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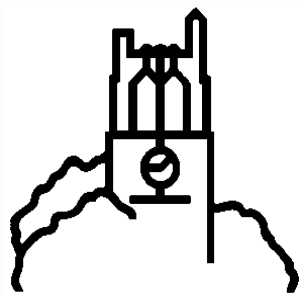
Extension Options for Better Livelihoods and Poverty Reduction: A Selected Review 2012–2015

by

Kristin Davis, Steven Franzel, and David J. Spielman



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EXECUTIVE SUMMARY

The context in which extension operates has changed dramatically in recent decades. As a result, there is a renewed interest in extension and an interest in changing traditional approaches to extension. With that renewed interest comes demand for information and analysis.

The overall goal of this report is to provide up-to-date information on key topics related to extension knowledge and perspectives and to enable decision makers to identify areas where (1) further evidence on extension through commissioned research is needed, and (2) extension investment practices should be reconsidered.

The authors do so with in-depth sections on farmer-to-farmer extension (F2FE) and the integration of nutrition in extension messaging. On F2FE, the authors assess the performance of F2FE and assess constraints and opportunities to improve performance, based on a review of new literature, that is, publications dated 2012 or later. Overall, findings were positive with regard to F2FE increasing the flow of information and innovations among farmers, leading to increased adoption, productivity, and improved livelihoods. Strategies were identified for improving F2FE's effectiveness, including measures for recruiting more women as farmer trainers, criteria for selecting farmer trainers, strengthening their links with extension staff, and low cost incentives for motivating them. The findings further indicate that in most instances, salaries and allowances are not needed to motivate people to volunteer. The authors also present findings on F2FE's cost-effectiveness, suitability in differing circumstances, and sustainability.

The authors then look at the integration of nutrition in extension messaging, finding that very few programs effectively integrate this and none at scale. They find limited information on the effectiveness of nutrition-focused extension. Nutrition messaging by extension faces major challenges such as funding, coordination, and capacity of agents. The authors recommend pursuing the topic with further research and cautious investment in pilot cases.

The authors present brief sections on the use of information and communication technologies (ICTs) in extension, pluralism, and producer organizations, and the need for capacity at all levels of extension services. Using a *best-fit* framework, the authors identify the extension characteristics and frame conditions that should be present to effectively use F2FE and nutrition messaging. This is followed by a section on the need for more evidence on and the difficulty of showing extension's impacts. The authors call for better methods for analyzing extension in the future.

The authors conclude with specific recommendations on extension aimed at extension investors, be they national governments, foundations, or bilateral donors, with regard to evidence needed. They also identify extension interventions that governments and projects should consider to improve the uptake of improved practices.

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ABBREVIATIONS AND ACRONYMS

BMGF	Bill and Melinda Gates Foundation
DAES	Department of Agricultural Extension Services
EADD	East Africa Dairy Development
F2FE	Farmer-to-farmer extension
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GB£	British Pound
GFRAS	Global Forum for Rural Advisory Services
ICRAF	International Centre for Research in Agroforestry, now known as the World Agroforestry Centre after 2002
ICT	Information and communication technologies
IFPRI	International Food Policy Research Institute
NGO	Nongovernmental Organization
RAB	Rwanda Agricultural Board
R&D	Research and Development
RCT	Randomized Controlled Trial
SUN	Scaling Up Nutrition
T&V	Training and Visit
USAID	United States Agency for International Development
US$	U.S. Dollar

1. INTRODUCTION

Agricultural extension and rural advisory services play a central role in advancing technological, institutional, and socioeconomic change in many developing countries. However, the context in which extension operates is constantly changing, bringing with it new demands for data, information, and analysis. The purpose of this report is to provide issues for consideration in extension to development partners and national governments, using evidence and an integrated analysis to guide the development of programs and policies to improve the welfare of smallholder farmers and consumers. The main goal is to update extension decision makers on key areas of extension knowledge and perspectives developed in the past three years and to enable them to identify areas where (1) further evidence on extension through commissioned research is needed, and (2) extension investment practices should be reconsidered. A second goal is to examine current theories of change against recent evidence (2012–2016), taking a look at which extension models work where—in what environments, with what farmers, with what crops, and so forth.

As a global-level review, this report uses primary and secondary data on key extension trends in the last five years, looks at *what's working, what's not, and why*, and analyzes the conditions and context surrounding why approaches work or do not, and how to scale them up and make them more sustainable. Readers should note that this report is neither a comprehensive nor a systematic review of the scholarly or gray literature on agricultural extension. Rather, the report is a brief review of highlights and perspectives on extension, with a particular emphasis on farmer-to-farmer extension (F2FE) and nutrition extension. On the other hand, with regard to the issues covered, the report is both comprehensive and systematic. Specifically, the paper focuses on three areas: F2FE, nutrition messaging, and the need for more rigorous evidence in extension research.

Readers should also note that while the authors mainly use the term *extension*, it refers to a broad set of functions. Extension (also called advisory services, technology transfer, *animation rurale*, and knowledge exchange) has many different definitions and roles. Over the years the approaches and models have evolved. For the purpose of this paper, extension is defined based on Christoplos (2010), who describes it as:

> "…all the different activities that provide the information and services needed and demanded by farmers and other actors in rural settings to assist them in developing their own technical, organizational, and management skills and practices so as to improve their livelihoods and well-being."

2. FINDINGS

The context in which extension operates has changed dramatically over the past decades and even the past few years (Raj and Bhattacharjee, in press; Davis and Heemskerk 2012; Davis and Sulaiman 2014). Increasingly, attention is being given to the following observations in extension. Of course, data and information to validate or counter these observations are scant in many developing countries, suggesting the need for continued investigation and research. However, we do know that there is a renewed interest in extension and an interest in changing traditional approaches to extension. More trends than can be covered by the scope of this paper are certainly emerging.[1]

2.1. Specific Extension Cases

This section looks at specific extension approaches and, using a best-fit framework, analyzes the conditions and context surrounding why the approaches worked or not, what types of farmers or production systems they best serve, how to scale them up, and how to make them sustainable. We examine in turn the effectiveness of F2FE and the integration of nutrition in extension and advisory services.

2.1.1. Farmer-to-Farmer Extension: Performance, Constraints, and Opportunities

Introduction and Definitions. Following the decline of investments in government extension services in developing countries in the 1980s and 1990s, community-based extension approaches have become increasingly important. One such approach is F2FE, defined here as the provision of information and training by farmers to farmers, often through the creation of a structure of farmer-trainers (Scarborough et al. 1997). We use *farmer-trainer* as a generic term, recognizing that different names (for example, lead farmer, farmer-promoter, community knowledge worker) may imply different roles.

This section assesses the performance of F2FE and the constraints to and opportunities for improving its performance, based on a review of new literature, that is, publications dated 2012 or later. We first review new information on the scope and growth trend of F2FE programs. Next, we provide updates from the literature on the performance of F2FE programs. Finally we assess constraints and opportunities for improving F2FE programs. As we were unable to find a single article published after 2012 assessing the performance of F2FE in the absence of F2FE programs (that is, how farmers transmit information to other farmers outside of F2FE programs), this topic is not dealt with here.

Scope of F2FE Programs and Trends in Growth. F2FE programs date back considerably and have been used in the Philippines since the 1950s and in Central America since the 1970s (Selener, Chenier, and Zelaya 1997). However, F2FE programs have grown tremendously in Africa in recent years and are now quite common. For example, in a survey of 39 of the largest organizations providing extension services in Malawi, Masangano, and Mthinda (2012) found that 78% used the approach. Tsafack et al. (2014) found that 47 of 151

[1] For instance, using ICTs to strengthen capacity of extension agents (Raj and Bhattacharjee in press); new roles for private sector actors (Babu, Sette, and Davis 2015); and renewed focus on the role of agricultural extension in nutrition and health messaging (Fanzo et al. 2013).

organizations (31%) providing extension services across seven provinces of Cameroon used the approach.

It is evident that in many countries, the use of F2FE among development organizations has increased in importance during the last decade. In Cameroon, Kenya, and Malawi, the proportion of organizations using the approach that started using it in 2005/2006 or later was 58%, 58%, and 75%, respectively (Tsafack et al. 2014; Franzel, Sinja, and Simpson 2014; Kundhlande et al. 2014). Sample size ranged from 24 to 30 organizations in each country. Only about 15% of organizations in the three countries came into being after 2005, indicating that the vast majority of new users were existing organizations that took up the approach.

Evidence on the Performance of F2FE, Using Publications since 2012. Evidence on F2FE's performance is categorized according to five key criteria, that is, the degree to which the approach (A) increases the flow of information and innovations, leading to increased adoption of improved practices, (B) benefits and empowers different types of farmers in the community, such as women, (C) is cost-effective, (D) is suitable in varying circumstances, and (E) is sustainable.

A. Does F2FE increase the flow of information and innovations among farmers, leading to increased adoption, higher productivity, and improved livelihoods?

We were unable to find any formal impact evaluations that used a randomized controlled trial (RCT) to assess the impact of F2FE. One such study is underway in Uganda by the Paris School of Economics in the Bill & Melinda Gates Foundation (BMGF)–funded East Africa Dairy Development (EADD) Project, but results will not be available for two years.

In Kilosa District, Tanzania, Nakano et al. (2015) examined the impact of F2FE in spreading the use of improved technology in irrigated rice production. The project trained 20 *key farmers*, each of whom was responsible for training five others, called *intermediary farmers*, who then were to teach others. The researchers used a five-year panel dataset and econometric analysis to determine the impact of the extension approach on uptake of a new variety of rice and associated management practices. They found that yield gaps between key and intermediary farmers on the one hand and other farmers, on the other hand, widened after the start of the project, as key and intermediary farmers adopted new practices faster than other farmers. However, as time went on, improved practices diffused to ordinary farmers and yield gaps among the groups declined. Research also showed that having social ties to key and intermediary farmers and having plots close to theirs played an important positive role in adoption among ordinary farmers.

A weakness of the study was that the researchers relied on farmers' recall in 2010 to collect information on yields for the 2008 and 2009 seasons (Nakano et al. 2015). Second, the authors did not mention how they addressed possible bias given that the agency conducting the impact study also implemented the development project. Farmers may have realized that researchers were looking for positive effects over time and may have thus biased downwards recall information on pre-project yields. A third weakness was that the program analyzed contained only 20 key farmers and 100 intermediary farmers. A scaled-up version of the program may not be as effective as this one, because supervision and coordination may not be as strong in a large-scale program. Wellard et al. (2013) assessed the performance of farmer-trainers, called community-based extension workers, in Ghana, Malawi, and Uganda working with Self Help Africa, a UK-Ireland-based Nongovernmental Organization (NGO). Project

interventions included soil conservation, tree planting, composting, livestock practices, group formation, HIV/AIDS education, and business activities. The authors compared farmers participating in the project with those not participating to assess the effect of the farmer-trainers. The control groups had observable characteristics similar to those in the project. As in the Tanzanian case mentioned above, pre-project data were not available, so the authors used farmer recall to estimate yields three to six years earlier, a possible source of bias. Researchers found that participating farmers had significantly higher adoption rates than control group farmers, but noted that factors other than farmer-trainers, such as provision of inputs to participating farmers, may have been responsible for these effects.

World Agroforestry Centre researchers assessed the effectiveness of an F2FE program in which over 1,000 farmer-trainers trained dairy farmers on improved dairy feeding practices in the BMGF-financed EADD Project in Kenya. Researchers interviewed random samples of farmer-trainers (Kiptot and Franzel 2012; Karuhanga et al. 2013; Kiptot and Franzel 2014), *trainees*, that is, the farmers they trained (Kiptot et al. 2013), and EADD farmers, some of whom had had contact with farmer-trainers (Mwambi, Kiptot, and Franzel 2015). These studies indicated what training and use of innovations took place as well as the various actors' perceptions.

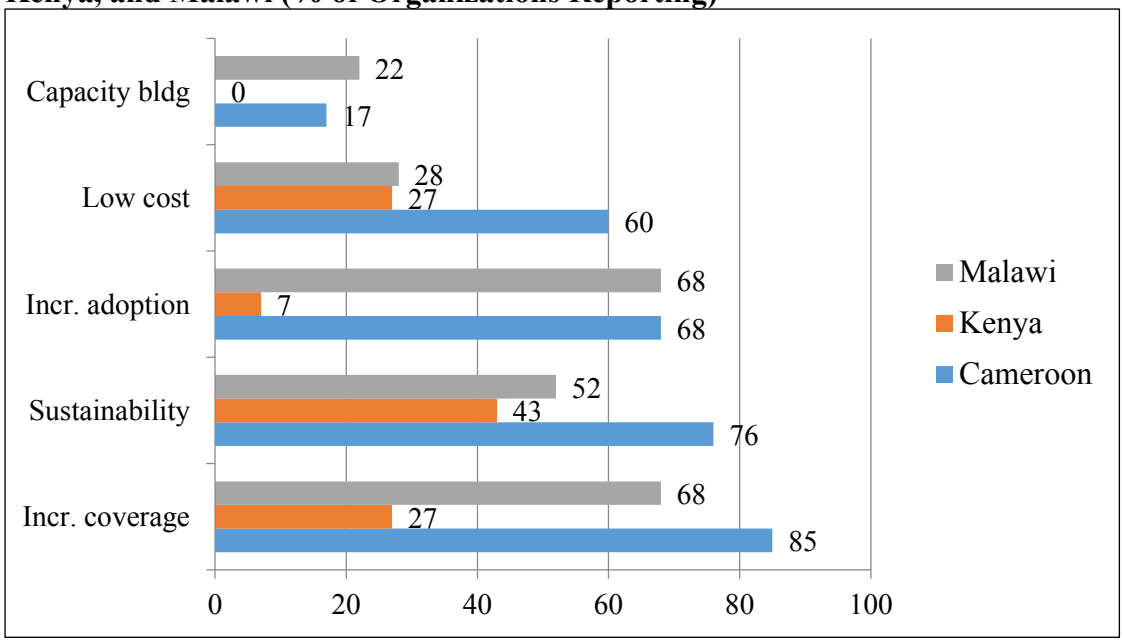
Overall findings were very positive. In Kenya, farmer-trainers reported training about 54 farmers (median, 20) over the previous month before the interview. Averages were skewed upward because a few of the trainers hosted large numbers of trainees at their farms who were brought by NGOs or other extension providers. In fact the median number of farmers trained by typical farmer-trainers, 20, mirrors the number of members in the dairy groups to which the farmer-trainers belonged (20 on average) and to whom their training was targeted. Surveys of randomly selected trainees found that they were pleased with the work of the farmer-trainers, that they were knowledgeable about the innovations on which they had received training, and that most were testing some of the practices they had learned about (Kiptot et al. 2013). Further, over 80% of trainees reported that they were disseminating innovations to others in their community. Mwambi, Kiptot, and Franzel (2015) found that randomly selected farmers participating in the EADD Project appreciated the farmer-trainers and found them to be effective, but generally preferred project extension staff as an information source.

Data on numbers of farmers trained by farmer-trainers were also available from surveys of randomly selected farmer-trainers in other countries. Farmer-trainers in Cameroon trained on average 58 farmers (median, 17) (Tsafack et al. 2015) and those in Malawi trained 61 farmers (median, 25) (Khaila et al. 2015) over the year prior to the survey. Karuhanga et al. (2013) reported that farmer-trainers in Uganda trained 16 farmers over the month prior to the survey.

Simpson et al. (2015) report on surveys of 80 organizations providing extension services that were using F2FE in Cameroon, Kenya, and Malawi. The organizations included government extension services, NGOs, farmer organizations, and private companies, and they were asked to report on their experiences. The surveys found widespread satisfaction with the approach as a means to improve the organizations' effectiveness in promoting adoption of innovations (Simpson et al. 2015). Median scores on overall effectiveness of the approach in helping organizations meet their goals ranged from 7.5 to 8 out of 10 in each of the three countries, with a score of 10 being extremely effective. Over 70% of respondents in each country gave the approach a score of 7 or 8.

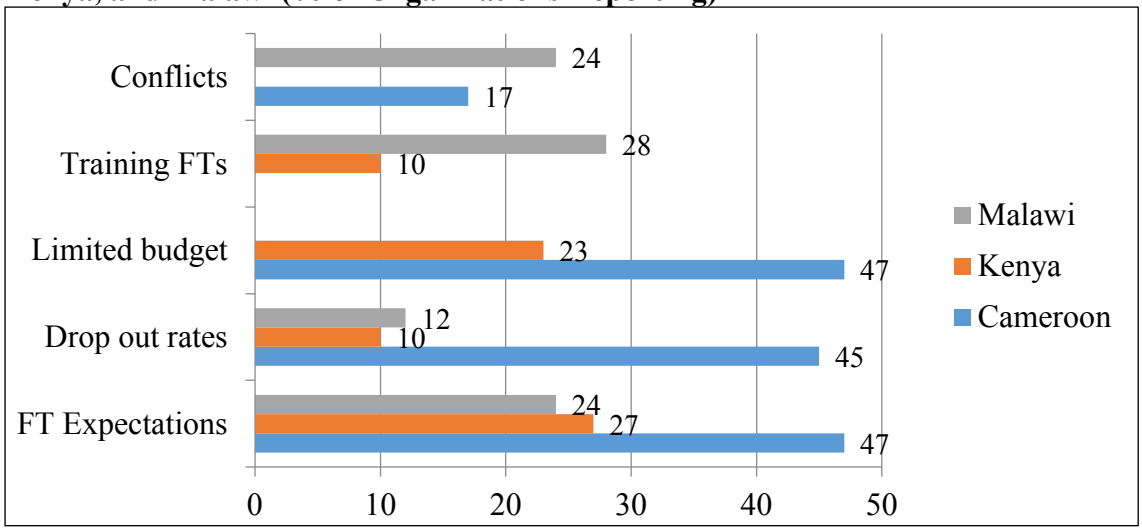
Main benefits, as perceived by the organizations, were increased numbers of farmers reached, greater adoption because farmers were more willing to learn from their colleagues who were practicing new technologies, and enhanced sustainability of extension efforts, as many felt that volunteer trainers continue working after projects end (Figure 1). Main challenges were farmers' high expectations in terms of financial and nonfinancial rewards, high dropout rates, and limited budget to support farmer-trainers (Figure 2).

Figure 1. Organizations' Views of the Main Benefits of F2FE Programs in Cameroon, Kenya, and Malawi (% of Organizations Reporting)



Source: Simpson et al. (2015).

Figure 2. Organizations' Views of the Main Problems of F2FE Programs in Cameroon, Kenya, and Malawi (% of Organizations Reporting)



Source: Simpson et al. (2015).
Note: FT = farmer-trainer.

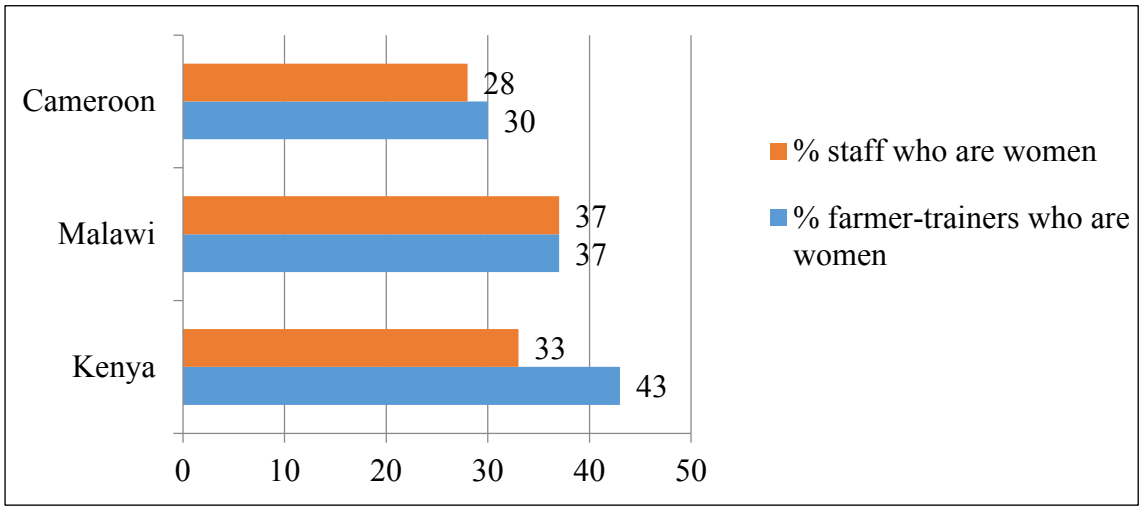
In a review of F2FE programs in Peru, Guatemala, Honduras, and Bolivia, RELASER (2015) found somewhat different strengths and challenges. There, F2FE programs were perceived to increase productivity, empower producer organizations, and benefit farmer-trainers (called promoters) who often became community leaders. Strengths included enhanced reach, low cost, and the fact that the programs reinforced the value of local knowledge. Challenges were that some promoters lacked effective communication skills and that the approach was not seen as valid by some governments.

B. Does F2FE benefit and empower different types of farmers in the community, such as women and other disadvantaged groups (for example, the poor and youth)?

Gender balance in agricultural extension is a key problem noted by many observers (World Bank, FAO, and IFAD 2009; GFRAS 2014). The two issues usually mentioned in this regard are that women make up only a small proportion of extension staff and female farmers have less access to extension than male farmers. Franzel, Degrande, and Kiptot (in press) compared proportions of women in farmer-trainer programs to their proportions in professional frontline extension positions in the same organizations, which included government, NGO, private sector, and farmer organizations' extension services. If the proportion of women among farmer-trainers is higher than the proportion among professional frontline extension staff, then farmer-trainer programs can be said to help increase the proportion of women providing extension services. Results on this are mixed (Figure 3).

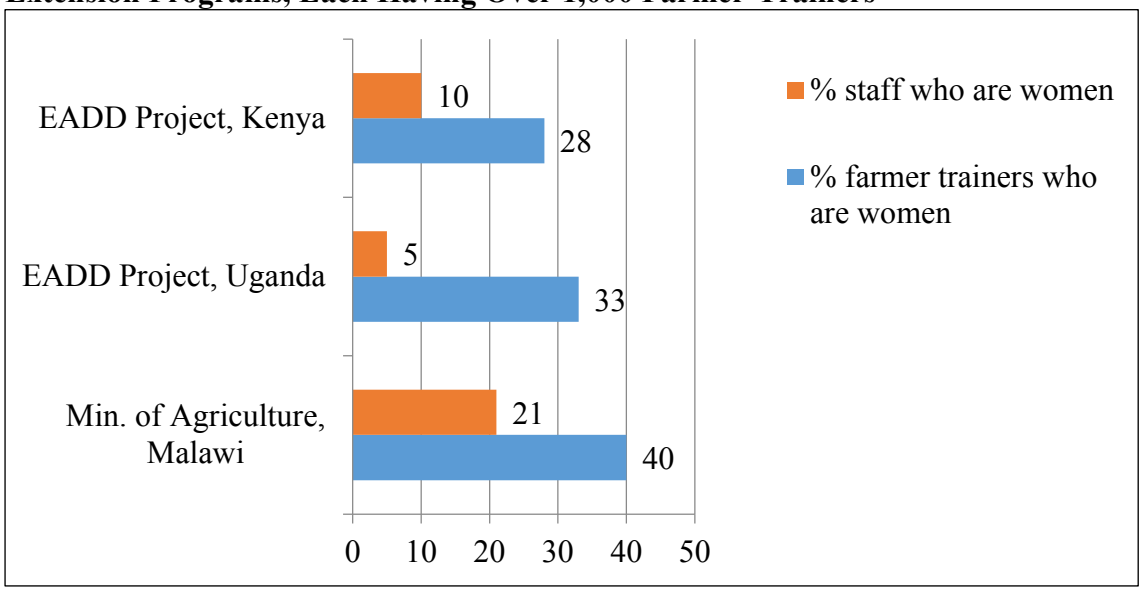
In Kenya, the mean proportion of farmer-trainers who were women across 30 organizations' F2FE programs was 43%, while the mean proportion of field staff who were women in the same organization was only 33%. Thus the proportion of female extension providers among farmer-trainers was 30% higher than the proportion of women among field staff. In Cameroon, the mean proportion of farmer-trainers who were women was 7% higher than the mean proportion of field staff who were women. In Malawi, the proportion of farmer-trainers who were women (37%) was the same as the proportion of women among the field staff of the organizations interviewed (Figure 3).

Figure 3. Proportion of Frontline Field Staff and Farmer-Trainers Who Are Women in Organizations Providing Extension Services



Source: Franzel, Degrande, and Kiptot (in press).
Note: Includes government, NGOs, private sector, and farmer organizations.

Figure 4. Proportion of Staff and Farmer-Trainers Who Are Women in Three Large Extension Programs, Each Having Over 1,000 Farmer-Trainers



Source: Franzel, Degrande, and Kiptot (in press).

In certain organizations, farmer-trainers had a dramatic effect on raising the proportion of women providing extension services, since they found it easier to recruit female farmer-trainers than to hire female field staff (Figure 4). For example, in the EADD Project in Uganda, only 5% of the professional trainers were women, whereas 33% of the 1,141 farmer-trainers were women. In the Ministry of Agriculture of Malawi, 40% of the 12,000 volunteer farmer-trainers are women while only 21% of the field staff is women (Franzel, Degrande, and Kiptot in press).

Researchers also confirmed that having more female farmer-trainers resulted in more women trained in Cameroon, Kenya, and Malawi. Male and female farmer-trainers trained about the same number of farmers in all three countries. However, women trained more women than men did. In Cameroon, women made up 74% of farmers trained by women while they made up only 41% of those trained by men. This difference was highly significant ($p < .01$, that is, there is less than a 1% chance that the difference was due to chance and not because there is a real difference between the two proportions). In Malawi, women made up 62% of those trained by women and 55% of those trained by men ($p<.02$). In Kenya, women made up 48% of those trained by women and only 40% of those trained by men but the difference was not significant.

No information was available in the above studies on the degree to which F2FE programs engage youth or the poor.

C. Is F2FE cost-effective, does it have high net benefits relative to other approaches, and does it bring high benefits relative to costs?

Little information is available to answer these questions. Kiptot, Franzel, and Kirui (2012) reported that the main costs of the EADD Project's F2FE program were the initial training, follow-up training, and incentives to motivate farmer-trainers, such as contests, T-shirts, and bags. In the EADD farmer-trainer program in Kenya, these costs amount to about U.S. dollars (US$)160 per farmer-trainer per year. This includes 2–3 days of residential training at

induction (including classroom, field activities, and field visits), about 2 days per year of follow-up training, and T-shirts and bags (Kiptot, Franzel, and Kirui 2012).

Wellard et al. (2013) calculated discounted benefit-cost ratios for four F2FE programs run by the NGO Self Help Africa in Ghana, Uganda, and Malawi. They compared the costs and returns associated with a farmer-trainer program with a nearby area not benefitting from farmer-trainers. Discounted net benefits ranged from British pound (GB£) 3,000 to 14,000 per farmer-trainer over a four year period, while costs were GB£ 510 to 3,160. Benefit-cost ratios ranged from 6.8 to 1 to 14.2 to 1, indicating that the investment in an F2FE program yields high returns. However, no comparisons were made with the benefit-cost ratios of implementing other extension approaches, which, in theory, could have higher benefit-cost ratios.

D. Is F2FE suitable in varying circumstances?

Surveys of 80 organizations across three countries found that F2FE was appropriate for a wide range of enterprises and innovations (Simpson et al. 2015). However, the authors caution that the approach may not be appropriate for high-risk and very technical enterprises and practices (for example, certain crop-spraying practices), for innovations where cost of an error may be very high (for example, treatment of livestock diseases), or for what are essentially permanent decisions (for example, siting of water control structures).

F2FE has been reported not to work well in areas of low population density where transportation is a constraint (Kiptot, Franzel, and Kirui 2012). It appears to work best where farmers are organized, that is, farmer-trainers are serving members of a farmer group or a producer organization, as trainers then have a ready clientele. It may be less suited to high-income, commercial systems, where the opportunity cost of labor is high and social networks may be weaker than in less commercial systems.

E. Is F2FE sustainable—that is, how feasible it is for local institutions to manage the approach once external support ends, and how long it will take to achieve sustainability?

In certain respects, many F2FE initiatives have achieved a great degree of sustainability. For example, in western Kenya, Lukuyu et al. (2012) found that farmer-trainers were actively training farmers three years after the project supporting them had ended. The main reason was that local village authorities were supporting and promoting the trainers and they were able to continue accessing new information from various sources such as government and NGO extension services. In fact, surveys of farmer-trainers in Cameroon, Kenya, and Malawi found that large numbers of farmer-trainers had served previously as farmer-trainers for other organizations or were currently serving more than one organization. Thus, from the perspective of the village, the approach could be termed sustainable as it often continues indefinitely following the end a particular project's support. However, the approach still usually depends on continued technical support from extension services, albeit different ones, over time. In Rwanda, an F2FE program involving 86 farmer-trainers was found to be working effectively three years after a project supporting it had ended. The Rwanda Agricultural Board had taken over backstopping the program following the end of the project (the EADD Project, funded by BMGF) and had even expanded the number of farmer-trainers to 130 (Kiptot et al. 2016). In other cases, technical support weakens over time and likely reduces the effectiveness of farmer-trainers.

Over 40% of farmer-trainers in Cameroon and Kenya reported that they received no follow-up training after their initial training, though some acknowledged that they did continue to learn from extension staff during visits and farmer training sessions.

Main Constraints and Opportunities

Deficiencies in extension services that affect their effective use of farmer-trainers. The voluntary adoption and continued and expanding use of the F2FE approach by organizations in the absence of any direct external promotion confirm organizations' perceptions that F2FE is an effective tool. The ratios of program field staff to farmer-trainers, and of farmer-trainers to farmers trained, substantiate the ability of the approach to both expand organizations' geographic coverage and numbers of farmers reached (Simpson et al. 2015). In addition, although there is evidence that the particular projects mentioned above were using the approach effectively, observers noted instances in which the approach was less effective because of poorly functioning extension services. Three different sets of problems were noted.

First, in some instances, extension staff lacked resources (for example, vehicles or money for fuel) to go to the field. Second, in some areas and programs, extension staff and farmer-trainers appeared to have little or no new information to share with farmers. For example in one government-managed F2FE program, extension staff and farmer-trainers said that the main technology they were disseminating was a planting method that had been introduced to farmers 15 years earlier. In a third set of cases, extension programs were not addressing farmers' needs or tailoring recommendations to farmers' resource constraints and circumstances. Nor did these programs have monitoring systems for eliciting farmers' feedback on the practices being disseminated. The lesson here is that an F2FE program embedded in a research or extension program can only be as effective as that program; if it is not helping farmers to improve their productivity or meet other important farmer needs, then an F2FE program will be of limited effectiveness.

Third, in some circumstances, the approach to making effective use of farmer-trainers was deficient. For example, in one instance, a program did not appear to be giving farmer-trainers sufficient training on a range of complementary practices. Different farmer-trainers were selected for introducing different, complementary practices. For example, one farmer was trained in planting, another in fertilizer use, another on pest control, and so forth. On an individual basis, they did not have access to new information or technologies. In another example of deficient use of the approach, in several programs, farmer-trainers' main role appeared to be to mobilize farmers for attending training sessions led by extension staff rather than to train farmers themselves. The overall lesson from these constraints in effective extension approaches is that farmer-trainers can contribute to improving the effectiveness of extension agencies only if the extension service (1) helps farmers to learn new and effective practices that meet their needs, and (2) makes effective use of farmer-trainers.

Constraints limiting F2FE programs' effectiveness and opportunities for addressing them. For relatively well-functioning extension programs, five main constraints limit the effectiveness of F2FE programs: gender imbalance, inappropriate selection procedures of farmer-trainers, lack of continuous training and links to extension services, low motivation and incentives, and lack of national policy support.
Each of these is relatively easy to resolve and can be addressed using low-cost approaches that can greatly increase the effectiveness of F2FE programs.

a. Gender imbalances in extension

An important but neglected advantage of F2FE programs is that they can often help organizations to increase the proportion of women providing and accessing extension services. However, many F2FE programs are unaware of this potential and thus have low proportions of women in their farmer-trainer programs. In contrast, as mentioned above, other organizations have actively recruited women as farmer-trainers and have been able to attain proportions of 40-50%. Technoserve (2012) highlights methods for increasing gender balance in F2FE programs:

- Targeting women's groups to recruit farmer-trainers;
- Recruiting through churches, where women often congregate;
- Offering women child care services during training sessions;
- Proposing that married couples take on roles as farmer-trainers; and
- Setting quotas for female farmer-trainers, for example, insisting that local organizations nominate equal numbers of men and women to be farmer-trainers.

Policy makers and organizations interested in increasing the proportion of women providing and accessing extension services should consider adopting F2FE approaches and proactively recruiting women, as it is often easier to recruit female volunteer farmer-trainers than to recruit female extension workers.

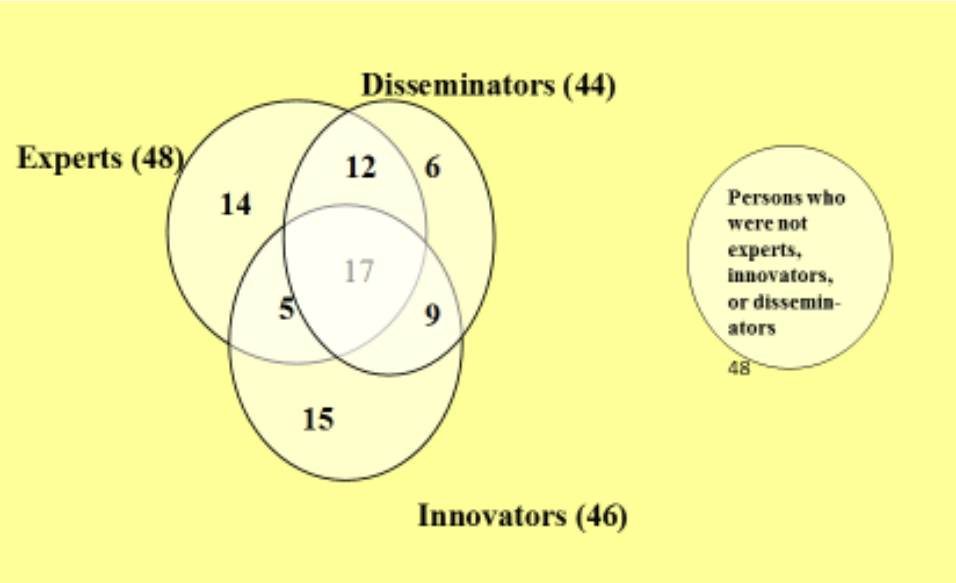
b. Inappropriate procedures for selecting farmer-trainers

A constraint in some programs is that organizations select farmer-trainers on the basis of their farming expertise rather than on their interest and expertise in training and disseminating information. Titles such as *master farmer*, *lead farmer*, and *model farmer* appear to reinforce this tendency. In Malawi, Kundhlande et al. (2014) found that one-third of organizations having farming expertise as a criterion did not have criteria for farmers' communications skills or interests in sharing knowledge. Some organizations gave emphasis to farming expertise because it is more easily observable than interest and ability to communicate findings to others.

Franzel et al. (2013) assessed whether expert farmers are also expert disseminators. They created indices to assess farmers' degree of expertise in farming and expertise in disseminating information with regard to fodder shrubs, fast-growing legumes for feeding dairy cows. Results indicated that 40% of farmers with farming expertise were not expert disseminators and lacked the interest or ability to communicate findings to colleagues (Figure 5) (Franzel et al. 2013). The interest and ability to communicate findings may be difficult for outside organizations to assess, but local leaders and informants can readily identify persons with such characteristics. These findings reinforce the importance of involving community leaders in the selection of farmer-trainers.

In fact, other important reasons exist for involving local communities in selecting farmer-trainers. Encouraging local leaders (for example, leaders of farmer groups or village development committees) to choose farmer-trainers helps increase local ownership and accountability of F2FE programs.

Figure 5. Overlap between Expert Farmers, Innovators, and Disseminators in a Sample of 146 Adopters of Fodder Shrubs, Kenya



Source*:* Franzel et al. (2013).

Organizations following this approach often found that community members became more proactive in supervising and demanding services from farmer-trainers and in ensuring that they performed effectively. These organizations worked with local leaders on criteria for selecting farmer-trainers and often allowed them to nominate or choose the leaders themselves.

Figure 5 also shows that many expert farmers (54%) are also not strong innovators, that is, they do not conduct experiments to test new practices. Some observers claim that an effective farmer-trainer should also be a strong innovator, for integrating new knowledge with local knowledge and because new practices often need modification to fit varying contexts.

Social network analysis has been useful in understanding how F2FE works and for assessing the effects of recruiting different types of farmers as farmer-trainers. Ben Yishay and Mobarek (2014) found that *peer farmers* in Malawi (typical village members selected by focus groups of their peers) were more effective at promoting adoption than were *lead farmers*, local leaders identified by the same focus groups, or government extension workers. Vasilaky and Leonard (2013) found that intervening in social networks could promote farmer-to-farmer learning and adoption. The authors randomly paired female farmers in villages in Uganda who did not know each other and encouraged them to share new agricultural information on cotton, a recently adopted cash crop. The intervention significantly increased the productivity of all farmers except those in the highest quartile of productivity and significant spillovers in productivity reached male farmers as well. More findings on the effect of social networks on farmer-to-farmer learning are discussed in Section II.3.

c. Lack of continued training and links to extension

The problem of lack of continuous training appears to have two causes. First, some organizations begin with a set of practices they are promoting and do not add to these over

time. Once farmer-trainers have promoted these for some time they and the farmers they train lose interest. A second problem is that some organizations recruit more farmer-trainers than they can effectively train. Ironically, the same extension managers who say that they have recruited volunteer farmer-trainers to reduce the costs of reaching large numbers of farmers find that they cannot afford to train the farmer-trainers they have! Both of these problems need to be addressed at the design stage. In the first instance, project designers need to understand that the task of increasing productivity is a continuous one and not a question of simply moving from one level of productivity to another. Thus, training must be periodic, so as to reinforce earlier training, respond to new problems, and further increase productivity. Second, planners need to understand that maintaining volunteer farmer-trainers is not free—trainers require periodic training, which has cost implications.

The backstopping of farmer-trainers by extension staff was seen as critical for the success of a farmer-trainer program. Where extension staff was working for the same organization as the farmer-trainers, an occasional problem was that the ratio of farmer-trainers was too high for the extension staff to adequately backstop them. Whereas it is difficult to set a rule as to an appropriate ratio, a ratio of more than 100 farmer-trainers per extension staff member, as was found in some instances, was likely to result in insufficient backstopping. A second problem was that extension staff sometimes lacked resources, such as transport, to backstop.

Where the extension staff was from a different organization than the farmer-trainers, the problem constraining backstopping sometimes involved poor institutional linkages. Some NGOs using government extension staff to backstop their farmer-trainers found that involving government ministries in the planning of the project and ensuring that frontline extension staff had the resources to properly backstop led to strong institutional linkages and effective backstopping (Franzel, Sinja, and Simpson 2014).

d. Lack of motivation and incentives for farmer-trainers

A key problem noted by some organizations was farmer-trainers' lack of motivation, which was exacerbated by the fact that they were not paid for their work (Kundhlande et al. 2014; Tsafack et al. 2014). While some do leave F2FE programs because of not being paid, many farmer-trainers work effectively without pay. Farmer-trainers in Cameroon, Kenya, and Malawi were asked what motivated them to become farmer-trainers and what motivated them to remain serving. Representatives of extension organizations were also asked what they perceived farmer-trainers' motivations to be. These are explained in more detail following.

Gaining knowledge for increasing one's own income was the main reason for *becoming* a farmer-trainer across the three countries, cited by 58% to 64% of farmer-trainers (Table 1) (Simpson et al. 2015). Altruism was a close second, cited by 42% to 69% of farmers. Improving one's own social status and social networking were ranked third in Kenya and Cameroon, with 28% to 34% of farmer-trainers citing this. Proportions were much lower in Malawi, although representatives of extension organizations believed that social status was in fact an important motivation but that farmers were hesitant to admit it. Project materials (for example, fertilizer for demonstrations) were cited as an important benefit by 8% to 30%, and income-earning opportunities from being a farmer-trainer, such as selling seed from one's demonstration plot or providing training for a fee, were cited by 5% to 23% of farmers.

Table 1. Proportion of Farmers Scoring Different Motivations as Important for Becoming and Remaining a Volunteer Farmer-trainer

	Cameroon		Kenya		Malawi	
Motivation	Becoming	Remaining	Becoming	Remaining	Becoming	Remaining
Gain knowledge	64	56	62	53	58	38
Help others	69	79	42	49	56	58
Social status	26	41			4	5
Social Networking	34	32	28*	28*	4	3
Project financial/material benefits	30	28	27	31	8	6
Income from associated activities	NA	NA	23	61	5	14

Source*:* Tsafack et al. (2015); Khaila et al. (2015); Kiptot and Franzel (2014).
Note: *In the Kenya questionnaire, social status and social networking were combined into a single variable called social benefits; NA indicates not available, because farmers in Cameroon were not asked to rank the motive on income from associated activities.

The motivations for *remaining* a farmer-trainer were similar to those for becoming a farmer-trainer with three important exceptions (Table 1). First, gaining knowledge declined in the *remaining* motivation as compared to the *becoming* motivation in all three countries, probably because training was more prevalent at the beginning of the project when farmer-trainers were recruited.

Second, altruism increased in all three countries, perhaps reflecting the satisfaction that farmers got from actually helping others. Third, the motivation to earn income from associated activities increased significantly in both of the countries where it was assessed. In Kenya it rose from the fifth most important motivation to the first, and in Malawi, the proportion citing it as important almost tripled, from 5% to 14%. In Kenya, 50% of the farmer-trainers in the EADD Project were earning income from associated activities, whereas 24% of farmer-trainers in Cameroon and 18% in Malawi were doing so (Kiptot and Franzel 2014; Khaila et al. 2015; Tsafack et al. 2015). The higher proportion in Kenya was because the sample there was drawn from farmers practicing dairy, a highly commercial enterprise, whereas those in Cameroon and Malawi included many farmers with less commercial enterprises such as food crops.

Table 2. Matching Incentives to Farmer-trainers' Motivations

Motivation	Incentives
Altruism, social status	Contests, certificates, badges, community recognition
Increasing knowledge	Training, study tours, training materials
Income	Links to buyers of inputs (for example, seed) and services (for example, training)

Source*:* Simpson et al. (2015).

The findings indicate that in most instances, salaries and allowances are not needed to motivate people to volunteer. Extension providers can make their F2FE programs more effective and sustainable by understanding which motivations are most important to their trainers and providing low-cost incentives for keeping them motivated (Table 2).

For those trainers interested in altruism and social benefits, means of recognition (certificates, T-shirts, and public recognition from local leaders) are important. For those interested in increasing their knowledge, the most important incentives are training, brochures, reference materials, and visits with researchers and innovative farmers. For those interested in earning income from associated services, helping link farmer-trainers to clients interested in buying their services is important. In some instances, organizations insist that farmers pay farmer-trainers for their services, starting with small, in-kind payments (contributing a cup of milk for each training on dairy), or reimbursing trainers for transportation costs.

e. Lack of policy support

Some governments have explicit policies supporting farmer-trainers. Some African countries, such as Malawi and Rwanda, published national extension policies that include support to F2FE programs. In Malawi, the Department of Agricultural Extension Services (DAES) of the Ministry of Agriculture supports farmer-trainers and sets policies coordinating the use of farmer-trainers by other agencies, such as NGOs. For example, Kundhlande et al. (2014) reported that DAES forbids NGOs from paying salaries to its farmer-trainers because this would create a problem for other organizations, such as DAES, that use the approach but do not pay their farmer-trainers. In Rwanda, the Rwanda Agricultural Board (RAB) initiated farmer-trainer programs to assist farmers with different commodities, such as dairy, potatoes, and maize. Called *community-based trainers*, they are trained by RAB and supervised by district extension staff (Kiptot et al. 2016).

Two models demonstrate how the governments in two emerging economies support F2FE. In parts of Peru, F2FE has become the main delivery vehicle for extension (Franzel, Degrande, Kiptot 2015). Peru's Yachachi (from the Quechan word for 'one who teaches') program reaches 90,000 of the country's poorest Andean farmers. In addition to being locally recruited and selected, these farmer-trainers are paid by the government via community-awarded innovation funds (no external funding is involved). They receive the equivalent of US$340 per month for four days a week, equivalent to 67% of a government extension technician's salary. Women comprise 25% of the 2,500 Yachachis. Training activities focus on a wide range of crop, livestock, and agroforestry practices. Importantly, the Peruvian National Institute of Agricultural Research provides ongoing training and support to Yachachis.

In Indonesia, the government's district-level extension services recruit and pay farmer-trainers (called farmer extension agents) to work with their extension staff (E. Martini, personal communication, 2015). Districts employ about 4,000 farmer-trainers and terms of service vary by region. Some pay stipends amount to about 50% of what government frontline extension staff is paid, while in other districts, they are not paid salaries but receive free training themselves.

Policy support for F2FE, even without budgeted programs to support its implementation, could help F2FE programs in several ways. First, it lends legitimacy to the approach and would help facilitate the moral support of national and local authorities, which many farmer-trainers value. Second, policy support could help prevent the conflicts that sometimes arise

between government and NGO extension staff and farmer-trainers. Third, it could open up avenues for other entities to recognize and support the approach, such as mass media, civil society organizations, and banks, which may consider giving preferential loans to farmer-trainers.

As common as F2FE programs are, training materials on the use of the approach and analyses and comparisons of F2FE programs are scarce. None were found on the Internet. Such materials would be extremely useful, both for organizations operating F2FE programs and for those wanting to start them.

2.1.2. Nutrition and Agricultural Extension

Background to nutrition messaging in extension. Many governments and development institutions are focusing on the agriculture-health-nutrition nexus (for example, the World Bank, the International Food Policy Research Institute (IFPRI), and BMGF). For instance, the Scaling Up Nutrition (SUN) Movement is focused on malnutrition. SUN was founded on the principle that all people have a right to food and good nutrition (Fanzo et al. 2013). SUN engages governments, civil society, development partners, the private sector, and researchers to improve nutrition.

As the focus moves to the agriculture-health-nutrition links, program planners naturally look to institutions that can help in this effort. Extension is naturally being called upon to play a role in improving nutrition at the local level, as it is seen as a rural education and technology transfer service located at the community level mainly through government or civil society frontline workers.

This is not the first time agricultural extension services have been seen as a vehicle for nutrition messaging. Several decades ago clear programs and links existed in certain countries between extension and nutrition—for instance home economics agents in the United States and Tanzania (see Box 1 for some history).

In a study conducted in 2013, Fanzo and colleagues (2013) stated that "…agricultural extension and advisory services…are often mentioned as a promising platform for the delivery of nutrition knowledge and practices, due to the close interaction that [these services] have with farmers…" The rationale for integrating nutrition in extension comes from the following aspects of extension services: "(a) an established infrastructure (b) reach (c) community trust, and (d) and cultural awareness, including (e) an understanding of how to mitigate the constraints faced by farmers" (Fanzo et al. 2013).

Box 1. A Short History of Nutrition in Extension

FAO (Food and Agriculture Organization) first introduced nutrition concepts into the training of extension personnel for rural development projects in the 1960s. In the 1970s, the United States Agency for International Development (USAID) joined the effort. Their thinking was that the agriculture sector would need to expand beyond its sole focus on food production, and incorporate food consumption to have an impact on nutrition. In 1978, FAO developed a teaching set, called the "Field Programme Management: Food and Nutrition," aimed at addressing this expansion. The training materials contained technical information on nutrition as well as lessons to enhance the managerial and communication skills of extension staff. This teaching set served as a global resource and was adapted to the national contexts of at least 10 Latin American and several African countries.

Source: Fanzo et al. (2013).

Findings on Nutrition Messaging in Extension. Masset and colleagues (2012) conducted a systematic review of agricultural interventions that improved children's nutritional status. While they included interventions such as home gardening and small-scale livestock production, they did not include extension programs that did not have a specific goal of reducing undernutrition per se. They found mixed results, with a positive effect on production but not income, increased consumption of protein and micronutrients, and no effect on iron absorption but some on vitamin A absorption. They concluded that it is difficult to answer the study question with any degree of confidence and that more rigorous studies were needed.

In a study in 2013, Fanzo and colleagues looked at the current situation with regard to integration of nutrition in agricultural extension services. Using a combination of literature review, surveys, and semi-structured key informant interviews, they documented the current status, the training situation of extension agents at that time, and challenges and opportunities for the integration of nutrition into extension services (Fanzo et al. 2013; Fanzo et al. 2015). The authors found that while some programs used nutrition messaging in extension (Table 3), many challenges existed and none of the programs were at scale. Their study included a number of cases where good practices and opportunities were identified.

Extension services can work on nutrition aspects in several ways. Responsibility for food *availability* falls under most agriculture ministries, thus extension agents tend to work in this area (Fanzo et al. 2013). They can also focus on nutrition access or utilization of nutritious food (ibid). Fanzo and colleagues found nutrition activities in extension such as use of home gardens, biofortification, and reducing postharvest loss.

Involving extension agents in nutrition messaging has several implications. First, extension agents today are typically trained in technical agricultural topics. While their role is expanding and thus their skillset (Davis and Sulaiman 2014), extension agents are still mainly focused on the agriculture (and technical) sector. Extension tends to focus on crops and food and on livestock and natural resources management. Agents thus may have and use extension messages that fit within these themes (Fanzo et al. 2013).

Table 3. Who Is Using Nutrition Messaging Today and Where?

Organization/Project	Country
FAO	Malawi
SPRING/USAID, Strengthening Partnerships, Results, and Innovations in Nutrition Globally	Bangladesh, Burkina Faso, Haiti, India, Niger, Nigeria, Uganda
Integrated Rural Nutrition Project	Zambia
Nutrition Improvement Project	Vietnam
Government	Ghana
Government	Tanzania
Government	Rwanda
Digital Green, Food-Based Strategies to Control Vitamin A Deficiency Project	India
Desarrollo de Proyectos Productivos Agropecuarios program	Colombia
Government, DAI's Urban Gardens Project	Ethiopia
Home extension agents within National Agricultural Extension System	Guatemala
Government	Kenya
Government, World Bank	Haiti

Source*:* Fanzo et al. (2013).

Relatedly, a second element to consider is the need for specialization for nutrition. While certain nutrition training can and should occur during pre-service or in-service training, the field of nutrition itself is a highly technical one that sometimes requires health professionals to teach. Thus the element of backup by subject matter specialists is important. Box 2 indicates different roles and functions of extension agents in providing nutrition messages. Table 4 shows specific messages that extension could provide, and how.

A third element is the multi-sectoral nature of health messages. When extension agents get involved in nutrition issues, overlaps arise with institutions dealing with health and sanitation, with resulting policy and coordination implications. Extension does not typically work in other sectors such as health or water. One reason that health and nutrition messages sometimes get lost in rural areas is that they are a function of both health services and agriculture services (whether governmental or nongovernmental). Thus issues like nutrition can often fall through the cracks in rural areas.

These different types of messages have implications as to types of delivery systems and incentives. Certain messages could be easily transmitted in simple messages on flyers, posters, or radio, perhaps targeting audiences at clinics and in markets. For example, radio programs could broadcast messages about diverse foods for better nutrition or the need to breastfeed for six months. Messages could also be depicted on posters. Many radio programs already broadcast food preparation tips and some even have soap operas to promote consumption of orange-fleshed sweet potato.[2]

[2] http://www.farmradio.org/portfolio/fighting-vitamin-a-deficiency-with-orange-fleshed-sweet-potato/

Box 2. Types of Nutrition Extension Providers

Fanzo et al.'s (2013) nutrition and extension study identified eight distinct types of nutrition extension providers:

1. Generalist – Has a broad range of agriculture-based knowledge relating to farming systems, fertilizers, and/or marketing, in addition to knowledge on rural poverty alleviation and development issues.
2. Nutrition specialist – Focuses on nutrition and serves as a technical backstop, providing ongoing training to frontline extension agents. Responsible for relaying relevant information from research to frontline agents, and in turn gathers feedback from frontline agents concerning the needs of the local community.
3. Generalist with access to nutrition specialists – Is agriculture-focused with basic training in a range of topics including nutrition. With an understanding of the potential causes of malnutrition, assists the community in accessing nutrition resources and/or services, including nutrition specialists.
4. Home economics extension agent – Is a nutrition specialist, typically female and housed within agriculture ministries, responsible for addressing the nutritional needs of vulnerable family members, care and feeding practices, food preparation, and intra-household distribution of food. A fixture of extension services during the 1970s and 1980s, before the role was refocused toward agricultural production.
5. Lead farmer/community volunteer – Community member trained by extension agents to be a farmer-to-farmer "promoter" within his/her own community. Assists with agricultural training and/or dissemination of nutrition messaging, extending the reach of extension agents. The approach aims to move away from a dependence model toward one where community members learn skills and the methods to share them.
6. Farmer field school (FFS) facilitator – Typically a local, national, or international NGO that leads community farmers in experiential group learning activities, including experiments with different cultivation techniques, field observations, and group analysis. While the focus is primarily on agricultural production, the participatory nature of FFS provides an entry point to the discussion of other priority issues such as HIV, gender, and nutrition.
7. Health sector extension agent/community health worker (CHW) – Considered the main source of nutrition education by female beneficiaries, a CHW offers a direct entry point for nutrition messages, providing nutrition counseling that touches upon components of a balanced diet, the importance of kitchen gardens, and appropriate feeding practices for children.
8. Educator – A teacher or professor who plays an important role in nutrition messaging; the emphasis on nutrition within school curricula varies across countries, however.

Source*:* Fanzo et al. (2013).

Table 4. Extension and Nutrition Messaging Examples

What types of messages could extension promote?
• Consumption of iodized salt or iron-fortified foods • Importance of antenatal care, growth monitoring visits, and post-natal care • Diet diversification including growing and consuming nutrient-rich foods • Encouragement of exclusive breastfeeding for six months • Encouragement of complementary foods for children aged 6-24 months • Promotion of milk as an important source of calcium, iron, and protein • Improved storage of agricultural yields through appropriate technologies • Promotion of improved seeds and new crops with high nutritional value • Food processing and preservation • Food hygiene and safety • Basic knowledge of food groups and their role in nutrition • Local biodiversity in the nutrition context
How to incorporate messages into extension?
• Educate extension agents on which locally available food varieties would serve specific nutritional needs • Conduct cooking demonstrations with local, nutrient-dense food sources • Distribute flyers/brochures containing information on nutritional content of crops • Promote equitable intra-household food distribution to meet dietary diversity guidelines, particularly for mothers and children • Supply extension agents with nutritious recipes for distribution to the community • Provide extension agents with easy-to-use food composition guides • Use ICT, radio, and TV programs to convey nutrition extension messages • Use community theater, music, and drama to communicate nutrition extension messages

Source*:* Fanzo et al. (2013).

There are also strong reasons for departments of health and agriculture to work together. For instance, health professionals could provide extension personnel with recipes and other information to share with their clients. They could do joint demonstrations of cooking and preserving food.

Another element regarding nutrition and extension is the thinking in recent years that extension should play many nontraditional roles—such as helping to rebuild communities after conflict, assisting farmers to deal with climate change, organizing producers into groups and accessing markets, reaching out to women and disadvantaged groups—the list goes on. Thus extension agents are often called to integrate other types of activities and messages into their work, in addition to addressing traditional agricultural topics. While this potentially poses a threat to the workload of extension agents, it also offers an opportunity. Extension agents can and should respond to the needs of the community. Thus if nutrition messaging is an identified need, mechanisms that allow agents to respond should be available.

These elements highlight the critical need for capacity and skills for nutrition messaging. Extension agents are already found to have weak technical (for example, in crops, animal production, natural resource management) and nearly nonexistent functional capacities (Davis and Sulaiman 2014; Davis, Ekboir, and Spielman 2008). To deal with nutrition messaging extension, agents need a certain amount of technical skills—that is, knowledge of biochemistry and physiology. However, even greater is their need for functional skills such as the ability to communicate well, to form farmer groups, or to link farmers to the information they need. The reason for this is that to deal with complex issues like nutrition, extension agents first require basic functional skills such as communication and brokering.

A study by Kadiyala et al. (2014) provides a sense of how extension programs might evolve in the near future to combine health, agriculture, nutrition, and ICT. The study evaluated the efficacy of community-centric participatory video production and dissemination to strengthen agricultural extension systems, specifically in reference to the promotion of maternal, infant, and young child nutrition-related behaviors and care practices, including child feeding, care during pregnancy, and handwashing. Together with the Voluntary Association for Rural Reconstruction and Appropriate Technology, a local NGO operating in the state of Odisha, India, Digital Green produced 10 videos that were disseminated with the involvement of four community resource persons and 37 community service providers to motivate adoption of selected behaviors and practices. Findings from the evaluation, covering Digital Green's pilot activities during the course of a single year from 2013 to 2014, indicated acceptance among both frontline workers and participants, and retention and comprehension of key messages embedded in the video content. That said, the evaluation period was too short and constrained by internal factors (for example, limited participation of key target groups) and supply-side constraints (for example, limited availability of quality food supplements) to detect significant changes in maternal, infant, and young child nutrition-related behaviors and practices.

Thus many challenges remain to be faced in using nutrition-focused extension or in providing nutrition messages via existing extension programs. This is due in part to the challenges faced in all extension programs: lack of political will, limited capacities at individual and organizational level, and lack of financial resources to ensure quality programs. In their study of nutrition and extension, Fanzo and colleagues (2015) found that challenges specific to nutrition extension included time, money, human resources, mobility, communication, gender bias, and women's limited access to extension services.

In spite of the challenges, the majority of respondents in the Fanzo 2013 study—64 out of 68—stated that agricultural extension was a valid mechanism by which to deliver nutrition information to households (Fanzo et al. 2013). The question is how. We conclude by offering some insights regarding where and how nutrition extension might be used, how to help it perform better, and how to bring about a desirable impact when doing so. Box 3 provides some initial principles. The next section applies a best-fit framework to agricultural extension nutrition messaging.

Conclusions on Nutrition Messaging by Agricultural Extension. In conclusion, limited information exists as to the effectiveness of nutrition-focused extension. Few if any examples of such programs exist at scale. Nutrition messaging by extension also faces major challenges (as do mainstream extension programs). However, this is an important enough topic to be pursued further in terms of research and cautious investment in pilot cases.

Box 3. Guiding Principles for Improving Nutrition through Agriculture

Planning for nutrition:

1. Incorporate explicit nutrition objectives in agriculture policy and program design.
2. Assess the context and causes of malnutrition at the local level, to maximize efficacy and reduce negative externalities.
3. Do no harm. Identify potential harms, develop a mitigation plan, and set in place a well-functioning monitoring system.
4. Measure nutritional impact through program monitoring and evaluation.
5. Maximize opportunities through multi-sectoral coordination.
6. Maximize impact of household income on nutrition, such as through increasing women's income.
7. Increase equitable access to productive resources.
8. Target the most vulnerable.

Taking action. All approaches should:

9. Empower women, the primary caretakers in households, through: income; access to extension and advisory services and information; avoiding harm to their ability to care for children; labor and time-saving technologies; and support for rights to land, education, and employment.
10. Incorporate nutrition education to improve consumption and nutrition effects of interventions; employ agriculture extension agents to communicate on nutrition as feasible.
11. Manage natural resources for improved productivity, resilience to shocks, adaptation to climate change, and increased equitable access to resources through soil, water, and biodiversity conservation.

These can be combined with approaches to:

12. Diversify production and livelihoods for improved food access and diet diversification, natural resource management, risk reduction, and improved income.
13. Increase production of nutritious foods, particularly locally adapted varieties rich in micronutrients and protein, chosen based on nutrition gaps at the local level and available solutions.
14. Reduce post-harvest losses and improve processing.
15. Increase market access and opportunities, especially for smallholders.
16. Reduce seasonality of food insecurity through improved storage and preservation and other approaches.

Creating a supportive environment:

17. Improve policy coherence regarding support for nutrition, including food price policies, subsidies, trade policies, and pro-poor policies.
18. Improve good governance for nutrition, by drawing up a national nutrition strategy and action plan, allocating adequate budgetary resources, and implementing nutrition surveillance.
19. Build capacity in ministries at national, district, and local levels.
20. Communicate and continue to advocate for nutrition.

Source: Fanzo et al. (2013).

We also suggest that agricultural extension services provide nutrition messaging only when and where the following pre-conditions exist:

- Poverty and malnutrition are major issues in the country or region;
- The program fits national goals and strategies with regard to nutrition in rural areas;
- A supportive environment exists for interministerial or interprogram cooperation;
- Extension agents have support from supervisors and extension services have support from the government;
- Extension agents have sufficient functional capacities to conduct their work; and
- Extension agents are backstopped by nutrition specialists or programs.

In working with nutrition-focused extension programs, several things must be kept in mind. The first is the issue of *scale*. As noted by Fanzo et al. (2015), few of the integrated nutrition extension programs work at scale. As we continue to work on best-fit approaches by adapting to local conditions, we need to consider how programs could be scaled up to reach more people and have more impact.

The second issue is that of *sustainability*. Political support is crucial for this. Projects focused on specific topics can come and go, but national governments must focus on strategies and policies and the resources needed to implement them.

Finally, as noted by Fanzo et al. (2015), little *documentation* is available on the effectiveness of nutrition programs integrated into extension services. More research is needed to show the value for money and impact of such programs.

2.2. Additional Areas of Note for Extension Today

As mentioned at the beginning of the paper, after going into detail on F2FE and the integration of nutrition into extension messaging, we touch briefly on other key areas for extension today. These include the use of information and communication technology, pluralism and producer organizations, and capacity for extension.

2.2.1. Information and Communication Technologies (ICTs)

ICTs are seen as crucial for sharing information and supporting and scaling extension work (Raj and Bhattacharjee in press). This field is evolving rapidly and many examples exist. For instance, the www.betterextension.org website lists the following global good practice notes on ICT for extension services published in 2015:

- Navigating ICTs in Extension and Advisory Services
- Videos for Agricultural Extension
- Social Media for Rural Advisory Services
- Web Portals for Agricultural Extension and Advisory Services
- mExtension – Mobile Phones for Agricultural Advisory Services
- Using Radio in Agricultural Extension

Many opportunities exist to strengthen extension through the use of ICTs. This includes tools to disseminate information, but also those that allow extension agents to strengthen their individual capacity through training and knowledge sources.

However, there is still a dearth of research on the real effectiveness of ICTs for extension and not many examples at scale (see Aker 2011). ICTs are meant not to replace but rather to

supplement the work of extension agents, and are likely to perform better if there is a credible source of content and real interactions to answer follow-up questions, troubleshoot problems, and otherwise complement the ICT tools themselves. ICTs are potentially useful for basic and straightforward messages but may not be the best tool for more complex messages such as natural resource management or integrated pest management.

2.2.2. Pluralism and Producer Organizations

Today there is great recognition of the many different types of actors providing advisory services. The private sector, producer organizations, and NGOs provide many services in rural areas. For instance, as a result of reforms of public extension in the 1990s, Brazil's extension system became highly pluralistic, with over 400 agencies, including the state, farmer associations, cooperatives, trade unions, companies, and NGOs (Babu, Sette, and Davis 2015). Agro-dealers are one type of private extension provider operating in rural areas. Although slightly dated, research shows both a certain level of effectiveness as well as questions as to how effective agro-dealers actually are (both in Kenya; see Maina and Gowland-Mwangi 2011 and Odame and Muange 2011). In general, these providers need basic technical and functional competencies to do their jobs well (Davis 2015). An important note in this regard is the continuing role of government in coordinating and regulating service provision to ensure quality.

We noted earlier that producer organizations play an important role in extension (GFRAS 2015), Based on a review of empirical literature and an iterative process similar to grounded theory, where hypotheses were continuously checked in the field, the paper concluded that producer organizations are critical for extension because they:

- Understand their members' issues and needs;
- Have the trust of members and the local community;
- Can help link producers to other actors in agricultural innovation systems; and
- Can provide complementary services such as financial services and farmer advocacy (GFRAS 2015).

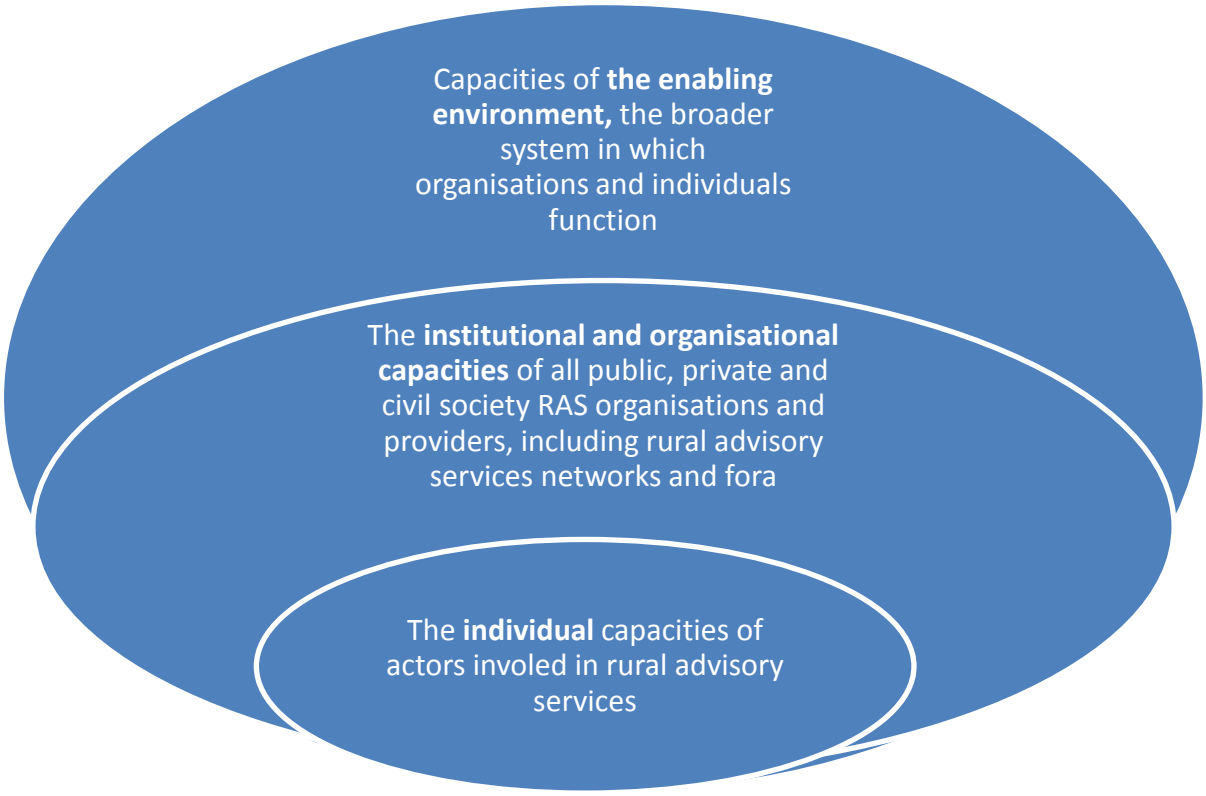
In some cases, producer organizations may be in a position to provide advisory services to their members, particularly when they are marketing high-value cash crops. Producer organizations often need strengthening in the following areas with regard to providing such services (ibid.):

- Better governance and management of the organization;
- Strengthened capacity to provide services, such as monitoring and evaluation and linking to research; and
- Better integration of women and the rural poor in their organization.

2.2.3. Capacity of Individuals, Organizations, and Systems

The issue of capacity cannot be emphasized enough with regard to extension and advisory services. This is addressed in depth in the *New Extensionist* document by the Global Forum for Rural Advisory Services (GFRAS) (Davis and Sulaiman 2014). Nearly every area covered in this paper highlights the need for strengthened capacity. As noted by Davis and Sulaiman (2014), capacity strengthening must occur at three levels: individual, organizational, and system (Figure 6).

Figure 6. Levels of Capacity Strengthening



Source: Adapted from FAO (2010).

We often focus on the individual level at the bottom of Figure 6. Organizational and even system-level capacities are important too, however, for sustainability and support of an enabling environment. For example, improving the capacities of agricultural researchers and policy makers, leading to more effective and appropriate technologies and policies, can help make extension organizations more effective. Key capacities for the enabling environment and organizational level include items such as:

- Strategic management
- Management of organizational structures and physical infrastructure
- Instillation of functional processes, systems, and procedures
- Provision of incentives and rewards
- Management of human and financial resources
- Knowledge management

However, it is at the individual level where we have the so-called *frontline extension*. Broadening the roles and functions of extension has many implications for extension's role and the functional capacity of extension agents. The call for extension to deal with a wide variety of challenges, from peace building to equipping smallholder farmers to deal with climate change, obviously has capacity implications as well. Using a global discussion and inputs from key experts, the GFRAS Consortium on Extension Education and Training developed a set of core competencies needed by extension managers and agents to function well in their jobs (Davis 2015). These include the following module titles being developed into a New Extensionist Learning Kit, a set of learning materials developed to strengthen capacity at the frontline using face-to-face, self-directed, or blended learning approaches:

1. Introduction to the *new extensionist*
2. Extension approaches and tools
3. Extension program management
4. Professional ethics
5. Adult learning and behavior change
6. Communication for innovation
7. Facilitation for development
8. Community mobilization
9. Farmer institutional development
10. Value chain extension
11. Agricultural entrepreneurship
12. Gender and youth issues in agricultural extension and rural development
13. Adaptation to change

The list is long and potentially overwhelming for training institutions to implement. However, a good number of these competency areas are widely recognized and already being addressed by many organizations (for example, value chain and marketing by Catholic Relief Services and a series by the program Modernizing Extension and Advisory Services[3]).

2.3. The Need for More Evidence and the Difficulties of Showing Impact

As seen in the preceding sections, the body of analytical insights on extension is rapidly expanding, but many gaps and questions remain as to the effectiveness and impact of various extension programs and approaches. Much more evidence on promising extension approaches, and even traditional ones, is clearly needed. This section addresses the literature on extension evaluation and points out reasons for the dearth of evidence.

It is often challenging to accurately attribute a change in some outcome variables of interest—crop yields, farm output, household income, or individual welfare—to the presence and provision of extension services. At the participant level, challenges stem from factors such as: the heterogeneous nature of conditions facing individuals and households who join in an extension activity (their endowments and constraints); variations in how those individuals and households use information provided by extension (their innovative capabilities); differences in their beliefs, preferences, and expectations (behavioral elements); and institutional factors (rules and norms) that might circumscribe their decisions. At the provision level, challenges relate to factors such as: the incentives, resources, and capabilities of individual extension agents or agencies; the nature of their relationship with the participant; and the overall objectives of the extension system.

Where such challenges are observable and measurable, evaluation tools exist to control for these differences, isolate the relationship between extension and outcomes of interest, and characterize the nature of that relationship. However, in most situations, these challenges are difficult to observe and measure, requiring more creative means of testing relationships between extension and desired outcomes.

[3] See https://sites.google.com/a/meas-extension.org/public/meas-offers/training

2.3.1. Evaluation Literature

Comprehensive approaches to evaluating the impact of extension address these challenges by combining both formative and summative techniques (see, for example, Reichhardt 1994; MacKay and Horton 2003). Formative evaluations seek to improve the activities that contribute to the program's objectives by identifying problems and remedies. Summative evaluations, on the other hand, seek to identify patterns of performance that can be assessed against criteria such as effectiveness, value, or outcomes. Evaluations may rely on a single approach or combine both approaches, and may be conducted both during (ex inter) and after (ex post) a program is implemented.[4]

Formative evaluations have long been a part of the research on extension systems in developing country agriculture. Formative evaluations include operational studies focused on organizational performance assessment, institutional learning and change, and capacity strengthening as a means of enhancing performance (Horton et al. 2003; Peterson, Gijsbers, and Wilks 2003). Formative evaluations also include case studies that draw out broad insights and lessons on extension challenges, solutions, and performance. Case studies can be conducted at several different levels. For example, some studies highlight specific organizational innovations around extension activities (Hall et al. 2002; Clark 2002). Others provide qualitative insights into governance, structure, and management of national extension systems, for example, Raabe (2008) and Birner and Anderson (2007) on India's extension system. Still others explore the role and influence of extension services provided by community-based organizations (Feder et al. 2010) or the private sector (Zhou and Babu 2015; Feder, Birner, and Anderson 2011). These supply-side analyses often focus on priorities, incentives, and accountability to better understand the inner workings of an extension system or organization (see, for example, Anderson and Feder 2007).

In the aggregate, these formative studies are useful in providing insights into alternative ways of designing extension—alternative governance and management structures, systems, and processes—to increase their impact on technological change in agriculture. They are also useful in identifying and comparing extension priorities (productivity improvement, poverty reduction, social protection, or other), focus (food staple commodities, high-value commodities, or natural resources), geography (national coverage, administrative coverage, or coverage by agroclimatic zone), type (joint research-extension projects or singular extension campaigns), and organizational attributes (participation by public, private, or civil society organizations, or combinations thereof). They are also useful in simply providing a sense of a country or organization's commitment to and prioritization of agricultural development. However, their highly aggregated analysis of systems, processes, and organizations often limits what can be said about the direct and attributable impact of a specific extension approach on technological change in developing country agriculture.

The summative evaluation literature on extension attempts to remedy these formative evaluations with its grounding in empirical analyses of technology adoption patterns, trends, and determinants. Griliches (1963, 1964) provided some of the earliest conceptual guidance by highlighting the role of research and extension in the framework of the agricultural production function. Hayami and Ruttan (1971) enhanced the theoretical structure of this relationship with their induced innovation model, which describes how sustained productivity

[4] For the purposes of this report, we defer discussion of ex ante evaluations of evaluation programs to future work.

growth results from technological changes arising from agents' responses to changes in relative factor endowments and prices. Rogers (1983) introduced the sigmoid adoption curve, attributes of adopters along that curve, and characteristics of technologies that affect the curve's shape. From here, the literature branches off into several different directions.

One branch of the literature on technological change in agriculture is highlighted by studies based on the summative evaluation approach, primarily in the form of benefit-cost analyses of research investments (see seminal papers by Alston, Norton, and Pardey 1995; Echeverría 1990; Huffman 2001). These studies are often designed to evaluate how an investment in agricultural research and development (R&D) changes the ratio at which agricultural inputs are transformed into outputs, and how the net benefits of the investment are distributed between consumers and producers. Estimation of an internal rate of return in these evaluations allows for comparison across R&D investments and in relation to alternative investments. In this context, the costs and benefits of extension are often a measured component in these studies insofar as extension reduces the lag times associated with moving innovative ideas along the continuum from basic research to applied research to product/process development, and, eventually, to experimentation, adaptation, and application (Alston, Norton, and Pardey 1995).

Among the many findings in this literature, a meta-analysis of the rates of returns to R&D by Alston et al. (2000) is worth noting. The meta-analysis makes use of 1,128 observations from more than 250 rates of return studies[5] to estimate the returns to research, research and extension, and extension projects as reported in studies conducted between 1953 and 1997. The meta-analysis takes great pains to discuss sources of bias and measurement error in the estimation of these returns, for example, the possibility that rates of return studies may omit cost elements of extension activities that are directly or indirectly part of the investment. These issues notwithstanding, their findings suggest that, all else equal, lower rates of return are indicated when the investment is made in extension only (when compared to a research-only investment), and when the investment is a combined research and extension project (as compared to either one alone). This raises questions about the returns to extension investments relative to research investments, and draws attention to the critical challenge of measurement.

Another branch of the evaluative literature on extension examines the determinants of technology adoption. Reviews by Feder, Just, and Zilberman (1985) and Sunding and Zilberman (2001) bring clarity and contextualization to the theoretical underpinnings of the technology adoption process and, implicitly, the evaluation of extension's influence on this process. Importantly, many of these studies raise the fundamental issue of measuring adoption determinants—including the role of extension—in empirical studies. Empirical estimates of the determinants of technology adoption are susceptible to several types of problems that affect our estimation of the impact of extension. Most notably, Feder, Just, and Zilberman (1985) highlighted the need to improve empirical strategies to identify a causal relationship between adoption and its determinants, and more specifically, to differentiate the complex relationships between farmers' observable and unobservable characteristics, on the one hand, and the contextual or environmental characteristics facing farmers, on the other hand.

[5] The precise number of observations and studies varies according to the type of analysis conducted. See Alston et al. (2000) for complete details.

2.3.2. Measurement Challenges

These early observations open the door to a discussion of the measurement challenges facing evaluations of extension programs, specifically, the identification of causal relationships between extension services and outcomes of interest such as learning, adoption, yield gains, or increases in income and welfare. We examine these issues below, highlighting the importance of considering sample selection bias, endogeneity, and heterogeneous effects when measuring the impact of extension. We refer readers to de Janvry, Dustan, and Sadoulet (2010) for an exposition of the challenges associated with impact evaluation and attribution with respect to agricultural technology adoption, and to Waddington et al. (2014) for a review of how common these issues are in the evaluation of FFSs, just one of several extension approaches that have been the subject of evaluation in recent decades.

First, consider the issue of sample selection bias, in this context defined as the possibility that the selection of individuals in an analysis of adoption determinants is nonrandom, such that the estimated influence of a given determinant on adoption may not be an accurate reflection of the influence on the wider population being studied. In effect, this means that the sample of farmers used in the analysis is systematically different from the wider population of interest, and that estimates of the impact of extension may be biased in some unknown direction.

For example, individuals may have self-selected into an extension program because they have some affinity for new technologies or public programs. Or they may have been targeted by the extension agent or project staff because of their social or geographic proximity; or they may have observable attributes that affect adoption such as experience, education, or wealth, or unobservable attributes that similarly affect adoption, such as cognitive capacity, willingness to learn, or preferences for ambiguity. This can be especially problematic when farmers, extension agents, communities, or others decide on an individual's inclusion in an extension programs in a manner that is not observable to the evaluator (see Baker 2000; Ravallion and Wodon 1998). Where sampled farmers are systematically different from farmers in the population of interest, any inferences about the ease with which extension contributes to technology may be biased.

Biased inferences can result in poor program design and undesirable outcomes. For instance, national-level replication of a successful pilot program might underperform if expectations are based on upwardly biased evaluation results. Alternatively, a national program might over-perform if the bias is downwards—if the sample was less likely to adopt a technology than the population at large for some unobservable reason—but overspend if program outlays were based on per-farm spending figures calculated from the sample.

Second, consider the issue of endogeneity, which in the context of evaluating extension describes the omission of confounding variables or the possibility of alternative causal relationships that challenge the attribution of outcomes (for example, learning, adoption, yield increases, or welfare improvements) to an extension program. Many factors confound the straight line of causality between extension and changes in farming behavior, technology adoption, farm income, or household welfare. The possibility of reverse causality, for example, suggests that farmers participate in extension activities because they have already adopted a technology and are seeking opportunities to share their knowledge or venues to demonstrate their technological prowess. Similarly, the possibility of simultaneity suggests that the mean behavior of a group—a farmer's peers or community or cooperative, for example—influences the individual's adoption decision, but her adoption decision in turn

influences the group's behavior, again posing challenges for estimating a causal relationship between extension and technology adoption. Without the use of methods to convincingly address possible endogeneity in the relationship between extension and technology adoption, there are real risks in assigning anything more than an association between the two.

The issue of simultaneity is particularly relevant in the context of evaluating farmer-to-farmer peer effects as discussed earlier. A rich body of evidence suggests that farmers rely on their peers and social networks as reliable and trusted sources of information on new technologies and practices in agriculture (Anderson and Feder 2007). These peer effects and social networks effectively capture the extent to which information or learning externalities accrue from one farmer to another. A seminal study by Foster and Rosenzweig (1995) examined this in the context of the adoption of high-yielding cultivars during the Green Revolution, and a significant share of adoption studies since then has routinely included some measure of social networks among their determinants of adoption.

However, few studies venture to credibly demonstrate the existence of a *causal* relationship between social networks and technology adoption: most can only claim to demonstrate an *association*. This challenge is described by Manski (1993) as the *reflection problem*, which describes the difficulty, in our context, of differentiating between an instance where two farmers adopt the same technology because one learned from or mimics the other, or because the two farmers simply share similar traits or characteristics—observed or unobserved—that independently influence their adoption decisions (see also Brock and Durlauf 2001). Estimation of the causal relationship between peer effects and technology adoption is made even more difficult when the nature of the information available through social networks is heterogeneous; for example, some farmers may have early adopting peers who had favorable experiences with the new technology, while others have peers with unfavorable experiences or no experiences whatsoever (Magnan et al. 2015; Maertens and Barrett 2012; Conley and Udry 2010).

Third, consider the issue of heterogeneity, which in this context is the ability of an evaluation to report beyond just average effects of extension on learning, adoption, income, welfare, or other outcomes for the overall population of interest, and to highlight variation in these effects on particular *subpopulations* of interest. This is of particular note where an extension program's mandate is specifically designed to reach vulnerable, isolated, or marginalized populations. This may suggest coverage of subsistence farmers, who are largely disconnected from the market or lack the farm surpluses and purchasing power to participate in market transactions, or female farmers, who may have less access to extension due to social, cultural, or economic reasons, or other subgroups whose observable and unobservable characteristics may be significantly different from the mean. Using evaluation approaches that are unable to measure heterogeneous effects may result in poor program design and undesirable outcomes similar to those described above when pilot extension programs are scaled up or replicated at the national level.

Researchers have invested heavily in finding ways to address these issues, ranging from difference-in-difference evaluation measures to various instrumental variable and matching techniques to experimental approaches designed to produce credible counterfactuals with which to compare the effects of extension on the treated against similar but untreated individuals and households (see de Janvry, Dustan, and Sadoulet 2010). The state of the art has advanced considerably in recent years, providing us with an increasingly strong toolkit to: measure the role of extension; understand both supply-side and demand-side constraints associated with extension provision and use; address selection bias; ascribe causality; and

examine heterogeneous effects with respect to extension's impact. Many of the advances are attributable to the combined efforts of disciplines as varied as economics, education, and social psychology that together aim to understand behavioral dimensions of learning. This includes understanding the nature and intensity of learning processes, the exploration of learning failures, and ultimately, the evaluation of extension programs on learning and higher-order outcomes of interest.

2.3.3. New Approaches to Measuring Impact

Of note is the increasing use of experimental methods, particularly RCTs in which the technology or training is randomly assigned to participants in an extension program as a means of mitigating the selection bias and endogeneity problems described above (see Banerjee and Duflo 2009; Duflo, Glennerster, and Kremer 2007). However, RCTs have attracted criticism by others for designs that are often poor representations of the decisions that farmers face under real-world conditions (Barrett and Carter 2010; Leamer 2010).

Another challenge with the current cohort of RCTs is that they tend to focus on the impact of a single extension approach on technology adoption: an all-or-nothing approach to evaluating what works. A finding of an early RCT in agricultural technology adoption by Duflo, Kremer, and Robinson (2011) indicates that neither the prior provision of starter kits nor participation in a demonstration plot had any significant effect on fertilizer uptake among farmers in western Kenya, whereas the nudge that encouraged adoption was a fertilizer credit and savings instrument that improved farmers' management of their consumption and investment decisions. For our purposes here, the study immediately suggests that two common extension tools—starter kits and demonstration plots—were entirely irrelevant to technology adoption in this context. This can be (mis)interpreted to suggest that extension simply does not matter.

Kondylis, Mueller, and Zhu (2014) provide an important exception to this observation. Their study uses an RCT to compare the impact of two distinct extension approaches—a conventional training and visit (T&V) model and a model that provides more direct contact and training for farmers—on the adoption of sustainable land management practices in Mozambique. Their findings indicate that direct training of contact farmers through the latter model leads to significantly larger levels of information dissemination and adoption among farmers. This kind of analysis provides a basis for comparing what approaches work in extension, and could inform future research.

Masset and Haddad (2014) provide another exception. Their study uses an RCT to examine the extent to which participant involvement in the monitoring of a farmer field school (FFS) program improves its impact among farmers using integrated pest management for rice cultivation in the Philippines. Their findings indicate that participatory monitoring increases with the number of FFS sessions attended, generating significant effects on learning outcomes but not on rice yields. This kind of analysis, apart from making effective use of an extension intensity measure rather than a simple exposure measure, again demonstrates the importance of comparing the impact of innovative approaches.

With respect to peer effects and the reflection problem described above, a growing body of literature has developed methods to isolate the impact of social networks on learning. For example, studies of peer effects that explicitly address the reflection problem often combine the random allocation of a new technology with questionnaires covering a battery of possible

peer effects to identify causal relationships (Magnan et al. 2015; Babcock and Hartman 2010; Cai, de Janvry, and Sadoulet 2015; Duflo, Kremer, and Robinson 2011; Duflo and Saez 2003; Kremer and Miguel 2007; Oster and Thorton 2012). Others use panel data to similarly identify and measure peer effects (Conley and Udry 2010; McNiven and Gilligan 2012; Munshi 2004; Foster and Rosenzweig 1995). This type of analysis provides a replicable basis for studying with greater confidence the farmer-to-farmer learning effects described earlier.

Hanna, Mullainathan, and Schwartzstein (2014) also provide an interesting new twist to the extension literature. Their study of seaweed farmers in Indonesia explores the extent to which experienced farmers learn (or fail to learn) about a technology simply by noticing key features of the data in their possession that are closely correlated with productivity improvements. They hypothesize that learning failures arise not only from insufficient information obtained by or provided to the farmer, but also insufficient attention paid to the data by farmers once obtained or provided. Their experiment was designed in a manner that allowed for the measurement of whether farmers were optimizing a given input dimension (pod size) based on whether they paid attention to that dimension. Results showed that farmers do not optimize the dimensions that they fail to notice even though they are provided with associated information, at least not until they are presented with information that specifically highlights the relationship between the specific input dimension and productivity. These results suggest that information provision is a necessary but insufficient condition for technology adoption, and that identification of information that is otherwise neglected or unnoticed is required to elicit behavioral changes and technology adoption.

Their investigation is but one of several studies that illustrate the interactions between technology, information, and behavior. Many of these studies build on the groundbreaking integration of psychology with economics by Tversky and Kahneman (1973, 1992). Importantly, they offer new opportunities to understand precisely how farmers learn from extension, and what learning approaches fit well with heterogeneous farmer populations.

Of course, while studies in this vein provide useful insights, it is important to take care in drawing conclusions about the performance of an extension intervention simply from the results of a single study or even a few related studies. Given the peculiarities in the context or deficiencies in the way the intervention was implemented, it is rare that a single study or set of studies can provide a definitive evaluation of a given extension approach. Few venture into identifying whether poor performance is attributable to how the extension approach was implemented versus the underlying principles of the approach versus the technology or practice promoted as part of the intervention. Even fewer venture into establishing broad external validity by identifying the conditions and populations under which replication and scaling up of the extension approach might be successful.

Moreover, while many of these studies do well in measuring the efficacy of extension approaches, learning dynamics, and peer effects, they rarely venture back into the realm of cost-benefit analysis. During the past 15 to 20 years, little has been written on the cost-effectiveness of extension when compared to evaluative literature on efficacy. This may be due to inherent measurement challenges, the passé nature of rates of return studies, credibility gaps created by self-evaluation studies, or a host of other factors (see Alston et al. 2011).

Similarly, a lot less has been written on the effects on extension service provision attributable to different incentive systems for extension agents. Since extension agents in developing countries are often expected to spend a significant amount of time in the field with farmers or moving across large distances between farms, it is often difficult to monitor or measure their

activities. When combined with differences in extension agent capabilities, variability in weather and market conditions, and other such factors, it is difficult to measure the impact of an individual extension worker's effort on the various outcomes of interest noted earlier. Studies of similar phenomena have been conducted on education in developing countries (see Banerjee and Duflo (2016) for a brief review of civil servant absenteeism). Studies in a similar vein on agricultural extension would be a novel contribution to the evaluation literature.

Finally, the question arises as to whether formative or summative evaluations have had a significant influence on the design and execution of extension programs in developing countries. The impact pathway of extension evaluations is often indirect, as evaluations may influence design and execution by: (1) improving the quality of discourse and discussion among researchers and analysts who often design extension programs for governments; (2) providing practitioners, advocates, and other stakeholders with evidence and insights that are used to make the case for greater investment in extension or changes in the design of extension programs; (3) providing farmers, farmers' associations, and community organizations with similar evidence and insights; or (4) influencing policies, investments, rules, and regulations that govern extension and are designed and implemented by key ministries, departments, and agencies.

Significant variation clearly exists in the extent to which *evidence* on extension's impact is able to influence decision-making. Many evaluations indicate instances where extension programs have had limited impact (see, for example, Waddington et al. (2014) for a review of evaluations on FFFs' impact). Other evaluations demonstrate that such impact, where measurable, has come at an unacceptably high cost (see, for example, Anderson, Feder, and Ganguly (2006) on the T&V approach). Still others demonstrate that impact is highly sensitive to context and approach, often heterogeneous across different subpopulations of interest, and sometime accompanied by unintended but nontrivial consequences. However, the influence of such evaluations on public investment in extension remains limited. Even in instances where major donors withdraw their backing for a particular extension approach, developing country governments, NGOs, and many others actors in the wider innovation system persist with the approach.

In some cases, such persistence pays off with a little tweaking at the margins or innovative adaptations of the approach. However, in other cases, the persistence reflects a tendency toward hysteresis, or a long lag between the impetus for systemic change and the change itself.

If nothing else, this suggests the need for continued evaluation of both the efficacy and cost-effectiveness of extension programs and approaches. It also suggests the need to take extension evaluation more seriously: rather than focus primarily on evaluation of a given technology's performance, emphasis could be placed on evaluation of the technology's performance under different learning approaches. In other words, for a given technology, if evaluators are able to demonstrate that extension approach A can increase the technology's benefits by some measurable degree when compared to extension approach B at some cost per farmer, then there is scope for evaluation to play a more influential role in shaping extension policies and investments in developing country agriculture.

Considerable scope exists for improving the evaluation of extension programs—both national programs and more project-based activities—in a manner that provides comparative insight into the efficacy and cost-effectiveness of alternative extension approaches. Again, whereas

many evaluations are designed around the question of whether a particular technology or practice works, the broader question we should be asking is what types of learning approaches work well with a given technology or practice, at what cost, and how those approaches might be improved. Evaluations of ICT initiatives in extension, given their faddish popularity, are especially relevant in this context (see Aker 2011), but the same lesson applies to other approaches such as FFFs and T&V models, both of which are still in use today (Waddington et al. 2014; Anderson, Feder, and Ganguly 2006).

2.3.4. Extension and Advisory Services: Lessons for the Future

Extension and advisory services are widely recognized as important components of agricultural development strategies. Yet they do not have the high profile in development debates of other components, such as agricultural research. This is partly due to the fact that it is difficult to show evidence of their impact, as reviewed above. Another reason is that crop and livestock researchers are also better organized and their work is well documented and widely shared. In contrast, the extension community's voice and experience are less frequently heard (Christoplos 2010). Anderson's comment that research on extension and advisory services is chronically underfunded is as true today as when he made it in 2008 (Anderson 2008).

Nevertheless, the literature on the contributions of extension and advisory services to agricultural development is growing. As mentioned earlier in the section on difficulties in showing impact, some studies are primarily formative, seeking to improve design and implementation of extension initiatives such as their governance and management structures and processes. Others are more summative, focusing on measuring and documenting an extension approach's impact on such variables as adoption, yield, and income. Assembling cases documenting lessons learned and impacts would be important for informing a range of audiences: policy makers, researchers, donors, and designers and managers of development initiatives. It would also be important for raising the profile of extension and advisory services in global debates and sharing extension's lessons and achievements with stakeholders.

This section examined the difficulties in extension evaluation and the requirement of better methods for the future. Next we use a best-fit framework to analyze these approaches and make recommendations for improvement.

3. APPLYING THE BEST-FIT FRAMEWORK: WHERE DO APPROACHES WORK? UNDER WHAT CONDITIONS?

As stated earlier, the best-fit framework enables users to examine the major characteristics of extension services on which policy decisions must be made: (1) governance structures, (2) capacity, organization, and management, and (3) advisory methods. The framework further identifies four sets of *frame conditions* that should be considered when deciding extension characteristics: (1) the policy environment; (2) the capacity of potential service providers; (3) the types of farming systems and the market access of farm households; and (4) the nature of local communities, including their ability to cooperate.

We thus examine first how the characteristics of extension services apply to F2FE and integrated nutrition extension (Table 5). We then apply the frame conditions to these approaches (Table 6).

Table 5. Characteristics of Extension Services Applied to F2FE and Integrated Nutrition Extension

Characteristics of Extension Services	Approach	
	F2FE	**Integrated nutrition extension**
Governance	F2FE is often a link between a project, government extension services, and local community. F2FE programs embedded in a research or extension program can only be as effective as that program. The stronger the role of local communities in selecting farmer-trainers and monitoring them, the more accountable farmer-trainers are likely to be to the community.	Varies but there are implications for links with the Ministry of Health and various funded projects.
Capacity	Projects typically bring additional resources for training and implementation; farmer-trainers require capacity strengthening; government services require capacity on how to work with farmer-trainers.	Agents need special training on nutrition messages; best if backed up by subject matter specialists who have expertise in nutrition.
Management	Varies according to project but issues to consider include coordination, incentives, and training. In the F2FE examples in this paper, extra resources were brought by project partners, such as NGOs who funded transportation of farmers and training.	Varies. Implications regard the core mandate of extension vs. special project needs, that is, nutrition Include nutrition messages that can fit within existing work portfolios. Back up frontline extension agents with nutrition subject matter specialists. Allow subject matter specialists to serve as technical advisors and coordinators for a larger team of extension agents.
Approaches	Community-based extension; demonstrations; market-oriented extension approaches. While farmers appreciated farmer-trainers and found them effective, they still preferred project extension staff as an information source.	Demonstrations, flyers, leaflets; adult education approach; community health approach Expand the nutrition messaging toolbox using ICTs. Use food-based approaches to extension. Engage the community by promoting model farmers in nutrition, empowering community members to serve as change agents for nutrition.
Cross-cutting areas	Good approach to use to increase services to female farmers, or to increase the number of female leaders or trainers To achieve a high proportion of women among farmer-trainers, it is usually necessary to proactively recruit female farmer-trainers.	Invest in female extension agents.

Source*:* Authors, partially adapted from Fanzo et al. (2013).

Table 6. Frame Conditions Affecting F2FE and Integrated Nutrition Extension and Implications

Frame Conditions Affecting Extension Approach	Approach	
	F2FE	**Integrated nutrition extension**
Policy environment	Availability of sufficient resources to invest in social mobilization and group formation may be necessary, at least from an organizational-level policy Lack of any extension policy is an issue in most countries Some countries have a more supportive environment with regard to emphasis by the Ministry of Agriculture or state leader. Many times policies are mainly on paper and providers lack the resources to actually implement.	A strong relationship must exist between the Ministry of Agriculture and Ministry of Health at national and/or local level. A supportive environment and resources are critical to allow extension agents to engage in health messaging. At least organizational policies if not national ones must be in place to provide the necessary capacity and incentives to work in this area. Catalyze ministerial collaboration and coordination. Engage policy makers to stimulate political will.
Capacity of providers	Providers of extension must really focus on empowerment and adult education approaches to enable farmer-trainers to function well.	Basic training is needed in nutrition and/or health for frontline agents; backup is needed by subject matter specialists. Equip extension agents with functional skills such as participatory needs analysis, communication, facilitation, management, and gender awareness. Include continuous professional development and mentoring to strengthen competencies.

Table 6 cont.

Frame Conditions Affecting Extension Approach	Approach	
	F2FE	**Integrated nutrition extension**
Production systems	F2FE likely works best in areas where there is medium to high agronomic potential and local markets nearby. Since the approach targets female trainers well, we recommend focusing on products where women may have a comparative advantage such as high-value vegetables or small animals. A suitable business climate and commercialization would aid farmer-trainers to earn income from providing training and other services. F2FE is likely more suitable for simpler messages and/or demonstrations, rather than highly complex techniques where higher levels of training and sophisticated demonstrations are necessary (for example, integrated pest management).	This approach would be most effective where there are high levels of food and nutrition insecurity, and limited opportunity for diversification of crops.
Community aspects	F2FE likely works best in areas with high social capital (farmers are organized) and an absence of strong social hierarchies, a relatively high population density (which reduces transportation constraints), and high community trust. F2FE was appropriate for a wide range of enterprises and innovations. F2FE may not be appropriate for high-risk and technical enterprises and practices (for example, certain crop-spraying practices), innovations where cost of an error may be very high (for example, treatment of livestock diseases), or for what are essentially permanent decisions (for example, siting of water control structures). F2FE is less suited to high-income, commercial systems, where opportunity cost of labor is high. Clientele should have at least basic education levels. Post-conflict areas may be difficult for this approach. ICT infrastructure is not critical to the approach. High ethnic/language diversity would indicate use of this approach to better reach marginalized farmers.	This approach would be most effective where there are high levels of literacy. In areas with high illiteracy levels, visual and verbal nutrition messages can be used. High community trust and the extension professional being a community member are advantageous. ICT infrastructure is not critical to the approach.

Source*:* Authors, partially adapted from Fanzo et al. (2013) and Davis and Heemskerk (2012).

3.1. Scaling

As noted in earlier sections, evidence is limited about the success of scaling up programs such as F2FE and integrated nutrition extension. For F2FE, a scaled-up version of the program may not be as effective because supervision and coordination may not be as strong in a large-scale program as in a pilot. With nutrition extension, simple messages or packages (such as promotion of kitchen gardens) could be taken to scale if the necessary training of frontline agents has occurred and operational resources in the support programs are sufficient. However, in both cases, moving from the pilot stage to a large-scale program requires continuous and nontrivial levels of investment in both monitoring and formative and summative evaluation.

3.2. Sustainability

We approach sustainability from a holistic manner, including social, economic, and environmental sustainability. Since most extension approaches and programs focus on economic sustainability, we do too, but programs also need elements of social and environmental sustainability.

F2FE appears to have strong elements of sustainability. For instance, increased numbers of farmers can be reached and greater adoption can occur because farmers are more willing to learn from their own colleagues. Using local farmer-trainers can enhance the sustainability of extension efforts both socially and economically. It has been shown that farmer volunteer activities sometimes continue indefinitely after projects end, with participation in other organizations and projects. Farmers' motivations to help others (that is, to receive training and accrue social benefits) are often sufficient to maintain their interest in training others. It is also noteworthy that farmer-trainers are increasingly able to earn income from selling inputs or services associated with their extension activities, including from offering training. However, some concerns are (at times) farmers' expectations in terms of financial and nonfinancial rewards, high dropout rates, and limited budget to support farmer-trainers. Furthermore, the approach still often depends on continued support from extension services. Finally, farmer-trainers are more effective when motivated through learning new and effective practices.

It is more difficult to ensure economic sustainability of nutrition extension services. Perhaps the best approach in this regard would be to use a modified F2FE approach similar to community health workers, where a cadre of local community members acts as focal points for nutrition messages. They must be backed up by extension and subject matter specialists, however.

4. SUMMARY AND TRANSFORMATIVE INVESTMENT RECOMMENDATIONS FOR DECISION MAKERS

The overall goal of this report was to update information on key areas of extension knowledge and perspectives in the past three years and to identify areas where (1) further evidence on extension through commissioned research is needed, and (2) extension investment practices should be reconsidered.

We did this with in-depth sections on F2FE and the integration of nutrition in extension messaging. We also included some brief informational sections on the use of ICTs in extension, pluralism, and producer organizations, and the need for capacity at all levels of extension services. We then used a best-fit framework to identify the extension characteristics and frame conditions that should be present to effectively use F2FE and nutrition messaging. We now conclude with specific recommendations on extension for extension investors, be they national governments, foundations, or bilateral donors. We also identify extension interventions that governments and projects should consider to improve the uptake of improved practices.

4.1. Recommendations on Further Evidence and Documentation on Extension through Commissioned Research

a. Invest in summative evaluations of both the efficacy and cost-effectiveness of extension programs and approaches. Specific research includes the impact of ICTs on program goals and scaling up of F2FE and nutrition extension services.
b. Invest in formative evaluations of extension programs and systems to better understand the wider context and processes that contribute to success, replicability, and scaling up.
c. Systematically document lessons learned and good practices in extension in a manner that synthesizes evidence from multiple approaches to evaluation.

4.2. Reconsiderations for Extension Investment Practices

a. Use a systems approach rather than focusing on system components; in addition to extension methods and tools, address the policy environment, political support, capacities of providers and clientele, governance and management of extension and rural development, and coordination among actors.
b. Adapt programs to context and the unique attributes of a given clientele—the production system, agroclimatic conditions, sociocultural characteristics, socioeconomic institutions, and so on—and avoid standardized approaches and trendy labels.
c. Focus investments on more than just technological solutions in agriculture by exploring grants that experiment with novel learning approaches for adult farmers (both female and male), and other target groups of interest. (For example, explore F2FE, community-centric video-based extension, and other approaches in a strategic and concerted manner to reach more small-scale farmers, female farmers, and female trainers in a more effective manner.)
d. Ensure functional capacities are in place for extension providers from all sectors through pre-service or in-service (topping up skills) training for extension agents.
e. Provide training to project partners and grantees on the use of various extension approaches and the other critical elements (governance, management, capacity, etc.).

f. Strengthen sustainability of programs by working through existing national and international structures and networks.

4.3. Platforms for Discussing Extension Internationally

a. Engage in high-level policy dialogue with state leaders on how to systemically strengthen extension and better invest in extension for improved outcomes in nutrition, health, and livelihoods.
b. Use evidence to engage in policy dialogue to promote an enabling environment for extension programs.
c. Engage with the private sector and NGOs in extension provision.
d. Use convening power to promote knowledge sharing and experience exchange in personal and program experiences with promising extension approaches.

4.4. Extension Interventions that Investors Should Consider in Priority Geographies to Improve the Performance and Impact of Investments on Smallholders

a. Assist grantees and partners to share experiences and lessons and use state-of-the-art extension approaches.
b. Improve the performance of existing extension services operating in target geographies.

Given the significance of the last two, we discuss each in more detail:

4.5. Assist Projects Supporting Extension to Share Experiences and Lessons on Extension and Use State-of-the-art Extension Approaches

We did not conduct an inventory of extension approaches used by agricultural development projects, but we have seen many of them. Our observation is that some projects use innovative extension approaches effectively and learn important lessons, but have no way to share these lessons with other extension projects. A case in point is the effective methods that Technoserve has used to increase the number of female farmer-trainers as a means to empower women and increase their access to extension services (see a. on p. 11). Providing a forum, such as a workshop, for representatives of partners to share their experiences and lessons in extension could help projects to improve their performance in this area.

A second observation is that many projects are not taking advantage of recent lessons that have been learned about novel extension approaches and how to make existing approaches more effective. Workshops to expose and train project partners on state-of-the-art extension approaches could help them to improve their own approaches. These workshops could perhaps be combined with the ones proposed above on exchanging experiences and lessons.

4.6. Improve the Performance of Existing Extension Services

While extension projects do engage the extension services operating in their geographies, many of these services, which include services managed by governments, NGOs, farmer organizations, and the private sector, are of limited effectiveness, and at times may operate at cross-purposes. We propose that investors and researchers conduct rapid, diagnostic, formative evaluations of extension systems in target geographies to identify roles and

capacities of extension providers, enabling environment, and constraints and low-cost opportunities to make extension systems more effective. These studies could be done at a national or province/district level. Possible innovations to improve effectiveness could include coordinating mechanisms, policy changes, policy implementation measures, capacity strengthening, and measures to enhance private sector and civil society participation in extension initiatives. Examples of such evaluations conducted by USAID's Modernizing Extension and Advisory Services project are shown at http://www.meas-extension.org/meas-offers/country_studies.

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