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Promising Approaches to Address the Needs of Poor Female Farmers

Resources, Constraints, and Interventions

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ABSTRACT

Recognizing that "gender matters," many development interventions have aimed to close the gender gap in access to resources, both human and physical, and to address the specific needs of female farmers. This paper critically reviews attempts to increase poor female farmers' access to, and control of, productive resources in Sub-Saharan Africa and South Asia. It surveys the literature from 1998 to 2008 that describes interventions and policy changes across several key agricultural resources, including land, soil, and water; labor-saving technologies; improved varieties; extension services; and credit. Compared with interventions designed to increase investment in human capital, only a minority of interventions or policy changes designed to increase female farmers' access to productive resources have been rigorously evaluated. Future interventions need to consider interactions among inputs rather than treat each input in isolation, adapt interventions to clients' needs, and pay attention to the design of alternative delivery mechanisms, the trade-offs between practical and strategic gender needs, and the culture and context specificity of gender roles.

Keywords: gender, agriculture, interventions, Sub-Saharan Africa, South Asia

1. INTRODUCTION

A wide-ranging literature, published mostly in the 1990s, has alerted development practitioners to the differential constraints faced by poor female farmers, particularly those in Sub-Saharan Africa and South Asia (Due and Gladwin 1991; Saito, Mekonnen, and Spurling 1994; Gladwin 2002). Many of these studies point to women's lack of access to land (see Agarwal 1994 for South Asia and Lastarria-Cornhiel 1997 for Africa), extension services (Saito and Spurling 1992), credit, and improved crop varieties, as well as women's generally low levels of human capital in terms of inadequate schooling and poor health and nutritional status (World Bank 2001). The cost of such gender disparities in productive resources has been well documented (World Bank 2001). In particular, a growing body of empirical work has suggested that increasing resources controlled by women could promote increased agricultural productivity (Saito, Mekonnen, and Spurling 1994; Udry et al. 1995; Quisumbing 1996). In addition to identifying gaps in resources controlled by men and women, Udry (1996), Kevane and Gray (1999), and Kevane (2004) pay particular attention to possible inefficiencies in intrahousehold allocation and the interaction between economic factors and defined gender roles as particular constraints to improvements in productivity and well-being in Sub-Saharan Africa. Doss (1999), in the context of identifying constraints to the adoption of new improved varieties and crop management systems in Africa, finds that African households are complex and heterogeneous, that gender roles are equally complex and embedded in agricultural and nonagricultural production systems, and that these roles and responsibilities are dynamic, responding to changing economic circumstances.

Recognizing that "gender matters," many development interventions have aimed to close the gender gap in access to resources, both human and physical, and to address the specific needs of female farmers. A large literature documents promising interventions to improve women's health, education, and nutritional status (see, for example, the *Lancet* 2008 series on undernutrition; King, Klasen, and Porter 2007; Allen and Gillespie 2001), which we will not review here. However, the literature on new approaches that address the productive needs of poor female farmers is still relatively "thin," is typically confined to one key resource (such as land), without consideration of the interaction among other resources, and tends to be in the "gray," or unpublished, literature. This paper attempts to address this gap in the literature by reviewing recent attempts to address the needs of poor female farmers, focusing on Sub-Saharan Africa and South Asia. Our paper attempts to answer the following questions: (1) Are women more constrained in access to, and control of, productive resources? (2) What are the key intervention strategies to address constraints to accessing such resources? (3) What are some of the promising approaches that have been used in the field? and (4) Have those approaches been rigorously evaluated, and what are the implications for scaling up?

We conducted reviews of the published and gray literature from the last 10 years (1998–2008) that describe interventions or policy changes in the areas of land, water, and soil fertility; new varieties and technologies; extension; labor; access to markets; credit and financial services; and social capital and infrastructure support services. We focused on those interventions or policy changes that had been evaluated, noting that those make up a minority of interventions reviewed. Based on that review, we identify areas for further research and action.

2. LAND, SOIL FERTILITY, AND WATER

Land

Women are often disadvantaged in both statutory and customary land tenure systems (Agarwal 1994; Lastarria-Cornhiel 1997; Kevane 2004). They have weak property and contractual rights to land, water, and other natural resources. Even where legislation may be in place to strengthen women's property rights, lack of legal knowledge and weak implementation may limit women's ability to exercise their rights.

Many explanations have been proposed for the existence of productivity differentials among male and female farmers, particularly in Sub-Saharan Africa. Udry (1996) found 30 percent lower productivity on female plots than on male plots within households in Burkina Faso, because labor and fertilizer (manure) tended to be more intensively applied on men's plots.[1] Goldstein and Udry (2005) attributed the productivity differential among male and female farmers in Ghana to women's higher level of tenure insecurity, which renders them less likely to invest in fallowing their land since they risk losing the land if they are not actively farming it. Holden, Shiferaw, and Pender (2001) found that female-headed households in Ethiopia have lower land productivity, owing to resource poverty (insufficient male labor and oxen) and low substitutability among factors of production.

Imperfections in land rental markets may lead to large productivity differentials that are not gender neutral: not only is female-headed households' land used much less productively than land cultivated by male-headed ones (Holden, Shiferaw, and Pender 2001), but female-headed households also tend to rent out their land to tenants with much lower productivity (Bezabih and Holden 2006; Holden and Bezabih 2007). Bezabih and Holden (2006) applied a double moral hazard model with tenure insecurity and transaction costs to data from Tigray to explain the productivity differential. In their model, female-landlord households were more tenure insecure and were therefore less able and less likely to use threat of eviction and contract renewal as an instrument to enhance productivity on rented-out land. An alternative explanation is that female landlords faced higher transaction costs in the land rental markets and therefore had greater difficulty evicting inefficient tenants and searching for and finding more efficient tenants. Indeed, Holden and Bezabih (2007) found significantly higher levels of inefficiency linked to contracts of female landlords with in-law tenants, owing to the difficulty of evicting one's relatives and the high transaction costs of tenure-insecure female landlords who are less able to freely screen and select the better tenants. An important policy implication of their analysis is that strengthening women's land rights may be good not only for equity but also for efficiency of land use.

Indeed, following a low-cost, rapid, and transparent community land registration process in Ethiopia, female heads of household in Tigray were more likely to rent out land, because tenure security increased their confidence in doing so (Holden, Deininger, and Ghebru 2007). The Ethiopia land certification scheme is worth noting because land administration committees at the *kebele* level (the smallest administrative unit in Ethiopia) were required to have at least one female member and land certificates were issued after public registration for transparency (Deininger et al. 2007). The land certificates included maps and pictures of husband and wife.[2] Holden, Deininger, and Ghebru (2007) argue that land certification had a greater impact on women's participation in the land market because land certificates may be more valuable to women, whose tenure rights have been less secure than those of men. In Ethiopia, participation in the land rental market may have been women's best option to obtain returns to owned land because cultural norms do not favor women's cultivating the land themselves. Single women or married women without an able-bodied man in the household would have to depend on

[1] These findings are not inconsistent with Quisumbing's (1996) findings that managerial ability does not differ between male and female plot managers, if all inputs are controlled for. Studies that document yield differences between male and female farmers attribute them to the differential application of inputs to men's and women's plots.

[2] Having photos instead of signatures may increase the difficulty of husbands to sell or rent out land without their wives' consent; photos are also more meaningful in a society with very low literacy rates.

assistance from other, unrelated men to cultivate their land. Participation in the land rental market as landlords increases women's options to obtain returns from owned land.

Participation in land markets may be critical to women's ability to sustain a livelihood, even if only in the land rental market. Indeed, women may find leasing land easier than purchasing it because leasing does not create long-term secure property rights in the borrower/lessee. In Burkina Faso, the increased and changing market value of land has had the surprise effect of creating avenues outside of traditional channels for women to lease land over the long term, anonymously (Bruce 2006). Male landholders who have excess land are more willing to lease to women because women cannot claim permanent rights to land. Husbands generally support this borrowing of land by their wives, and women are therefore better able to cultivate land independently, even though they do not own it (Giovarelli 2006).

Change is needed in property rights laws so that women may hold individual or joint title to land. But for legal change to translate into change on the ground, legal awareness is important. Deininger, Ayalew Ali, and Yamano (2008) found that households' awareness of their land rights as defined by the 1998 Uganda Land Act, which strengthened tenure security and legal protection of customary owners and women, increased the propensity to undertake soil conservation measures. An increase of a household's legal knowledge by one element would, according to the coefficients, result in an increase in the propensity to undertake soil conservation that is equivalent to increasing the length of possession by more than 15 years or the head's level of education by more than seven years. Moreover, the finding that only a minority of land users are aware of such provisions suggests that legal literacy campaigns can have a potentially large impact on agricultural productivity.[3]

Consistent with the above, several innovative pilot interventions have been used to build awareness about women's property rights, although it is important to note that these have not yet been evaluated. In Zambia, the Justice for Widows and Orphans Project, a network of nongovernmental organizations (NGOs), has established community-level advice groups for women and trains them on property law and the writing of wills. In Zimbabwe, Women and Law in Southern Africa trains community-based paralegals on inheritance laws. And in Rwanda and Kenya, NGOs are promoting marriage registration, oral and holographic wills, and memory books because lack of identification cards and low literacy rates among women constitute a major impediment to acquiring land title (Knox et al. 2007).[4]

In situations where women face labor market discrimination, obtaining access to land may be even more important to women's livelihoods. In India, returns to women's labor in own-agriculture are higher than in off-farm employment because of wage discrimination in the latter (Deininger, Jin, and Nagarajan 2006). However, this finding is very context specific. In the Philippines, where women have higher probabilities of working in nonfarm employment because of higher education levels than men, their returns in agriculture are lower than men's (Estudillo, Quisumbing, and Otsuka 2001; Quisumbing, Estudillo, and Otsuka 2004), so women are better-off participating in the nonfarm labor market than cultivating their own farms.

[3] Of course, awareness of the rights is useful only if women (and men) have those rights.

[4] Wills are tricky matters in populations with low levels of literacy and low levels of access to legal services. In such circumstances, greater flexibility in the type of will that is considered valid may be necessary. For example, an oral, or nuncupative, will is a will that has been delivered orally to the witnesses. Usually, wills are written. In the United States, oral wills are considered valid only if they are made during a person's "last sickness," witnessed by at least three persons, and reduced to writing by the witnesses within a specified amount of time after the testator's death (http://en.wikipedia.org/wiki/Nuncupative_will). A holographic will is one that is completely handwritten, dated, and signed by the person making it, and is generally not witnessed. Holographic wills are common and are often created in emergency situations, such as when the testator is alone, trapped, and near death (http://www.nolo.com/definition.cfm/Term/252FDDEE-72FB-4145-978D4F193DFE81EF/alpha/H/). Memory books rely on oral (subsequently transcribed) or written testimonies of persons regarding inheritance and bequests. Provided that reliable witnesses can be found (for example, family members or disinterested parties within the community in the case of family disputes), such nonstandard forms of wills might be better guarantees of women's land rights than standard legal documents, particularly when poor women do not have access to legal services.

Soil Fertility

While securing access to land encourages investment in sustainable land management techniques, farmers must also be equipped with fertilizer and improved seeds to reap the most productivity from their land. Gladwin (1992) finds that female heads of household uniformly apply less fertilizer than males. However, when farmer characteristics are controlled for in regression analysis, the critical factors that significantly limit fertilizer application are lack of access to credit and cash (Gladwin 1992), not the sex of the farmer. However, since female farmers have less access than males to credit and cash, they apply less fertilizer, and obtain lower yields and incomes as a result.

Targeting of credit to female farmers for fertilizer purchases has been recommended for at least a decade, as in the case of Malawi (Gladwin 1992). In a special issue of *African Studies Quarterly* (2002), Gladwin (2002) and other authors explore the gender dimensions of fertilizer use in Sub-Saharan Africa, discussing both inorganic fertilizer as well as biomass-based soil fertility replacement techniques. Policymakers' interest in fertilizer voucher programs has increased recently with the successful (partly because of good rains) implementation of a fertilizer and seed voucher program in Malawi in 2006–2007. A team composed of members from Imperial College London, Wadonda Consult, Michigan State University, and the Overseas Development Institute evaluated that program and reported their findings in 2007. We present many of the recommendations in that report, with modifications to make them more gender sensitive.

Gladwin (2002) has recommended distributing vouchers through women's farm clubs. In the Malawi context, the evaluation team found that there is an existing local government structure that reaches all rural farming households, which is not the case with farm clubs, and focus groups with women revealed that vouchers were, in general, distributed without any discrimination by gender.[5] Although vouchers were in the past an effective vehicle for the administration of subsidized fertilizer on credit, their reach was generally limited and most of these clubs have disbanded. Attempts to create a large-scale network of clubs for distribution of coupons or fertilizers would be very costly in terms of time and human resources. In addition, the evaluation team argues that distribution using local government structures will help in strengthening the decentralization process. While these findings are relevant to Malawi, they will have to be adapted for application in different countries and contexts. For example, different local organizations may be appropriate in other places. In some countries, local government may be the best conduit; in others, it may be civil society organizations. In Nigeria, for example, several female farmers reported that they could not apply fertilizer to their own plots because the subsidies were controlled by their husbands (Valerie Rhoe, personal communication, 2008). So, while using existing structures to distribute fertilizer vouchers may be more cost-effective, whether such structures allow women to be reached should be assessed prior to the implementation of any sort of voucher distribution program.

The evaluation team recommended the implementation of "flex voucher" schemes that are not restricted to specific types of fertilizer or seeds; such vouchers should be given a nominal face value approximately equal to the subsidy they represent (or could be indexed to protect against price increases). Flex vouchers are less likely to crowd out the private marketing system because they are not tied to the purchase of a specific product (which could be subject to supply bottlenecks, or which could be monopolized by government providers).

Additional recommendations from the Malawi fertilizer voucher subsidy scheme include the following: extend the subsidy to all smallholder farmers, not just maize growers, but without additional allocations to cash crop growers and with a lower subsidy per recipient to keep the overall budgeted cost roughly similar to that of 2006–2007; provide farmers with more choices of inputs and fertilizer bag sizes to buy at subsidized prices; give coupons a nominal face value approximately equal to the subsidy they

[5] Nevertheless, the need to travel long distances to markets with stock and to wait in queues, either overnight or from very early in the morning, placed particular difficulties on access by the poor and by women. Increased demands for tips or small bribes in congested situations pose further problems (Imperial College London et al. 2007, 55).

represent; and when the coupons are redeemed by input sellers, augment the fixed face value by a district-specific "location premium" to cover the cost of transportation to remote areas.

A recommendation that is applicable in a variety of settings, and to different types of inputs, is packaging inputs for sale in smaller units. To address women's cash constraints, Gladwin (2002) recommends the introduction of *small bags* of fertilizer in local shops or market stalls, or sales of fertilizer by the kilogram—this would benefit poor farmers in general, who often do not have enough cash to purchase 50-kilogram bags of fertilizer. Where women do not have enough cash to pay for fertilizer, fertilizer-for-work programs can be targeted to women or fertilizer can be sold to women in small bags at lower cost. Introducing a high-value cash crop into women's cropping systems so that they can use the income from the cash crop to pay for fertilizer use on their food crops is another strategy for ensuring their ability to adopt.

A major problem with providing policymakers with recommendations regarding fertilizer delivery to female farmers is that alternative means of providing subsidized fertilizer and seed packages (starter packs, vouchers, and so forth) have not been rigorously evaluated against other alternatives. The recommendations in Gladwin (2002) involve linear programming and other simulations; a field-based evaluation would be better at identifying constraints to implementation and scaling up.

Other approaches to enhancing soil fertility include biomass transfer and sustainable soil fertility replacement (SFR) techniques (Place et al. 2007). For example, biological nitrogen fixation technologies via agroforestry innovations or grain legumes could be introduced to female farmers. Green manure or biomass transfer could also improve the soil's organic matter on women's fields. While such approaches often entail less cash expenditure than inorganic fertilizers, they may require more labor. Biomass transfer from hedgerows may be easier for women than nitrogen-fixing trees, especially where tenure restrictions prevent women from planting trees. Gendered aspects of extension services related to SFR are discussed later (see Section 5).

Water

Because of their different productive and reproductive responsibilities, men and women often have different priorities for how water is used. Yet, despite international mandates to address those differences, Rathgeber (2003) notes that gender analysis is still largely absent in the water sector because water projects are highly technical and implemented by engineers who lack the training to integrate gender concerns. While a larger literature exists on women's domestic water needs than on their productive water needs, evidence suggests that in Sub-Saharan Africa, women are often excluded from irrigation projects or stripped of their usufruct rights to land when new irrigation schemes are introduced. A well-known example comes from The Gambia, where women lost rights to grow swamp rice on communal land when an irrigation project gave control of the land to male heads of household (Carney 1988). In South Asia, even though joint agricultural holdings are more common than in Africa, there are still significant gender differences in control over water.

The social status of a potential water user and his or her wealth, influence, and credibility in the community can become important determinants of decisions concerning water policy, allocation, pricing, and monitoring. The poorest members of the community and women are often excluded from accessing irrigated water through criteria stipulating that users must own land (as opposed to using it) and be heads of household. Meinzen-Dick and Zwarteveen (1998) note that men tend to have more external ties, including political connections to irrigation officials, and are more likely to speak in public at water user association meetings, giving them greater influence over water management decisions. In western Kenya, a case study (Were, Swallow, and Roy 2006) of communities that developed their own spring protection and piped water to members' homesteads found that although women were excluded from the main water user associations, they played pivotal roles in advocating for, and initiating, the associations—even forming separate groups to raise funds for the water projects, purchase household goods, and pay school fees. Women, in particular, benefited substantially from the projects in terms of time savings, health, and small-scale production. However, communities in which men and women trusted each other less and

exchanged less information were not as successful at working collectively to mobilize male-controlled cash and labor for water user associations, suggesting that in addition to technical capacity and funding, gender relations can be an important constraint to, or opportunity for, the adoption of improved water supplies.

Women's willingness to participate in water user associations will vary, however, according to cultural norms. In a case study of domestic water needs in India, for example, a majority of women interviewed said that they preferred for their husbands to participate in water management committees and represent their wives' interests, given that there are gender norms that discourage men and women from interacting in public (Singh et al. 2006). In Zimbabwe, attempts to train women as well sinkers (persons who dig wells) to give them opportunities for skilled paid jobs failed because the intervention required male and female trainees to share the same living quarters, considered culturally inappropriate. Follow-up attempts to train a female-only team of single women also failed because of the suspicion that the women were selected not for their skill but for their desirability as single women, but when the project tried to train married women, time constraints prevented the women from being away from their families for the full length of the training. The project finally decided to train the women as latrine builders, which would allow them to still learn skilled work but remain in their villages while doing so (UNDP 2006).

Evidence suggests that water projects that can help women meet other livelihood needs are likely to be more sustainable than projects focused only on domestic water supplies. Designing water supplies for mixed use can enhance livelihoods without compromising the quality of availability of water for domestic needs. In rural Zimbabwe, where women's gardens are an important source of income and food security, the Collector Wells project developed domestic water sources that also provide enough water to irrigate the gardens by drilling horizontal boreholes to exploit shallow groundwater tables. Although the average cost of building the collector well and setting up a garden is significantly higher than that of a standard borehole with hand pump that would meet only domestic water needs ($10,600 and $4,700, respectively), the money earned from the gardens was often invested in petty businesses or saving schemes (Moriarty and Butterworth 2003).

3. LABOR

Low Levels of Investment in Human Capital

Low levels of human capital—such as that embodied in years of schooling, health, and nutritional status—constrain poor rural women in their multiple roles as agricultural producers, workers, mothers, and caregivers. The World Bank (2001) and King, Klasen, and Porter (2007) for the Copenhagen Consensus 2008 have documented the costs to societies at large of gender inequalities in women's schooling, health, and nutritional status. The intergenerational gains to investing in women's human capital are enormous: Smith and Haddad (2000), for example, attribute more than 50 percent of the reduction in child malnutrition rates between 1970 and 1995 to improvements in women's education (43 percent) and women's life expectancy relative to men's (12 percent), higher than increases in national food availability (26 percent) and the health environment (19 percent). Recognizing this, various approaches have been used to increase investments in women's schooling, health, and nutritional status. Because those approaches have been reviewed elsewhere (*Lancet* 2008; King, Klasen, and Porter 2007; Allen and Gillespie 2001), we highlight only key innovations here.

Increasing the levels of human capital embodied in future generations of female farmers needs to begin with investments in young girls' schooling. In many cases, this means increasing the incentives to families to keep young girls in school, instead of taking them out of school to work on the farm or to take over their mothers' domestic tasks. A key policy innovation has been the use of conditional cash transfers (CCTs), many of them targeted to the woman in the household, to increase investments in child schooling, health, and nutrition. In Bangladesh, the Food for Education Program, now converted to a cash transfer program, increased girls' enrollment by 44 percent and boys' by 29 percent (Ahmed and del Ninno 2002). In Mexico, Schultz (2004) found that PROGRESA, a CCT program that gave cash transfers to mothers conditional on their children's school attendance and visits to health clinics, increased enrollment rates of girls by 11 to 15 percent and boys by 5 to 8 percent. Overall, the program increased schooling by 0.66 years on the baseline level of 6.80 years of schooling, and is predicted to increase lifetime incomes by 8 percent. As a result of PROGRESA, both children and adults have also experienced improvements in health (Gertler 2000). Specifically, children receiving PROGRESA's benefits had a 12-percent lower incidence of illness as a result of the program's benefits, and adults reported a 19-percent decrease of sick or disability days. In the area of nutrition, PROGRESA has had a significant effect on reducing the probability of stunting for children aged 12 to 36 months (Behrman and Hoddinott 2005). CCT programs are now widespread in Latin America and are also starting in North and Sub-Saharan Africa.

Because of the success of CCTs in improving educational attainment, health, and nutrition, this mechanism has also been used to achieve other development outcomes, such as delaying marriage and reducing risky behavior associated with HIV/AIDS (to be discussed later). In Bangladesh, for example, the Female Secondary Assistance Project provides a stipend to girls who agree to delay marriage until they earn their secondary school certificate. The government of India also recently launched a pilot CCT program that will pay poor families to raise and educate girls (American India Foundation 2008). Called "Dhan Laxmi" after the Hindu goddess of wealth and prosperity, the program aims to change society's perception of girl children and counteract the skewed sex ratio in India, which has resulted from the widespread practice of sex-selective abortion and infanticide. The pilot CCT program will begin in 11 blocks in seven states this year. Payments from the government to beneficiary families will be spread over 18 years and are conditional on birth registration, immunization, school enrollment (with 80 percent attendance), and marriage after age 18. While there are no direct nutrition-related conditionalities, the commitment to educate girls and delay the age of marriage is likely to contribute to better maternal health, and therefore, indirectly, to improved child nutrition.

In the area of health and nutrition, nutrition policy has shifted from piecemeal approaches aimed at reducing young child malnutrition to a greater focus on female health and nutrition through the life cycle (ACC/SCN 2000). Previously, nutrition policies aiming to reduce child malnutrition treated a

pregnant woman and lactating mother as a target but not the intended beneficiary. While both the child and the mother may benefit, such a narrow approach is likely to limit the overall effectiveness of nutrition interventions and the sustainability of their impacts. A shift toward greater focus on female health and nutrition through the life cycle, as opposed to the traditional concerns with maternal nutrition during pregnancy and lactation, would benefit women more directly (Gillespie 2001). In this regard, adolescent girls are a group that deserves attention.

Because adolescent girls are not physically or emotionally ready for childbearing and rearing, prevention of adolescent pregnancy and risky behavior is essential. A rising incidence of HIV/AIDS has prompted the search for approaches that would prevent the onset of risky sexual behavior, particularly among young women. The World Bank is now implementing a randomized intervention in Malawi that provides incentives (in the form of school fees and cash transfers) to young girls who have recently dropped out of school (Berk Ozler, personal communication, 2007). Because girls enrolled in school are less likely to engage in risky behavior, keeping girls in school may also prove to be effective in fighting HIV/AIDS. Securing women's property and inheritance rights can also help prevent the spread of HIV by promoting women's economic security, thereby reducing their vulnerability to risky behaviors (Gillespie and Kadiyala 2005).

Among the specific nutritional needs of women, anemia deserves special mention because its effects on physical productivity are directly relevant to the productivity of female farmers. According to a World Health Organization review of nationally representative surveys from 1993 to 2005, 42 percent of pregnant women and 47 percent of preschool children worldwide have anemia (Kraemer and Zimmermann 2007). The major cause of iron-deficiency anemia is low consumption of meat, fish, or poultry, especially in poor people. Women of childbearing age are at high risk for negative iron balance because of blood loss during menstruation and the substantial iron demands of pregnancy (Black et al. 2008). Anemia is associated with reduced productivity both in cross-sectional data and in randomized interventions (Thomas et al. 2004; Li et al. 2003; Basta, *Karyadi, and Scrimshaw* 1979).

Some longstanding approaches to address iron-deficiency anemia include iron fortification and supplementation efforts, and there are many vehicles for fortification of iron, either as single nutrients or in combination with others. This includes home-based fortification with sachets to be sprinkled on food as well as industrial fortification of flours, rice, and salt (Mannar and Gallego 2002). The advantage of family-sized sachets is that the dispersible micronutrient supplement is added to the family pot of food so that it benefits the whole family—including mothers—and not just children beginning complementary feeding. Although sprinkles-based interventions for complementary feeding have been evaluated (Menon et al. 2007), this particular approach has not. In particular, its ability to benefit mothers crucially depends on the underlying pattern of intrahousehold food distribution.

Finally, another intervention that could allow female farmers to function in their dual roles as agricultural producers and caregivers is one that allows women to continue to breastfeed while working in the fields. The Baby-Friendly Community Initiative, coordinated by The Gambia's National Nutrition Agency, is a national multisectoral program integrating nutrition, agriculture, hygiene, and sanitation in a community-driven project. Some communities have reestablished traditional baby-friendly rest houses where women can breastfeed while working their fields and instituted a local law relieving women of hard work during the three months before and six months after delivery (Jallow 2005).

Low Labor Productivity

Low levels of human capital may be an important reason for low labor productivity, but here we focus on technology-driven approaches to improving women's labor productivity. A poor woman's labor is often her only resource, even if she may not control it completely. However, women's productivity in agriculture and home production, including food processing and preparation, is low, and many home production tasks are filled with drudgery. Given that gender norms discourage more equal sharing of home production activities between men and women, women will not be able to allocate their time to

more productive (or remunerative) uses unless their labor productivity increases through the design and adoption of culturally appropriate technologies.

Introducing technologies that reduce women's time and energy expenditures can enable women to invest in income-generating activities, childcare, or much-needed rest and leisure time. Postharvesting machinery for processing rice, for example, reduces drudgery from hand pounding, increasing the volume of rice processed and allowing women to use their time more flexibly (Paris, Feldstein, and Duron 2001). The need for such technologies is even more acute in households affected by HIV/AIDS, since women often bear the double burden of producing food and caring for the sick. But women also need access to complementary inputs in order to benefit from new technologies. For example, when fuel-efficient stoves were introduced in the 1980s to reduce women's energy burdens, conserve fuel, and decrease pollutants, women were slow to adopt them because they often lacked funds to buy them (Paris, Feldstein, and Duron 2001). Not all women, however, will benefit equally from labor-saving technologies, and thus interventions need to evaluate how different groups of women will benefit, or lose, from the introduction of technologies. While this is context specific, in general women from poor landowning households will benefit from technologies that save labor and reduce drudgery but landless women may be displaced by some labor-saving technologies, such as direct seeding, if interventions do not provide alternative employment opportunities for them.

Failed technology uptake suggests that new technology design needs to take into account culturally permissible roles for women. In Nigeria, a pedal-operated, bicycle-mounted rice thresher was introduced to female processors, but ultimately was rejected because using the thresher exposed women's thighs and wearing trousers was not a culturally appropriate alternative in the region (UNIFEM 1993). Involving women in the maintenance of new technologies can be one strategy for challenging rigid gender roles. When the Self Employed Women's Association began a campaign to mobilize women for water management in Gujurat, India, women resisted participating because they regarded the development and management of water infrastructure as male territory. However, when women became trained as hand-pump technicians to repair broken pumps, involvement in the campaign increased and women began to take ownership of water management (Panda 2006).

4. NEW VARIETIES AND TECHNOLOGIES

Because traditional agricultural research and development systems typically do not consult female farmers and end users, improved varieties and technologies do not take into account women's needs, preferences, and resources, including women's distinct nutritional needs for micronutrient-fortified crops. For example, biofortified crops with enhanced micronutrient content—such as orange-fleshed sweet potato with higher vitamin A content or high-iron rice that could help reduce the iron-deficiency anemia that affects millions of women and children worldwide—are currently being introduced and evaluated in the field. Yet a growing literature indicates that women and men often have different preferences for maturation periods, yields, tastes, and colors, which can influence farmers' willingness to adopt new varieties. For example, a study on the adoption of high-yielding varieties of maize in Zimbabwe found that in an area where men considered maize a cash crop, they did not rank taste an important criterion for adopting a new variety, while women did rank taste high because they used maize for cooking. Yet, in another site in Zimbabwe, where maize is considered a food crop, the same study found no distinctions between men's and women's preferences, since both men and women expressed concern about the tastes of various varieties. This implies that gender-differentiated preferences cannot be assumed but, rather, are influenced by crop use, locale, and the gender division of labor (Bourdillon et al. 2007).

Because women's preferences are often overlooked, even when they are the primary cultivators of a variety, involving women in participatory plant breeding can help to ensure that women's preferences are met and can also lead to better-performing varieties. A well-known example comes from Rwanda, where the International Center for Tropical Agriculture (CIAT) brought 90 female farmers responsible for growing beans on station to evaluate genetic material over four growing seasons. The bean varieties selected by the female farmers had production increases of up to 38 percent over breeder-selected varieties and outperformed local mixtures 64 to 89 percent of the time. Sperling and Berkowitz (1994) note that achieving these results required a multidisciplinary team to integrate farmers into the formal research process and a "sea change" in thinking from both the station researchers and the female farmers since both groups had to become accustomed to thinking of female farmers as experts in their own right. In fact, when CIAT staff first approached women farmers in the hillsides, the women sent them to wealthier, male farmers since the innovations system had long expressed interest in working with farmers who could afford to buy complementary inputs, such as fertilizer.

NERICA (or New Rice for Africa) varieties, developed by scientists at the West Africa Rice Development Association to resist drought and pests and thrive in poor soils, have been especially beneficial to women, who form the majority of upland rice farmers in Sub-Saharan Africa, supplying 52 percent of labor in land preparation, 80 percent in sowing, 88 percent in weeding, and 80 percent in harvesting (Somado, Guei, and Keya 2008). The short duration of the NERICA varieties helps reduce weeding labor. The gains for women farmers adopting NERICA have been greater than the gains for men (850 kilograms of paddy/hectare compared with 517 kilograms for men). Adoption of NERICA has also led to higher school attendance, increased gender parity, increased household consumption spending, and higher calorie intake.

Women often command fewer resources to invest in acquiring new and "lumpy" assets that require large initial financial outlays. Evidence suggests that they may be better able to adopt high-value crops that do not require large initial investments or asset ownership, since women's access to credit is more constrained than men's. In Zimbabwe, men's greater access to financial assets and formal marketing institutions rendered them more likely to adopt high-yielding maize varieties whereas women preferred to adopt open-pollinated varieties because the latter did not require them to obtain loans for fertilizer and seeds, and markets could be accessed through women's informal networks (Bourdillon et al. 2007). If large initial investments or asset ownership are required, mechanisms can be provided for women to pool resources or complementary assets can also be disseminated. Hallman, Lewis, and Begum (2007) describe two examples in an evaluation of agricultural technologies in Bangladesh. In the first, poor women members of an NGO were able to adopt a polyculture fish technology because the NGO arranged for

leases of fishponds and the organization of women into groups to manage the fishponds. Group fishponds substituted social capital for ownership of land, thereby allowing landless women to adopt the technology, provided that the groups could be sustained. In the second example, improved vegetable varieties for homestead production were disseminated through women's groups and targeted to women in households with relatively small amounts of land. Women were able to adopt this relatively non-lumpy technology because it required low levels of investment and did not require agricultural land. Finally, in a study examining the adoption of maize technologies and fertilizer in Ghana, Doss and Morris (2001) found that women's and men's differentials in planting improved varieties of maize (39 percent and 59 percent, respectively) were explained by women's and men's different access to complementary inputs, especially to land and extension services. Once those inputs were controlled for, the sex of the farmer was no longer statistically significant in explaining adoption decisions.

Women often have different risk profiles than men, which may also constrain their adoption of new technologies. In the case of the Bangladesh vegetable production project described above, women were able to successfully adopt the new technologies because they could be cultivated on homestead land, rendering them less vulnerable to the risk of sexual harassment. The vegetables were also less vulnerable to theft because they were cultivated on homestead land. In contrast, the fish polyculture project was more vulnerable because the fish could be stolen or poisoned and required women to leave their homesteads to manage them.

The introduction of new technologies may shift the gender division of labor, providing women with more control of resources or, alternatively, taking away their gains. In Akan households in Ghana's western region, where the traditional practice of "uterine inheritance" transfers land from a deceased man to his brother or nephew, a new land transfer practice has emerged in response to agroforestry adoption. Quisumbing and Otuska (2001) found that husbands are transferring land to their wives in exchange for their wives' and children's labor in establishing cocoa fields. Although daughters still receive fewer transfers of land than sons, the bias against women has weakened as the demand for their labor for cash cropping has increased their bargaining power. In other cases, technologies that increase the productivity or sustainability of land may encourage men to return to farming and decrease women's access to land. In The Gambia, Schroeder (1993) finds that women lost control of communal vegetable garden plots, an important source of income and bargaining power for women, when men were encouraged by an environmental stabilization intervention to plant fruit trees within the gardens in order to take advantage of the fenced enclosures, improved soils, and, most important, women's labor. In many cases, women were allowed access to their gardens only if they agreed to irrigate the trees, and their use rights were revoked once the trees began bearing fruit. Although gender relations are complex, conducting better baseline surveys of households and communities before introducing new technologies can shed light on how they may be affected by those new technologies.

While gender is an important distinction for analysis in project design and implementation, it is not always the most important distinction. A narrow focus on differences between men and women may mask more important differences among women, such as age, marital status, education level, and size of landholding—leading to the ineffective targeting of interventions. Doss (1999) notes that few studies have looked at such differences when analyzing factors that influence agricultural production and technology adoption. Which differences are most important will depend on context. In Kenya, young *Luo* women, who first learn to farm under the guidance of their mothers-in-law, defer much of the decisionmaking about their farms to their mothers-in-law and do not obtain the rights to farm independently until they have had children (Potash 1981). In the CIAT bean crop example discussed earlier, age was an important factor in selecting women to evaluate the genetic material. Community members thought that young recently married women lacked sufficient farming experience while older women might be too senile. Thus, women with between 15 and 25 years of farming experience, from both female-headed and male-headed households, were selected to participate. These examples suggest that older, actively farming women may have more resources to draw upon to better respond to extension messages and that interventions that do target younger female farmers need to be aware of the differential constraints they may face.

5. AGRICULTURAL EXTENSION

The gender division of labor by crop and task, although not static, means that female and male farmers often have different extension needs. Statistics on the percentage of female extension agents and female farmers served by extension services are dated (for example, Saito and Spurling 1992), but evidence suggests that traditional agricultural extension systems still do not pay adequate attention to gender, nor recognize the importance of women's social networks for information diffusion. As a result, untargeted dissemination is more likely to benefit men and better-off households. Although extension design is expanding beyond its traditional modes—that is, moving away from top-down, technology-driven, male-dominated approaches to demand-driven, gender-sensitive approaches focusing on broader, interrelated issues and facilitation—it is still unclear how these reforms have particularly affected women. Gender-sensitive, participatory approaches would be expected to have positive impacts on women, but little evaluation has been done.

Recruiting and training female extension workers, particularly in areas where cultural norms restrict male-female interaction, can increase women's participation in extension activities and their adoption of new technologies. A 1993 Food and Agriculture Organization study of 24 extension programs in Africa, Asia, and Latin America found that the presence of female extension agents was an important factor for the participation of female farmers in extension activities (in Lahai, Goldey, and Jones 2000). Other studies suggest positive gains from female extension agents working with female farmers and from female farmers demonstrating new technologies to other female farmers. In Kenya, for example, one study finds that female decisionmakers are unresponsive to increases in early coffee adoption by male farmers but that previous awareness and adoption of technology by farmers of the same sex increases the probability of coffee adoption (J. Berger and J. Gunning, personal communication). Recruiting and training female extension agents can also benefit male farmers. In rural Senegal, for example, both women's and men's knowledge of a set of natural resource management technologies (nursery techniques, composting and agroforestry practices) increased from contact with female extensionists (Moore et al. 2001).

Efforts to recruit and train female extension agents will be more successful if they take into account sociocultural norms that may limit women's participation. Under Nigeria's Unified Extension System, which included policy reforms aimed at improving extension services to female farmers, both male and female extension agents were given subsidized motorcycles to facilitate their travel to villages. However, in the southwest region of the country, where cycling is not culturally appropriate for women, most of the female extension agents gave their motorcycles to their male relatives instead of using them to travel to the villages. In an evaluation of the policy reforms, the female extension agents reported that they would have preferred to combine the government loan with personal savings to buy cars, which are a more appropriate means of transportation for women (Adetoun 2003).

Whether women prefer to work with male or female extension agents will vary by region and cultural norms influencing male-female interaction. In the evaluation of policy reforms under Nigeria's Unified Extension System, 69 percent of the respondents said that either male or female agents would be acceptable to them, but there was significant variation across states with different cultural norms. In areas where it is difficult to attract or retain female extension agents, extension services can still be tailored to meet the needs of female farmers. This includes training male extension agents in extension methods and communication skills suitable for female farmers and in tasks typically performed by women (for example, postharvesting techniques). Extension services also need to be brought closer to female farmers at times when they can attend meetings, since women often cannot attend trainings organized outside their villages due to childcare responsibilities and income-generating activities.

Extension messages, whether delivered by male or female agents, need to be given in the simplest terms possible. Where women have lower literacy or schooling rates than men, it is critical to adapt training materials so they can easily be understood by women. In Kenya, women who had less education than men excelled in the uptake of soil fertility replenishment technologies as long as explanations were

given in the simplest terms possible. In fact, qualitative data suggest that the women understood the technologies better than the men did (Place et al. 2007). In Bangladesh, a local NGO successfully taught illiterate women how to manage fishponds using notebooks with illustrated instructions. Finally, programs that implement targeting to reach female farmers need to give careful consideration to the targeting mechanism. Quota targeting, for example, may conflict with program objectives. In Bangladesh, where the donor mandated that women make up 30 percent of participants in an individual fishpond production program, extension agents signed up women by talking to their husbands, but women's role in fish production remained limited and women did not know the quantity of fish or the income generated from the project (Quisumbing and McClafferty 2006). Had a gender-sensitive monitoring system been in place, project implementers would have taken note of women's token participation, not simply the number of women to whom loans were disbursed.

Formal extension services are only one means by which information is diffused, suggesting that an important resource—social networks—can be better exploited to diffuse information. Social networks among farmers play a salient role as farmers observe and learn from the experiences of others in their network about the suitability and profitability of innovative methods in agricultural production. These networks are particularly important for women because they often have less access to formal channels of dissemination, as discussed earlier. Men's and women's networks also often differ. In Uganda, for example, where informal mechanisms are the most important sources of information for farmers, markets are a particularly important source of information exchange on agriculture, but men go to market much more often than women (Katungi, Emeades, and Smale 2008). In Kenya, church is an important information channel for female farmers, but less so for male farmers. These examples from the literature suggest that extension programs should try to reach men and women through different networks.

6. CREDIT AND FINANCIAL SERVICES

Collateral requirements, high transaction costs, limited education and mobility, social and cultural barriers, and the nature of women's businesses (often concentrated in low-return sectors) limit women's ability to obtain credit. Women's roles as primary caregivers and health risks associated with childbearing also lead to intermittency in employment, which makes them risky clients for banks (Rashid and Townsend 1993). Social customs in some cultures also prohibit women from receiving information from outside lenders—an important consideration if husbands do not fully convey the information to their wives. Under these conditions of imperfect information and barriers to access, credit and insurance delivery systems need to be designed to overcome women's constraints.

Targeting credit to women is often justified by the argument that female owners are likely to be poorer, be more credit constrained, and use resources more efficiently than male owners. If that were the case, we would expect returns to capital to be higher in female-owned firms. However, de Mel, McKenzie, and Woodruff (2007), evaluating an experiment randomly allocating capital equipment and cash to microenterprises in Sri Lanka, found that the average return of 5.7 percent per month masked huge differences by gender.[6] They found that mean returns to capital are zero among female-owned microenterprises, while returns to capital for male-owned enterprises are in excess of 9 percent per month. Such large returns show that, on average, male-owned enterprises are more likely to generate the return on investment necessary to repay microloans. In their analysis, de Mel, McKenzie, and Woodruff find that these differences in returns are primarily due to women's concentration in low-return industries. Female-dominated occupations appear to have poor returns to capital, even if there is a subset of female-owned firms that do generate returns sufficient to cover the cost of loans. To achieve higher returns and earn higher incomes, women farmers and entrepreneurs should therefore be encouraged to adopt high-value crops or enter high-return sectors.

Differences across the life cycle also need to be considered when targeting credit to women. A study in Guatemala (Kevane and Wydick 2001) found that gender differences in ability to expand family-owned enterprises were highly correlated to the life cycle. Young male entrepreneurs were more aggressive in generating employment than older male entrepreneurs, but older women generated more employment than young women or older men. Controlling for all other factors, the authors find that there is no statistically significant difference in the ability of male and female entrepreneurs to generate employment with an increase in access to credit. They argue that women in their childbearing years may not channel energies toward employment growth, focusing instead on child rearing, but it is during those years when impact on poverty reduction and child nutrition may be highest. The authors suggest that one option for targeting credit would be to "double dip"—target microenterprise funds to older females beyond childbearing years, who can expand the enterprise, but whose preferences would also tend toward welfare of grandchildren. Credit could therefore be targeted, or loan packages designed, based on women's different needs throughout their life cycle.

In designing loan packages for a heterogeneous clientele, lenders need to explore innovative ways of meeting clients' needs, even if it means departing from a traditionally successful business model. For example, while the Grameen Bank has been very successful in using group lending to overcome the need for collateral in reaching out to poor rural Bangladeshi women, it has recently relaxed the group liability clause in the Grameen II program by allowing defaulters to renegotiate their loans without invoking group pressure (Giné and Karlan 2006). Working with a rural bank in the Philippines, Giné and Karlan randomly assigned women to individual liability and group liability loan programs. They find that the conversion to individual liability does not affect the repayment rate, and leads to higher growth in center size by attracting new clients.

[6] Randomization generates exogenous differences in the capital stock of firms, allowing estimation of the return to capital that is not subject to endogeneity concerns.

Variations in credit packages—for example, by varying interest rates and loan maturity periods—may also better serve client needs as well as improve financial sustainability. Karlan and Zinman (2007) worked with a for-profit South African lender in a high-risk consumer loan market to randomize individual interest rate direct mail offers to more than 50,000 former clients. They find that clients' demand for credit depends a lot on interest rates offered. They suggest that if the responsiveness of different client groups to interest rates is heterogeneous, loan pricing can be used for targeting credit. For example, price cuts produced more borrowing by poor females, at a cost of few foregone profits. They also find that changing the duration of the loan significantly affects sizes of loans demanded, particularly for poorer clients. Varying interest rates and the duration of the loan may therefore be another way of reaching poor rural women farmers, whose ability to repay may depend on the gestation period of the crop—tree crops, for example, may offer large returns, but have longer gestation periods.

The literature on the gendered impact of financial services often overemphasizes credit at the expense of other aspects of financial services for poor women. The spectrum of financial services should include opportunities to save—and to protect those savings. Opportunities to save may take on different forms, and finding the appropriate vehicle could be important innovations in financial services markets. One example is the use of commitment savings products. Such commitment savings products are similar to the "forced savings" of group members in NGO programs, in which group members are required to contribute a small amount at every meeting, which is then kept in a group fund, and which is inaccessible to the group member or any family member. These commitment devices for savings could benefit those who have the self-control to save small amounts periodically, as well as those with familial or spousal control issues. Indeed, the literature on household savings, and on informal savings devices in particular, has emphasized impacts from spousal or familial-control explanations (Anderson and Baland 2002; Gugerty 2007).

Ashraf, Karlan, and Yin (2007) conducted an experiment by exogenously creating a financial asset to which one and only one person within the household had legal control and then measuring its impact on both decisionmaking power and household outcomes using a randomized controlled trial. The authors designed and implemented a commitment savings product with the Green Bank of Caraga, a rural bank in the Philippines. Current bank clients were randomly chosen to receive an offer to open an additional "commitment" account in their own name. The savings product provided individuals with a commitment to restrict access to their savings. Each individual defined either a "date" goal or an "amount" goal and was then not able to withdraw his or her funds until the goal was reached. The account also legally restricted access to committed savings by any person except the individual account holder. Any savings committed to the account were therefore controlled by that individual.[7]

The authors found that the product caused an increase in household decisionmaking power for married women, measured both in the women's own reporting of how household decisions were made and in the household's purchases of goods typically used by women. The effect on decisionmaking power was strongest for married women who had below-median household decisionmaking power prior to the intervention. They also found that households in which a woman was offered the commitment product were more likely to buy durables typically used by women within the household, and found no such effects on household durables when a man was offered the commitment savings account.

Yet another (perhaps more dramatic) example comes from Malawi. Opportunity International's bank in Malawi, OIBM, was founded as a traditional credit-led microfinance bank, but it now also offers two savings strategies: a biometric smart card that enables illiterate customers with no official government identification (the vast majority of the population) to open and manage a savings account using fingerprints for identification; and inexpensive community branches made from used shipping containers. The minimum opening deposit is $4.50. One early savings customer was a domestic servant

[7] The product incorporated a locked box for which the bank had the key, into which loose change could be deposited, so a woman was able to put small amounts aside, giving her the power to make decisions about that money once it reached a larger amount (Ashraf, Karlan, and Yin 2007).

whose employers had granted her severance pay when they moved away. She deposited the full amount at OIBM using her smart card. A few weeks later, when her husband died of AIDS, the husband's relatives came to seize the property of his widow. They found her smart card and took it to the bank, but the biometric reader showed "red light: no match." Although the relatives argued with the teller that this was their due, he held firm that the account belonged to the woman. Her savings were protected, and became her only asset as she began her life again. Shortly thereafter, thanks to the word spreading throughout Lilongwe "kitchen parties," OIBM experienced a flood of women opening new accounts (Cheston 2007).

7. ACCESS TO MARKETS

In addition to traditional production and market risks, such as a lack of market information on prices or the risk of having one's crops stolen, female farmers face many gender-specific barriers to accessing markets. These include culturally inappropriate modes of transportation for women, such as trucks or motorcycles; physical harassment by market or health officials when the high cost of permits leads women to market their wares outside market boundaries; time burdens that constrain women from seeking the best prices for their output; and even marital conflict if fluctuating prices lead a husband to believe that his wife is withholding money from him because she brought home more money on previous trips to the market (Barham and Chitemi 2008). Men may also appropriate crops for which women are traditionally responsible once they enter the market economy and become profitable.

Experience suggests that market-oriented interventions that facilitate women's market access will be more effective if they also address gender norms. In Tanzania, Barham and Chitemi (2008) found that women's farmer groups are less successful than men's groups both at searching for and accessing new output markets for their existing products and at pursuing new products under contract arrangements, because men are more likely to be approached for their products by agricultural companies or other chain actors who wrongly assume that men are the primary producers in the household. Market-oriented interventions thus need to address constraining gender norms that place women at a disadvantage when seeking new market opportunities. In Uganda and Malawi, for example, CIAT has implemented a participatory research approach titled Enabling Rural Innovations that develops the capacity of rural women and the poor to analyze and access market opportunities for competitive products that will increase farm income and employment. Women must account for between 30 and 50 percent of market group members, and enterprises must be selected based on the extent to which both women and men can benefit from the enterprise. Group members are also given training in group leadership, conflict management, gender issues, and HIV/AIDS awareness. A case study of the approach reveals that women improved their skills in becoming group leaders, training other farmers in experimentation and bargaining with traders, although men improved significantly more than women in these areas, suggesting that men were still able to better exploit social networks. The study also found that the increase in women's incomes from their new market opportunities led to an increase in household decisions being made jointly by men and women in both Uganda and Malawi (Kaaria et al. 2008).

Finally, it should be noted that as high-value agriculture assumes more importance in many parts of the world, new opportunities in export-oriented agricultural markets, such as horticulture, are created for women. Yet such jobs are often low paid, informal, and insecure and do not provide enough income for women to escape poverty. Much more research is needed on how to integrate women into global value chains in a way that increases, rather than jeopardizes, their well-being.

8. SERVICES AND SUPPORT INFRASTRUCTURE THROUGH COLLECTIVE ACTION

Working with groups is a major mechanism through which development programs and women themselves can increase women's control of assets, improve their productivity, and enhance their status and well-being. In fact, the social capital that groups generate has been recognized as an important asset in itself. Women draw upon a range of social networks for personal and family livelihood. Women's clubs, various forms of women's groups, and kinship ties, for example, are thought to further women's empowerment through fostering social capital, especially trust and norms. However, building social capital is not costless—networking takes time, especially when formal group meetings are required, and many groups require fees to participate. Women in poor households face particularly serious time constraints because of their various livelihood activities and childcare responsibilities. Membership fees may create a further barrier to participation by poor women who have limited control over cash resources (Meinzen-Dick and Zwarteveen 1998).

Thus, group-based programs should include institutional mechanisms that enable women to join groups and remain active members. Such mechanisms include allowing nonhousehold heads and nonlandowners to be group members, since adult males are usually defined as heads of household and women often do not have title to their land; timing meetings to accommodate women's workloads, which will vary according to agricultural cycles and their nonfarm employment; ensuring that all women (for example, poorer, less educated, single, or widowed women) have opportunities to voice their concerns in group meetings; and soliciting women's feedback in project monitoring and evaluation (Pandolfelli, Meinzen-Dick, and Dohrn 2008). A randomized evaluation of water infrastructure maintenance in rural Kenya found that speeches made by NGO facilitators about the importance of women's participation in the user committees increased their participation, along with encouraging women to attend the community meetings at which committee members would be selected and holding the meetings at a convenient time for women to attend (Leino 2007). A range of participatory rural appraisal tools, such as seasonal and daily calendars, as well as stratifying groups according to different social criteria (for example, widows, landless women) can help to ensure women's inclusion in groups.

Development planners that use social capital as an instrument for addressing the needs of poor female farmers need to assess the efficacy of working with single- or mixed-sex groups, which will depend on project objectives, women's and men's interest in those objectives, and the degree of gender segregations within communities (Pandolfelli, Meinzen-Dick, and Dohrn 2008). Where strong gender segregation exists, working with existing women's groups may help facilitate entry into communities and allow women to retain control of project benefits. Also, where women's and men's motivations for joining groups differ, projects that encourage mixed-sex groups may be less sustainable, especially once external funding runs out. In other cases, mixed-sex groups may be more effective at meeting project objectives, especially when women and men are both key users of a resource. In Bangladesh, Sultana and Thompson (2008) found that compliance with rules limiting fishing in protected areas is higher when both men and women are actively involved in fishery management groups, because much of the pressure to ensure compliance with fishing rules comes from women, who control catches, while men patrol the fish sanctuaries at night when it is unsafe for women to do so. In Madhya Pradesh, India, when women belong to forest protection committees, participate in committee meetings, and patrol the forest, control of illicit grazing and felling increases by 24 percent and 28 percent, respectively, and the regeneration of allotted forest also increases by 28 percent (Agarwal et al. 2006).

Evidence also suggests that women's inclusion in groups leads to better governance practices. For example, in the highlands of central Kenya, where women are regarded as more trustworthy than men with money, Kariuki and Place (2005) report that men express more satisfaction with how group finances are managed in mixed-sex groups than they do in all-male groups, because men are perceived as being more vulnerable to corruption.

Even when women's participation does not lead to greater group effectiveness, evidence from the randomized evaluation of water infrastructure management committees in rural Kenya suggests that there is little distortion in the effectiveness of these committees. The author suggests that the potentially negative impacts of the lower average education and experience of female committee members may be offset by other factors in which women might have a comparative advantage, such as lower monitoring costs of water infrastructure or better knowledge of the provisioning and safeguarding of water (Leino 2007). It is worth noting that although gender advocacy was used to encourage women's participation in the user committees, elected women were not given technical training on water infrastructure maintenance. This may explain why women's participation in the management committees did not lead to more effective management of water resources. In addition to leading to greater group effectiveness, mixed-sex groups may affect more transformative change in gender roles if, through repeated interactions, women receive greater recognition by men for both their paid and unpaid contributions to the community, although this hypothesis warrants further investigation.

Whether projects choose to work with mixed- or single-sex groups, experience suggests that they still need to incorporate sound gender analysis. For example, Hambly Odame (2002) notes that in western Kenya, men often account for a minority of members in women's groups. Failure by an agroforestry extension project to understand the importance of men's role in the distribution of resources and benefits within women's groups led to a 67-percent rate of collapse over a 12-year period, often resulting in a loss of labor, capital, and moral support for group members.

Finally, development practitioners tend to assume that women want to participate in groups, but like men, women need incentives, especially when the opportunity costs of their time are high, such as in labor-intensive collective action schemes. In the Philippines, for example, attempts to have women monitor lake water to determine whether soil conservation techniques were reducing silting were unsuccessful until the project realized that women were more interested in health issues than in soil loss. When the project began to raise awareness about how water quality affected the health of families and the program then expanded to include monitoring for *E. coli*, women's participation significantly increased (Diamond et al. 1997).

9. SYNTHESIS AND AREAS FOR FUTURE RESEARCH AND ACTION

Synthesis of Promising Approaches

Continue strengthening women's land rights and investing in schooling. The literature on women's constraints to adopting new technologies, accessing financial and agricultural support services, and even participating in groups overwhelmingly finds that service delivery, or access to other complementary resources in agriculture, is often limited by lack of access to land and low schooling levels. Thus, efforts to strengthen women's land rights through legal reform and to invest in girls' schooling by reducing the cost of schooling and increasing physical access to services, improving the design of service delivery, and investing in time-saving infrastructure must continue. However, in the short run, efforts need to be taken to overcome basic constraints imposed by lack of access to land and low levels of schooling. These include, among others, obtaining access to land through groups or through land rental markets, disseminating non-lumpy technologies, and communicating extension messages in simple ways.

Promote divisible technologies or smaller input packages that are more affordable, as well as opportunities for groups to achieve economies of scale. Women's lack of access to credit implies that they may be better able to adopt non-lumpy, divisible technologies (such as the vegetable technology disseminated through women's groups in Bangladesh) or afford inputs purchased in smaller quantities (such as small bags of fertilizer). Producer groups or credit groups might then be able to provide feasible mechanisms to achieve economies of scale or to invest jointly in more expensive equipment.

Adapt program design or service delivery to client needs. Many of the "promising approaches" reviewed in this paper include variations in program design to adapt product or service delivery to clients' needs, whether it involves changing the terms of credit provided through microfinance institutions, providing different types of savings instruments, tailoring agricultural extension messages to the characteristics of client groups, designing culturally appropriate and acceptable technology, or providing culturally acceptable ways of marketing agricultural produce. Indeed, unless interventions meet client needs, or are tailored to meet their needs, they likely will fail.

Consider interaction among inputs rather than treating each input in isolation. Program designers need to consider interaction among inputs rather than treating each input in isolation. This may mean strengthening women's access to resources across a range of resources rather than having an intervention oriented around a single resource. For example, Berti, Krasevec, and FitzGerald's (2004) review of the nutrition impact of agricultural interventions finds that those agriculture interventions that invested broadly in different types of capital (natural, physical, human, social, financial) were more likely to improve nutrition outcomes. Those projects that invested in human capital (especially nutrition education and consideration of gender issues) and other types of capital had a greater likelihood of effecting positive nutritional change, but they caution that such investment is neither sufficient nor always necessary to effect change.

Take gender roles into account when designing and implementing projects. Lastly, interventions that explicitly took into account gender roles were more likely to succeed than those that neglected them, and interventions that neglected gender roles were also more likely to reinforce or exacerbate inequitable access to resources between men and women. While there are limitations to what individual projects can accomplish, especially short-term pilot projects, at a minimum they should not perpetuate gender inequities, and at best, they can set in motion, or support extant, change processes within communities.

Outstanding Issues

Lack of evaluation. Most of the approaches reviewed have undergone very limited rigorous evaluation. For example, according to an evaluation of Drumnet's export crop adoption and marketing intervention in Kenya, no other randomized evaluations have been conducted of such interventions (Karlan, Giné, and Ashraf 2008). This is not to say that randomized evaluations are the only way to evaluate these "promising approaches," nor that quantitative evaluations always yield the most insights into gender

dynamics. Evaluations are often undertaken after projects have already been initiated, so randomized placement is not feasible. Alternative methods can be used to create suitable counterfactual situations, such as propensity score matching to select comparator communities to program communities, or to compare program beneficiaries to nonbeneficiaries. In addition to propensity score matching, double-difference, fixed effects, and instrumental variables econometric methods can also be used in impact assessment studies (see Ravallion 2008 for a review of impact evaluation methods).

Rigorous quantitative evaluation will not uncover gender concerns if the design does not pay attention to gender. Indeed, where rigorous evaluations (even randomized interventions) have been done, very few have paid attention to gender impacts, and often, an exclusive focus on quantitative indicators might lead to neglect of more subtle, contextual factors that influence project success. Qualitative and participatory methods provide critical insights into beneficiaries' perspectives, the value of programs to beneficiaries, the processes that may have affected outcomes, and a deeper interpretation of results observed in quantitative analysis (Baker 2000). Qualitative methods can be used to take advantage of the strength of in-depth interviewing to establish plausible linkages between the intervention and gender-specific outcomes, including how communities categorize gender and other social relations, and their perceptions and experiences of changes. Ultimately, combinations of before/after and with/without, as well as insiders' and outsiders' perspectives, provide the most convincing case of what changes can be attributed to these interventions.

While it may be ideal to have evaluations conducted by external entities to ensure impartiality, the lack of a monitoring and evaluation culture within implementing organizations is also a problem. For example, despite the importance of strengthening women's property rights for both equity and efficiency, an International Center for Research on Women scan (Knox et al. 2007) of 35 NGOs and 21 international nongovernmental organizations (INGOs) engaged in strengthening women's property rights found that only four NGOs and one INGO documented or monitored and evaluated the impact of their programs. The study found that while the approaches adopted by the organizations to strengthen women's property rights were promising, they narrowly focused on specific communities or localities, were often fragmented with little exchange of experience between local efforts, and lacked coordination and monitoring that can form a more integrated, effective response.

Lack of exploration of alternative design and delivery mechanisms. In addition to the lack of data with which to monitor and evaluate project impact, the lack of systematic exploration of alternative design mechanisms is a serious limitation. Programs are modified in an ad hoc manner, without systematic evaluation. Without evaluation, it is difficult to recommend what programs can be scaled up. Likewise, it is difficult to know what design features can be modified for local conditions without adversely affecting the overall outcome of the intervention.

Trade-offs between strategic and practical gender needs. Gender norms are complex. They change in response to shifting economic, political, and cultural forces, which can create new opportunities for women to strengthen their control of resources. Yet gender norms do not change overnight, and attempts to directly challenge such norms may unintentionally result in an erosion of women's claims to resources. Thus, development planners who seek to put agricultural resources in the hands of women need to consider the trade-offs inherent in interventions that challenge or respect local gender norms. In the gender and development literature, this is often referred to as meeting women's practical versus strategic gender needs, and a range of policy approaches, from Women in Development to Gender and Development, have focused on strengthening women's economic participation to challenging structural causes of women's disempowerment (Molyneux 1985; Moser 1989). Assessing the trade-offs between challenging and respecting local gender norms may be particularly salient to agricultural interventions since women's contributions to agriculture are still largely rendered invisible or characterized as solely of a subsistence nature in many parts of the world (for example, South Asia). The Bangladeshi NGO vegetable program discussed earlier in this paper was successful because it was designed in response to local gender norms that dissuade women from working outside of their homesteads. Women were able to successfully adopt the improved vegetable technologies, and contribute to their food security, because the technologies could be cultivated on homestead land, which also allowed women from very poor

households with no agricultural land to participate. Yet the project did not redress another by-product of those norms, women's constrained access to markets, which prevented them from selling their production. In another example from Bangladesh, Sultana and Thompson (2008) find that an NGO's insistence that it would work only with women to create aquatic resource management committees failed to involve women in the long run because it openly challenged local gender norms that discourage women's public participation, and men within the communities refused to allow their wives to participate. These examples do not suggest that gender norms that disadvantage women should not be challenged outright in agricultural interventions but that strategies for doing so must be weighed against other project objectives, such as increased food security or better management of natural resources, which, in turn, may influence gender norms. Encouraging women to define their needs and preferences prior to the design of projects is a first step toward ensuring balance between challenging and respecting local norms.

Sensitivity to culture and context. Gender norms are also context specific, varying across cultures and even within the same country, implying that there are no one-size-fits-all strategies for addressing the needs of poor rural women. In an evaluation of a conditional cash transfer program in Turkey modeled on Mexico's PROGRESA program, Adato et al. (2007) find that sociocultural norms against schooling girls in the eastern part of the country outweigh economic incentives, in the form of transfers, for sending girls to school. Without incorporating complementary approaches to address the cultural norms that constrain girls' access to school, the CCT program is not likely to achieve the improvements in human capital outcomes achieved by PROGRESA. Adopting the promising approaches described in this paper involves tailoring interventions to the specific sociocultural context in which gender relations unfold.

Concluding Remarks

It is ironic that despite the importance of agricultural interventions in increasing female farmers' access to productive resources and improving food security, there has been relatively little evaluation of those interventions, compared with interventions designed to increase investment in human capital. It is no coincidence that the well-publicized evaluations of PROGRESA and other CCT programs have led to their being adapted and implemented in many countries. The recent food price crisis only increases the importance of rigorous evaluations of agricultural interventions, particularly those targeted to female farmers, so that policymakers have better guidance on which programs to redesign and which to scale up to meet their development objectives more effectively.

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A promising finding was that 55% of studies tested interventions in controlled field trials and 18% were modelling studies both of which focus on the causal relationships between the interventions and yield and/or incomes. In addition, 28% of studies were from household surveys to determine if interventions designed for water scarce, small-scale farms worked in farmersâ€™ local contexts according to farmersâ€™ responses on yield and livelihood outcomes.Â Research in these geographies, metrics and outcomes will bring us closer to meeting the needs of water scarce, small-scale farms on the ground. To achieve the SDG 2.3 goal of bolstering small-scale farmersâ€™ yield and livelihoods, a greater research focus is needed in water scarce regions of LMICS. This brief focuses on key agricultural resources needed by poor female farmers to generate incomes and ensure their families' food security. It is organized around key resources and promising approaches to increase poor women's control of those resources. One resource that is not included in this review is human capital. It must be emphasized that investing in women's education, health, and nutrition is an integral part of enabling women to guarantee their families-and their own-well-being. These approaches were identified in the course of a review of projects and interventions train male extension agents to meet the specific needs of female farmers. target credit or design loan packages based on womenâ€™s specific needs. organise women into single- or mixed-sex groups to increase their control of project benefits and improve their well-being. Enhancing womenâ€™s access to agricultural resources not only increases their productivity it also enhances their social status. At the same time, gender norms are complex and take time to change. In this context, individual interventions are advised to adopt a medium-term approach that alternately challenge and respect gender rela Summary This paper critically reviews some recent attempts to increase poor female farmers' access to, and control of, productive resources, focusing on Sub-Saharan Africa and South Asia. It surveys the literature from 1998 to 2008 that describes interventions and policy changes across several key agricultural resources.Â Other versions of this item: Quisumbing, Agnes R. & Pandolfelli, Lauren, 2009. "Promising approaches to address the needs of poor female farmers: Resources, constraints, and interventions," IFPRI discussion papers 882, International Food Policy Research Institute (IFPRI). References listed on IDEAS. as.