily imply that a technology that improves the productivity of a women’s activity will make her or her children better off. In inefficient households, women achieve much lower yields and profits on land similar to that of their husbands. In Ghana however technology adoption is dependent on local politics and even profitable technology may not be adopted if resources cannot be allocated efficiently in the household and if market inefficiencies (like land tenure) enter into the household. Udry noted further that efficiency does not necessarily mean gender equality, although the efficient households are more likely to use new technology productively, which may have spillover effects.

## **COST BENEFIT ANALYSIS**

### **Lisa Ortiz (USAID)**

Lisa Ortiz presented on Cost-Benefit Analysis, specifically the logic and process behind economic rates of return (ERRs). In evaluating the investment-worthiness of projects, Ortiz explained the process of calculating an ERR using cost-benefit analysis (CBA). Ortiz compared net present value (NPV) and cost-benefit analysis (CBA) to show the benefits of CBA. To calculate the NPV you must pick a discount rate Ortiz noted, and CBA solves for the discount rate. Ortiz explained that the benefits of CBA are: the inclusion of non-monetary costs (like opportunity cost of time), identification of issues for evaluation and study, and provision of targets against which to measure success. CBA is also an accepted analytical tool among many development agencies and it highlights critical assumptions which allows testing the sensitivity around them. Ortiz also mentioned the downsides: studies show that estimated ERRs are consistently biased upward – what is needed is a system of checks and balances, and an expanding evidence base – a higher ERR doesn’t mean a higher absolute return, and project investments can be lumpy so it is not always easy to move resources from one to the other quickly even if you discover that one has a much higher ERR.

## **INVESTMENTS IN TECHNOLOGY WITHIN THE GLOBAL HUNGER AND FOOD SECURITY INITIATIVE**

### **Rob Bertram (USAID)**

Rob Bertram presented on Investments in Technology within the Global Hunger and Food Security Initiative. Bertram explained that from the research side of USAID, the focus is on public investments around technology, and specifically for component technologies, points of entry into systems, context, policy, market access, and resource allocation (at the household and other levels). Additionally, Bertram noted that absent a favorable policy environment, technology is greatly constrained. Bertram then spoke about Feed the Future (FTF), a growth-led initiative aimed at increasing the productive use of resources in ways that target poverty reduction and nutrition impacts. Specifically, FTF promotes climate change resilience, environmental sustainability, gender equity, and inclusive productivity gains that drive growth.

FTF also emphasizes the importance of reducing risks for investments in technology or inputs so smallholders will have a more favorable environment to get a better return on land capital. Bertram explained that gender is a significant aspect of the initiative due to women's importance as economic actors and managers of household resources. This year, according to Bertram, ten percent of FTF funds will be targeted towards R&D at the global level, investing in technologies and policies not targeted by others, and making up for market failures. In the FTF Research Strategy, developed jointly with the USDA, there are three main themes:

- 1) Advancing the productivity frontier
- 2) Enhancing nutrition and food safety outcomes
- 3) Sustainable intensification of key systems

USAID will be especially focused on the third issue: sustainable intensification. Other critical considerations that will affect research outcomes include country leadership and localization, mechanization, public/private interplay, organic growth, impact, and scalability.

## WORKING GROUP 3: HOW SHOULD USAID INTEGRATE TECHNOLOGY INTO THE FEED-THE-FUTURE INITIATIVE?

In this working group, participants discussed the challenges faced by USAID missions and best practices in identifying promising technologies, and reviewed strategies for adoption and how to integrate them into evidence-based programming.

*The Agricultural Technology Adoption and Food Security in Africa Evidence Summit Event Brief* prepared by

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