



POLICY BRIEF

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

RAISING AGRICULTURAL PRODUCTIVITY, INCREASING INCOMES, IMPROVING FOOD SECURITY, AND REDUCING THE BURDEN ON WOMEN IN AGRICULTURE

The promise and potential of gender-responsive agricultural policies in lifting agricultural families out of poverty while strengthening rural and urban economies are tremendous. Governments, donors, civil society organizations and the private sector can implement several policy measures to bring about a women-targeted technology revolution (see box 1). These broader policy lessons emerged from the first Eastern and Southern Africa (ESA) Region Sharefair on rural women’s technologies. Policymakers should specifically target those technologies that are appropriate for women. Women farmers should be made centre stage in the technology innovation and product design process. Policies introduced in isolation may not be fully successful in achieving the desired outcomes of improved technology adoption. In addition to promoting agricultural technologies, techniques and technologies that reduce the domestic care and time burden on women have the potential to shift the roles and responsibilities that women fulfil within and outside their homes. Encouraging adoption of new technologies by women farmers entails introducing a set of complementary policies such as innovative financing mechanisms, along with providing actual knowledge about technologies and bringing these technologies to the doorstep. Nudges and knowledge offered through innovative mechanisms such as the use of mobile phones is another cost-effective way of reaching out to women farmers about technology use and information. Strengthening

BOX 1 SUMMARY OF CRITICAL INTERVENTIONS NEEDED: AN AGENDA FOR ACTION FOR GOVERNMENTS AND PARTNERS

- Area-based approach for technology promotion
 - Policy and investments
 - Extension services
 - Demand-driven research and development
 - Technology transfer
 - Financial services
- Women farmers to design interventions with local authorities
- Reduce taxation on women’s technologies
- Policymakers to be rural technology champions

women’s land rights – including shifts in inheritance laws and land rental laws – is essential for women to believe that their investments in agricultural technologies will support their long-term personal, household and community-level goals. Well-informed policies that focus on the root causes of the women-technology gap instead of just the symptoms can have a long-lasting impact on improving food and nutrition security and increasing the incomes of many women family farmers.

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

Despite women accounting for 43 per cent of the agricultural labour force in developing countries and even more than 50 per cent of the agricultural workforce in most of the ESA region, the productivity gap between men and women farmers persists (FAO, 2011).¹ Existing family farm research shows that women consistently have lower productivity compared to male farmers, with the productivity deficit estimated to range between 13 and 25 per cent in Sub-Saharan Africa (World Bank and ONE, 2014).

Empirical evidence suggests that if women had access to the same productive agricultural inputs as men, they could increase their yields by 20–30 percent. Overall agricultural output in developing countries potentially could be increased by 2.5–4.0 per cent and 100–150 million people could be brought out of hunger just by providing men and women with equal access to productive inputs (FAO, 2011). In the United Republic of Tanzania, Malawi and Uganda, for example, narrowing the gender gap in agricultural productivity has the potential of raising gross domestic product by USD 105 million, USD 100 million and USD 65 million, respectively (UN Women, UNDP-UNEP PEI Africa, and World Bank, 2015).

Past studies investigating labour, land and agricultural productivity trends in African nations have paid little attention to differentiating these results by gender. There is overwhelming evidence demanding urgent attention to address the needs of women farmers, particularly in improving their access to and adoption of technologies for increased agricultural productivity. Empirical studies have suggested that women spend a greater share of their income in improving household welfare as compared to men. Raising women's incomes through better access to agricultural technologies has a higher multiplier effect than for men in raising the food and nutrition security of their families, which is key to improving the living standards of future generations (Quisumbing and Pandolfelli, 2010).

This policy brief lays out priority issues surrounding innovation, development and adoption of agricultural technologies by women as they continue to fulfil their role as farmers and primary agro-processors. It focuses on the programmatic actions that donors, governments, the private sector and

civil society organizations – African and international – can implement today to bring about an agricultural technology revolution, which can spill over in the form of a related agricultural productivity revolution. These broader policy lessons emerged from the first ESA Sharefair on rural women's technologies, which shed light on the many contributions that African women farmers make that consequently benefit their families and communities (see box 2).

BOX 2 INSPIRING AGRICULTURAL CHANGE: SHAREFAIR ON RURAL WOMEN'S TECHNOLOGIES

To boost attention to rural women as drivers of rural progress and change, a Sharefair was held in Kenya as a 2014 flagship event for the Regional Network on Gender and Rural Livelihoods for Eastern and Central Africa – in collaboration with UN Women, the African Union Commission, the Food and Agriculture Organization of the United Nations, the International Fund for Agricultural Development and the World Food Programme. The event brought together more than 100 rural technology innovator exhibitors from more than 14 African nations. The Sharefair was a platform for policymakers, academicians, farmers, primary food processors, food-processing industries, investors and technology innovators to interact directly with women farmers and young technology exhibitors.

Although the event showcased diverse agricultural technologies developed for women, by women and with women, key issues relating to scaling up technology availability, accessibility and adoption by women shaped many of the discussions. The exhibits also established the concept that Africa's women are a tremendous untapped resource for agricultural production and innovation.

Violet Malama, a family farmer from the Kafue district in Southern Zambia and a technology innovator, captured the essential message of the ESA Sharefair. She is an innovator of a greenhouse – made of used onion and tomato sacks, bamboo and tree bark – that is helping farmers in her village produce seedlings in four weeks instead of two months. "The machines the government introduced to us were very expensive", Malama observed. "They want us to get a loan, but as a woman who does not have collateral, how are you going to get a loan? You end up losing out. That is where I thought, there must be a way, and this greenhouse is a stepping stone for a family farmer and a villager".

NOTE: This box draws heavily on "The Hand-Hoe Must Go, Invest in Women Farmers", by Sophie Mbugua. A repository of resources related to the ESA Sharefair and African women in technology can be found at www.empowerwomen.org/cop/awit.

¹ Countries in the ESA region include Burundi, Djibouti, the Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Somalia, South Africa, South Sudan, Sudan, the United Republic of Tanzania, Uganda, Zambia and Zimbabwe.

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

We primarily focus on three types of technologies, which also constitute the range showcased at the ESA Sharefair:

- Machinery and equipment used by women that are labour-saving and reduce the time women spend on farming activities, including post-harvest and value-addition technologies
- Purchased production technologies used by women, such as fertilizer and hybrid varieties of seed
- New practices and techniques whose adoption might reduce the time women spend working on farms, lessen their domestic household work or raise their agricultural productivity

Some of these technologies might increase the amount of time women spend on their farms. All three types have the potential to raise agricultural productivity, reduce post-harvest losses, lower women's domestic care burden and improve the food and nutrition security of women family farmers in Africa. These technologies not only take into account the current roles and responsibilities women fulfil within and outside their households, but also the transformative role technology adoption may play in fundamentally shifting the roles of women farmers on and off farm.

A key output of the ESA Sharefair is a database of diverse agricultural technology innovations made by women farmers working in their local communities. For more information, see www.empowerwomen.org/en/sharefair2014.

POLICY ISSUES: FACTORS LIMITING TECHNOLOGY ADOPTION BY WOMEN FARMERS

Agricultural productivity differences between women and men farmers, particularly in the use and adoption of agricultural production technologies, have been broadly attributed to four main reasons: women's lack of access to agricultural technologies, women's lower human capital, insecure land rights and other structural factors including lack of access to financial resources (Kilic, Palacios-López and Goldstein, 2015). A sound understanding of these issues and constraints is key to framing a rigorous policy debate.

WOMEN LACK ACCESS TO AGRICULTURAL TECHNOLOGIES

Women farmers typically use lower levels of purchased technological inputs such as fertilizer and high-yielding seed varieties due to unequal access to resources by women in rural households, women's limited information and women's limited ability to influence household decisions (Peterman, Behrman and Qisumbing, 2014). Even if they use the same level of productive inputs as men, women farmers are still found to have lower returns from using these inputs (World Bank and ONE, 2014). In Burkina Faso, within the same family, female-managed plots have lower yields in all crops cultivated because they use less fertilizer and labour than the plots managed by the male farmers in the household (Udry and others, 1995). Similarly, female-headed households have a lower probability of adopting high-yielding varieties of maize in Ghana (Doss, 2002). That women lack access to these key technological inputs explains a significant portion of the agricultural productivity gap. Often, these **productivity differences disappear when women farmers have equal access to these technologies**. For example, the significant gender differences in the use of fertilizer in Malawi among maize-cultivating farmers disappeared when a field experiment supplied these inputs to both female and male farmers (Gilbert, Sakala and Benson, 2002).

In a recent assessment of the gender agricultural productivity gap in Malawi and Tanzania, the results suggest that women's access to agricultural implements and machinery is significantly lower than that of men. Differences in use of machinery explain 18 per cent of the gender gap in Malawi and 8 per cent in Tanzania. Often times, differences in use of agricultural inputs are due to a lack of access to markets or because women receive a lower price for their crop output, lack of access to land and women's lower education levels. Moreover, women face unique challenges due to their life-cycle and reproductive roles, which may further influence their participation on and off farm. Childbearing and -caring activities may reduce the time they can engage in farm and other employment work (Peterman, Behrman and Qisumbing, 2014).

Technology developers do not always design technologies in keeping with women's interests and limitations. Appropriate technologies designed to address labour constraints in key production activities carried out by women – and which address technology requirements across the whole value chain and production system

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

– are required. Removing structural, systemic factors and scaling up technologies that are both accessible and affordable to women is critical to achieving higher returns from women’s time and resource investments. For instance, the ESA Sharefair showcased the Portable Electro-Chemical Aflatoxin Testing Kit. The kit helps in the analysis of aflatoxin contamination in cassava and facilitates compliance with trade and other regulatory food and feed safety requirements, thereby enabling women in Uganda to access markets. Such technologies have the potential of narrowing the structural constraints women farmers face, and help improve the quality and volume of a main ingredient used in human diet and livestock feed.

LOW HUMAN CAPITAL AND WOMEN’S NON-WAGE HOUSEHOLD PRODUCTION WORK MAY PREVENT THEM FROM USING TECHNOLOGIES

Women shoulder the bulk of household and childcare responsibilities in many ESA countries. They are consistently found to have longer workdays as compared to men in many African countries, which is largely due to the time they spend on household work. For example, women devoted approximately 4.7 times more time in Madagascar, and nearly 3 times more in South Africa and Benin, to domestic and care activities (Blackden and Wodon, 2006). Building better infrastructure and expanding the use of food-processing technologies are great ways of reducing women’s time burden, as has been demonstrated in many African countries.

Adoption of agricultural technologies may influence women’s time-use patterns. In South Nyanza, Kenya, women in households that adopted sugar cane spent more time in domestic work, other income-generating activities and other community-level projects than women whose households cultivated food crops (Blackden, 2002; Rubin, 1990). Alternatively, household production tasks and the domestic care burden of women may limit technology adoption, especially if such technologies require a greater time commitment. In Ethiopia, adoption of sustainable agricultural practices depends on household size and labour availability, as their adoption increases women’s workload (Teklewold and others, 2013).

Women may also be hesitant to adopt technologies if they do not control the benefits that accrue from adoption (Dolan, 2002). One village showcased at the ESA Sharefair

demonstrated how designing technologies for women and ensuring that they control the benefits of technology adoption created a “green sustainable village”. Led primarily by women’s cooperative groups, several green technologies were developed and adopted, including a rainwater harvesting system and use of biogas residue as a fertilizer (see box 3).

BOX 3 TRANSFORMING INTO A GREEN SUSTAINABLE VILLAGE WITH THE HELP OF WOMEN’S TECHNOLOGIES

The United Nations Development Programme–United Nations Environment Programme’s Poverty-Environment Initiative, in collaboration with the Rwanda Environment Management Authority, assisted people in northern Rwanda’s Kabeza village to adopt technologies such as rainwater harvesting systems, the use of biogas residue as fertilizer, tree planting for climate proofing, and terracing that put the villagers on a pro-poor sustainable development path. The initiative was spearheaded by women-led cooperatives, which allowed these women to share any technology adoption risks. The intervention so far has had about 200 beneficiaries, 62 per cent of whom are women. Having greater access to water at a closer location and biogas for cooking saved significant time for both women and children. The initiative has also led to higher agricultural productivity, which has allowed a greater portion of the agricultural output to be sold to market. Ms. Solange, head of the village cooperative, proudly notes that “before, at this site, the poor people were the poorest among the poor, but if you see them now, they look better off”.

Note: Drawn from “PEI Africa showcases Rwandese success story at UN organized Sharefair” <www.unep.org/gender/Inspiringexamples/PEIAfricashowcasesRwandesesuccessstoryatUN/tabid/1059894/Default.aspx>.

Poor levels of human capital, health and nutrition also significantly constrain women’s ability to work as efficient agricultural producers. Low levels of human capital may influence women’s productivity in two ways. First, they may take longer to perform the same agricultural task. Second, **they may not use certain technologies if they lack the information and knowledge required to use it** (Foster and Rosenzweig, 1995). In fact, a significant portion of the on-farm productivity gap in Malawi is explained by the labour productivity gap, which is larger than the land

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

productivity gap.² Women are found to spend more time working on farm, which diminishes the size of the overall productivity gap, but increases the labour productivity gender gap because women take longer to perform the same task as compared to men (Palacios-López and Lopez, 2014). Lower wages than those paid to men and their domestic work burden keep women from employment in off-farm activities. Women thus spend more time working on their farm but do not gain the necessary productive inputs to improve their farm's productivity.

Compounding the problem of women's lower educational levels is the fact that, on average, they have less access to extension services than their male counterparts (Quisumbing and others, 2014). Where women have been found to have greater access to extension services, as in Ghana for livestock (World Bank and IFPRI, 2010), they have a higher likelihood of adopting technologies (Davis and others, 2012). The issues of off-farm time burden and low levels of knowledge and human capital are closely correlated, as a lack of time may prevent women from improving their agricultural know-how (see box 4). Other important considerations are whether technologies are affordable and culturally acceptable.

INSECURE LAND TENURE LOWERS INVESTMENTS IN IMPROVED TECHNOLOGIES

Rural women are less likely to have land under their control than rural men (Doss and others, 2013). Traditionally, women's rights to land were primarily governed by their marital status and confined only to having tenure rights on land that they cultivate. In Ethiopia, women's land rights do not extend beyond accessing or owning land outside the context of marriage (Aguilar and others, 2014). Not only are women discriminated against in formal land laws, but similar inequalities exist in family and

² Agricultural productivity refers to the value of output per hectare of plot; labour productivity refers to the value of output for the total number of managerial hours of labour on that plot. In Malawi, agricultural productivity is lower for plots managed by female-headed households as compared to male-headed households. However, the labour productivity difference between female- and male-managed plots is 44 per cent, compared to a land productivity difference of 25 per cent. The labour productivity difference reflects the fact that women spend more time on farm as compared to men, yet their value of output is lower. However, spending more time on farm reduces the overall land productivity gap between plots managed by female- and male-headed households.

BOX 4 REMOVE THE TIME BURDENS OF WOMEN FARMERS FOR A MORE PRODUCTIVE, IMPROVED LIFESTYLE

As highlighted in the ESA Sharefair, women are often involved in tedious, repetitive and burdensome tasks. Development of technologies that mechanize such repetitive processes – especially those involved in the post-harvest segment of the value chain – have proven to be very useful for women. Among the technologies showcased at the ESA Sharefair was the Rocket Stove, which is quite affordable, easy to build and provides strong heat without smoke. The stove uses 50 per cent less fuel compared to traditional stoves and is about twice as efficient as an open fire, thereby reducing the time women spend in cooking activities. The ESA Sharefair highlighted many other examples of affordable yet time-saving cooking stoves as well. Adoption of cheap post-harvest technologies offers yet another set of simple solutions proving to be very useful and relevant for women. Innovation and development of a post-harvest pit storage bag in Ethiopia and a hydraulic presser that processes cassava into high-quality flour are excellent examples of productivity-enhancing technologies that could be scaled up to allow for their adoption by large numbers of women. The key to expanding the reach of such technologies is a conducive, pro-women, policy environment and deliberate investment in the development of such technologies.

inheritance laws – consequently limiting the ability of women to claim and transfer land at the household level (Hallward-Driemeier, Hasan and Bogdana Rusu, 2013). Expanding and formalizing land laws leads to increased land-related long-term investments, as women may be unwilling to invest in land they are cultivating if there are risks of losing control of it over time and they are afraid that their land could be taken away from them. A land certification programme in Ethiopia that reduced tenure insecurity and risk improved productive investments and rental market activity (Deininger, Ali and Alemu, 2011).

Improving tenure security and access to land has direct consequences for bolstering investments in long-term, financial capital-demanding technologies. Tenure security in nine West African countries led to significantly improved tree planting and investments in land, but did not affect short-term investments such as use of purchased productive inputs (Fenske, 2013). Insecure tenure made women in southern Ghana leave their land fallow for a shorter duration as compared to men because of the fear of having

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

their land expropriated if they left it fallow for too long. Differences in cultivation trends explained the lower yield observed on female farms (Goldstein and Udry, 2008). Another related aspect is the intra-household dynamics of land ownership and agricultural decision-making; such analyses must distinguish between statutory and customary rights, as well as intra-household dynamics. In Malawi, Mali and Tanzania, joint ownership of land by a man and a woman is associated with having more influence on household agricultural decisions than for women who do not own any land. The influence that women have on agricultural decision-making is even higher when they own land themselves (Doss and others, 2013) (see box 5).

BOX 5 BOTH WOMEN AND MEN NEED TO BE CONSIDERED IN SCALING UP THE USE OF AGRICULTURAL INNOVATIONS

Often, women make choices by considering the constraints their households face; this could be due to either the presence or absence of men in their families. Where men are present in households, sometimes women and men operate on separate plots, or women and men operate on the same plot with varying degrees of decision-making across various agricultural activities (Quisumbing and others, 2014). In households where men are absent, women may face different challenges based on whether their household is headed by a divorced or widowed woman, or if the husband is physically away from home but contributing to household income. The impact of policies aimed at improving agricultural technology adoption by women will differ depending on household family structure and composition. For example, in Ghana, farmers in female-headed households have a lower chance of adopting improved maize varieties as compared to households where both women and men are present in a male-headed household (Doss and Morris, 2000).

STRUCTURAL FACTORS, SUCH AS LACK OF FINANCIAL PRODUCTS, INFLUENCE TECHNOLOGY ADOPTION

Several factors, such as **collateral requirements, mobility constraints, transaction costs and cultural barriers, prevent women from accessing financial products, credit and other services**. In some contexts, women may not receive information about financial products such as credit or weather insurance availability from informal lending sources, or information may not be fully transmitted between spouses within a household (Quisumbing and Pandolfelli, 2010). Women's demand for credit may be

hindered from the outset if they are seeking financial products in formal systems and entrepreneurship in general implies breaching social and cultural norms (Fletschner and Carter, 2008). In such contexts, **interventions that provide access to financial products to women farmers through familiar structures, such as rural savings and credit cooperative organizations, may inspire women to seek credit due to the prevalence of strong peer effects**. However, improved access to financial products may have a lagged impact on women. Lack of access to credit is one of the many constraints they face in adopting technologies. Providing a range of financial products – outside the already existing social practice of pooling money – will be important in changing behaviour to invest in adopting new technologies. Women also need equitable access to information and communication technologies, and to extension services.

PAVING THE WAY FORWARD: POLICY ACTIONS

Despite the emerging consensus that reducing gender inequality is a key aspect of agricultural development, policy reform has continued to be subdued. This situation is partly a result of the broader challenges facing the agricultural sectors in many Sub-Saharan African countries for women and men farmers alike such as stagnant overall agricultural productivity growth, low use of purchased inputs and small land size. Yet the promise and potential of gender-responsive agricultural policies in lifting agricultural families out of poverty, while strengthening rural and urban economies, are tremendous. This conclusion was enthusiastically upheld by a broad range of representatives of governments, donor agencies, and domestic and international civil society organizations at the ESA Sharefair. We provide a few policy options with a gender-responsive lens for scaling up technology adoption while catalysing food and nutrition security. Box 6 sheds further light on the current state of integrating gender in agricultural policies in Sub-Saharan Africa – which is a starting point for designing and implementing pro-women agricultural policies.

PROMOTE TECHNOLOGIES FOR WOMEN, TO WOMEN, WITH WOMEN

Policymakers should specifically target those technologies that are culturally and socially familiar to women. Such technologies neutralize the known risks in production

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

BOX 6 CLOSE THE NATIONAL POLICY GAP FIRST TO NARROW THE GENDER TECHNOLOGY GAP

In many African nations, promoting gender equity is increasingly becoming a part of the policy framework, yet there is a gap between the gendered dimensions of agriculture as a conceptual organizing framework and actual policy implementation. The Comprehensive Africa Agriculture Development Programme (CAADP), jointly supported by the African Union Commission's Department of Rural Economy and Agriculture and the New Partnership for Africa's Development, bundles women farmers along with youth and the disabled into a group labelled "vulnerable" in the policy document. Although CAADP encourages national governments to commit 10 per cent of their national budgets to agriculture, and while many countries lag in achieving the 10 per cent goal, CAADP may consider having a specific share of agricultural budgets dedicated to women in agriculture and agribusinesses to tap the tremendous potential of African women farmers.

At the country level, the evidence of gender integration in agricultural policies continues to be mixed. In most countries, gender equality is addressed in the development agenda, but the delivery mechanisms to ensure that plans and activities are implemented may not necessarily be in place. For example, gender is omitted in the Note de Politique Agricole of the Democratic Republic of the Congo. In Ethiopia, Kenya, Malawi and Uganda, the primary agricultural policies are much more gender inclusive and recognize the needs and constraints of women farmers in a comprehensive manner. Gender is mentioned as a cross-cutting issue in the National Investment Plan for Agriculture of Tanzania, in Mozambique's Agricultural Development Strategy and in Malawi's Agriculture Sector Wide Approach, among others. Most policies mention technology and women in the context of agricultural extension. The needs of women farmers as innovators, cultivators and distributors are often not mentioned explicitly in the development agenda. A key prerequisite for closing the gender technology gap between women and men farmers is to narrow the policy gap that exists in addressing the specific constraints facing women family farmers, especially at the programmatic and implementation level.

Note: This box draws on information from an upcoming UN Women report on gender integration in agricultural policies of various African countries.

women is to put them at the centre of the technology innovation and product design process, which was also one of the central messages of the ESA Sharefair. In Kenya and Tanzania, a programme promoting the purchase of irrigation pumps by women was unsuccessful because the pumps took two people to operate and required the use of legs for pedalling – an action that is considered culturally inappropriate (Njuki and others, 2014). In another intervention, women were provided training in homestead gardening, irrigation and animal rearing in Burkina Faso. An experimental evaluation of the programme found that women gained greater control over agricultural assets and small animals. Moreover, women were found to have a higher chance of making the decision to use garden products as well as the proceeds from these homesteads (van den Bold and others, 2013). Similarly, in Tanzania, a solar-powered irrigation pump has been developed that is capable of irrigating approximately 1 acre of land in 6–12 hours a day. The pump, which was showcased at the ESA Sharefair, is portable and can be easily transported between fields, offering an opportunity for developing a custom hiring irrigation service business for women entrepreneurs and women-led cooperatives. Besides considering cultural appropriateness, policy should also take into account the fact that women have multiple objectives while working on farm and may be particularly inclined to adopt technologies that prioritize their household's food and nutrition security (see box 7). In the long run, technologies with the potential to transform women's current roles and responsibilities – particularly in agricultural production systems – and allow them to seek remunerative work opportunities should also be developed and promoted.

CONSIDER THE NATURE OF TECHNOLOGY TRANSFERS: CASH VERSUS IN-KIND

Cash vouchers or direct asset transfers are an attractive policy option to encourage farmers to adopt particular technologies and agricultural inputs. Recently, many African countries have introduced cash voucher coupons to encourage the adoption of fertilizer. The impact, including the gender-disaggregated results, of the use of such vouchers is still being evaluated. In Mozambique, an experimental evaluation of the fertilizer subsidy programme reveals a relatively low uptake of fertilizer and improved seed varieties by farmers, potentially due to other credit or information limitations. Moreover, adoption of such technologies leads to differential benefits in

flows; are divisible so they can serve small-, medium- and large-scale operations; and combine various segments of the supply chain. A particularly helpful way of shortening the link between technology innovation and adoption by

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

BOX 7 FOOD AND NUTRITION SECURITY STARTS WITH AGRICULTURAL PRODUCTION FOR WOMEN

In Uganda, biofortified orange sweet potato (OSP) was promoted to enhance intake of vitamin A, particularly among children and women. The crop produces slightly higher yields compared to white or yellow sweet potato, which is the primary crop cultivated in the intervention area, but is also susceptible to rotting during dry weather spells. Because OSP is an agricultural technology that improves household health and nutrition, women may have a direct stake in its adoption. The programme used female farmer groups to distribute OSP vines; nutrition information about OSP was also given to these women. The experimental impact evaluation of the intervention found that the level of assets controlled by women within the household did not influence adoption of OSP. Plots that were jointly managed by the woman and man in the household, with the woman as the primary decision maker, were more likely to include the OSP crop, while plots that were solely managed by men had the lowest likelihood of cultivating OSP vines. The study sheds light on technology traits, such as enhanced household nutritional status, that may particularly appeal to women farmers (Gilligan and others, 2012).

yield and income (Carter, Laajaj and Yang, 2013). The relatively low uptake of fertilizer and improved seed suggests that poor farmers are likely to face constraints other than credit availability, such as prior knowledge about use that may prevent them from adopting new technologies. In a complementary intervention, along with voucher coupons, farmers were encouraged to open savings accounts; some farmers were also selected to receive a 50 per cent match of the savings left in their account between harvest and the time to purchase fertilizer. The matched savings intervention improved farmers' planning horizon and was used to encourage technology use beyond the intervention period (Laajaj, 2012). In Mali, when women were given free fertilizer, they increased their use of this input and invested their own resources in purchasing other inputs such as herbicides and hired labour. Although the programme improved agricultural output, it did not improve their profit significantly because of higher spending on other complementary inputs (Beaman and others, 2013). **Encouraging adoption of new technologies by women farmers may therefore require a set of complementary policies such as innovative financing mechanisms, along with providing actual knowledge**

about technologies and bringing the technologies to the doorstep. When simultaneously implemented, such complementary policies have the potential to enhance technology adoption by women. Scaling up use and knowledge of local technology solutions, such as those highlighted in the ESA Sharefair, along with appropriate transfers may be particularly attractive.

SMALL NUDGES CAN GO A LONG WAY

In Western Kenya, farmers were encouraged to use fertilizer by providing them with time-limited fertilizer discounts in the form of free delivery right after the harvest season. The evaluation of the programme suggests that such small nudges were much more effective in encouraging fertilizer use than much larger price subsidies during the planting season (Duflo, Kremer and Robinson, 2009). Similar policies focusing on fertilizer and other productivity-enhancing agricultural inputs that carefully consider women's time, information and financial constraints – such as periods when women may be particularly busy or when they are particularly resource limited – may potentially improve technology adoption by women. For example, if field training and extension activities are performed when women are especially busy due to household and childcare work, then women are unlikely to attend and participate in such events. Encouragement and nudges through social networks can also significantly improve adoption, as women rely on their informal social networks more than do men (see box 8). Nudges and knowledge offered through innovative methods, including picture-based extension services via mobile phones, is another cost-effective way of reaching out to women farmers about technology use and information. In a Niger programme that randomly provided mobile phones to enable access to market information, women farmers were found to have a higher likelihood of cultivating high-value crops such as peanuts and okra (Aker, Ksoll and Lybbert, 2012). The ESA Sharefair showcased mobile phone-based innovations such as I-Farm Kenya, which is an online platform that enables farmers to access video documentaries of best farming practices. Livestock Info Management System is another example of a mobile-based platform in Tanzania. The content of such interventions can be customized and made more affordable and accessible for women farmers. Leveraging private sector expertise and resources can be instrumental in such scaling-up efforts.

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

BOX 8 SHE WHO LEARNS, TEACHES: USING SOCIAL NETWORKS FOR TECHNOLOGY ADOPTION

Female family farmers often rely on informal social networks more than men to access information about new agricultural technologies (Katungi, Edmeades and Smale, 2008). Time and mobility constraints may prevent women from accessing public extension and formal agricultural information services (Kondylis, Mueller and Zhu, 2014; Quisumbing and Pandolfelli, 2010). In such situations, women rely extensively on female social networks to learn about new agricultural technologies. The ESA Sharefair also aimed to bring together the countless proof-of-concept innovations by women-led groups in the region, which need to be shared for further scaling up and to attract greater investments. In Mozambique, farmers in communities that had female contact farmers were more likely to teach others about environmentally sustainable land management practices (Kondylis, Mueller and Zhu, 2014). Similarly, in Ethiopia, the majority of farmers who had adopted purchased inputs, such as fertilizers, attributed their decision to having an individual of the same sex within their social network (Weir and Knight, 2000). Often, these social networks are highly segregated by gender and experience different kinds of information exchanges. Information networks of pineapple farmers in Ghana tend to be based on same-gender and -age groups (Conley and Udry, 2010). A study in rural India found that husbands and wives within the same household vary in their agricultural social networks and that female social networks have some influence on technology adoption by the household – even though these women receive information about the technology indirectly in a primarily patriarchal agricultural production system (Magan and others, 2014). Mobilizing social networks is essential in enhancing uptake of new technologies, as they not only allow access to knowledge about production practices, agricultural machinery and equipment, and market opportunities, but also encourage adoption through peer effects.

Note: The phrase “she who learns, teaches” is adapted from an Ethiopian proverb.

STRENGTHENING WOMEN’S LAND RIGHTS IS A LONG-RUN GAME CHANGER

Strengthening women’s land rights, starting from shifts in inheritance laws to land rental laws, is essential for women to trust that their investments in agricultural technologies will support their long-term personal, household and community goals. The Land Policy Initiative of the African Union Commission, the African Development

Bank and the United Nations Economic Commission for Africa has developed guiding principles on large-scale land-based investments in Africa; these address the need for providing secure access to land by women family farmers.³ Evaluation of South Africa’s Land Redistribution for Agricultural Development programme suggests that beneficiaries experienced a 25 per cent increase in their consumption expenditures. While their living standards initially dropped, beneficiaries experienced a 150 per cent increase in living standard after a period of more than three years, as measured by per capita consumption (Keswell and Carter, 2013). Similarly, the Land Tenure Regularization programme in Rwanda sought to register every landholder in the country with the explicit goal of recognizing married women as co-owners of land. As a result of the programme, investments in conserving land quality, such as construction of terraces and check dams, increased. These investment responses were notably stronger for female-headed households (Ali, Deininger and Goldstein, 2014). With their much larger and long-lasting welfare impacts, the empirical evidence strongly supports securing land rights as an effective asset transfer programme as compared to other cash or asset transfer programs (Keswell and Carter, 2013). While much work is needed in understanding the gender impacts of land distribution and grant programs, the average impact of such programs proves the effectiveness of such policies in encouraging long-run agricultural investments and in enhancing food and nutrition security.

CONCLUSION

In the work of many national governments, domestic and international organizations, civil society organizations, and donor agencies, there has been a heavy emphasis on gender as an organizing framework in development initiatives, especially in data collection efforts and impact evaluation. There is still a tremendous need to shift from using gender as a mere rhetorical, conceptual framework to gender-driven development investment in practice and action (see box 9). The ESA Sharefair was an excellent starting point in portraying the potential of Africa’s women as technology innovators, transformers and entrepreneurs. Evidence is needed at the household,

³ The document is available at http://www.uneca.org/sites/default/files/PublicationFiles/fg_on_land_policy_eng.pdf; additionally, the initiative convened a validation workshop for its gender strategy.

TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

BOX 9 WHAT DO WE STILL NEED TO LEARN ABOUT TECHNOLOGY ADOPTION BY WOMEN FAMILY FARMERS, AS HIGHLIGHTED IN THE ESA SHAREFAIR?

- What kind of technologies do women want, and how are women's needs included while co-innovating and developing agricultural technologies that improve agricultural productivity and agribusiness incomes?
- How can mutual accountability frameworks, such as the Pan African Federation of Accountants' Integrated Reporting Framework and the Comprehensive Africa Agriculture Development Programme Results Framework, attribute value to unpaid work by women in further enhancing rural development and food and nutrition security at national and regional levels?
- How can women gain more voice in household decision-making, and how can men be engaged in promoting gender equity in agriculture?
- What kind of innovative, cost-effective methods improve adoption by women family farmers?
- What kinds of financing mechanisms, including financial and weather risk insurance products, improve adoption of technologies in the shortest time frame?
- How does adopting technologies help women obtain the time needed for leisure and rest to ensure a long, productive and healthy life?
- How do women effectively learn about and disseminate new technologies?

Note: The Pan African Federation of Accountants supports integrated financial, social, economic and environmental sustainability reporting to value all assets, in order to promote transparency and accountability. The International Food Policy Research Institute, the African Union Commission's Department of Rural Economy and Agriculture, and the New Partnership for Africa's Development will release indicators of the Comprehensive Africa Agriculture Development Programme 2015–2025 Results Framework to support the Implementation Strategy and Roadmap of the Malabo Declaration of Food and Nutrition Security.

national and regional levels to better understand the effectiveness of positive, gender-targeted policies in action. Particular attention is needed for developing, disseminating and scaling up technologies that are developed by women innovators and reflect the specific needs

of women family farmers. A gender lens on agricultural development is required to extend the benefits of such efforts to enhancing food and nutrition security, raising agricultural productivity and transforming the role of women farmers in the agricultural value chain.

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TECHNOLOGIES FOR RURAL WOMEN IN AFRICA

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