BARRIERS TO INVESTMENT IN ADAPTATION

MSEs in different countries and economic sectors face multiple and varied barriers to investment in adaptation. This section discusses some of the key barriers that need to be addressed to strengthen the resilience of MSEs in developing countries. Corruption and public sector inefficiencies that affect the general business environment are not within the purview of this report.

Based on the findings from the case studies and literature review,[12] the barriers that prevent businesses from engaging in adaptation can be grouped into six categories, namely:

1. Lack of awareness and knowledge of climate risks
2. Limited availability or knowledge of adaptation options
3. Lack of technical capacity to implement
4. Lack of financial capacity to implement
5. Policy and regulation that hinder adaptation
6. Social attitudes toward adaptation

Climate Knowledge and Risk Assessment

Surveys show that most medium and large companies in Europe and the United States are increasingly aware of the risk that climate change poses to their business (Metcalf et al. 2010; UN Global Compact 2011; IFC and EBRD 2013; CDP 2014a; CDP 2014b). A survey in the United Kingdom found that smaller companies tend to be less aware of climate risks than their larger counterparts (Howe 2011; Ballard et al. 2013). Comparable surveys from Africa, Asia, and Latin America do not exist, but it is likely that awareness of long-term risks among MSEs in these countries is equally low or lower, when compared to larger businesses in the same countries.

Poor information—information that is unavailable or inaccessible—about the risks and uncertainties that are relevant to the scale and location of MSE activity makes it difficult for businesses to incorporate these risks in their decision-making. Investing in adaptation requires understanding how a specific industry or sector, in a specific place, is likely to be impacted by climate change. It requires the technical ability to assign probability to the risks associated with climate change impacts, to weigh alternative risk reduction options, and to determine the most cost-efficient and cost-effective options for that sector and geography.

An important consideration when it comes to MSEs is that smaller businesses often make costs with relatively short payback times (Danielson and Scott 2006).[13] This makes them flexible but also limits their perspective and reduces the likelihood that they will invest in adapting to long-term climate change. Even when relevant climate information is available and risk awareness is high, MSEs find it

BOX 5 | ZIMBABWE: CLIMATE KNOWLEDGE

Information on weather and climate patterns is important for the vast majority of farmers in Zimbabwe, who rely on rainfall. Rain-fed agriculture accounts for 95 percent of food production. The productivity of rain-fed crop farming in Chiredzi is low and very sensitive to rainfall fluctuations.[14] Because rainfall patterns are erratic, farmers find it difficult to predict the timing of seasons or plan for these seasonal changes; they often lose much of their harvest as a result. Climate sensitivity analyses have found that climatic factors in Zimbabwe significantly constrain agricultural production by smallholder farmers.[15] Access to accurate meteorological information is a particular weakness. Deficient telecommunications infrastructure in rural areas remains an issue. Even when new adaptation technologies are available in the country, most farmers in remote areas have limited access to information; they have no access to radio communications or newspapers.[16] In addition, literacy rates are low among farmers, especially women, who make up approximately 70 percent of smallholder farmers.[17]

The intervention, implemented by the Zimbabwean Environmental Management Agency, with assistance from UNDP and the Special Climate Change Fund, installed eight weather stations and developed a customized rainfall forecasting system to assist farmers in Chiredzi. As a result, those farmers can now plan for climate variability and extreme events. There have been visible improvements in crop cycle planning, drought preparedness, and adjusted farming practices to protect yields from low-rainfall seasons.

difficult to incorporate this information into practical business planning. Danielson and Scott (2006) also found that many MSEs make investments based on "gut feeling." This suggests that, when MSEs make investment decisions concerning risk management, sectoral trends, horizontal learning, demonstrations, and investments made by competitors are more important signals than net-present value calculations or other economic tools used to measure the costs and benefits of investments.

MSEs have limited tools and capacity to undertake risk-benefit assessments to support investments in climate-related risk reduction or new business opportunities. Providing business owners with a high-level analysis of sectoral risks is not enough, because such information is not necessarily actionable—especially in the case of climate change where the specific timing and location of impacts are so uncertain. Information about climate risks must therefore be available to businesses in a format that is understandable and actionable. In Zimbabwe, agricultural MSEs struggled to plan for rain-related weather events until (perhaps for different reasons) the public sector, with external development assistance, installed a higher density of weather stations to provide better information about upcoming local weather events (see Box 5). Such information should be coupled with guidance on what actions businesses can take to reduce their vulnerability—with an emphasis on the effectiveness of these actions (Howe 2011)—and the benefit of the investment for the business owner (Turpie et al. 2014). In the agriculture sector, especially, such horizontal learning from investments made by other MSEs would enhance the spread of adaptation options among communities (Conley and Udry 2008).

Cost-Effective Adaptation Measures

Adaptation options must have attractive risk-reward profiles, be cost-effective at a small scale, and be competitive against non-adaptive options with regard to price, operating costs, or sustainability of production. Businesses will not invest in an adaptation measure—especially when there are high, upfront investments—unless there are clear benefits in terms of increased resilience and/or profitability. MSEs may find that investing in increased climate resilience requires adaptation measures that are not within their scope of action (for instance, early warning systems, which are largely public goods) or necessitates costly infrastructure that does not make financial sense to purchase on their own.[19] Even when MSEs are aware of and can assess climate risks, they need to have the skills and ability to identify and evaluate viable adaptation measures. Knowledge is limited

BOX 6 | BENIN: GENERATING ALTERNATIVE INCOMES THROUGH RABBIT BREEDING AND CREATING NEW MARKETS

More frequent and severe floods in Benin have impacted vulnerable communities, especially in the fisheries sector, and led to reductions in their incomes. In response, UNDP partnered with the Department of Livestock and assisted MSEs in the livestock sector to develop rabbit breeding facilities on elevated platforms where they would have protection from the increased frequency of flooding. In addition to realizing an alternative income during periods when fishing cannot be undertaken, the diversification of economic activity has also created a new local market for rabbit meat and begun to transform the local economy of the village. This intervention was possible only because of resources from the LDCF and the Government of Benin, as well as contributions from beneficiaries themselves.[18]

32-year-old Beatrice Dossou, married with two children, is one of 10 rabbit breeders supported in the village of Sèhomi, a commune of Bopa. In July 2013, she received 10 two-month-old breeding rabbits (two males and eight females) and livestock equipment, including hutches, boots, a wheelbarrow, and a thermometer. Beatrice was trained in rearing rabbits. After five months of activity, Beatrice is reaping the fruits of her labor. In total she has sold 45 rabbits and made 125,000 CFA francs (approximately USD$300). The money generated by this first sale provided the means to cover important expenditures such as the school fees for her children, which would not have been affordable had she continued to rely on fishing alone.

and few tools are available for cost-benefit analyses of location- and time-specific adaptation measures.

If adaptation measures are to drive potential opportunities, owners of MSEs need to know what options they have and why they would benefit from investing in adaptation. For example, if farmers are accustomed to growing certain crops year after year, they can be reluctant to plant alternative crops unless they can see the potential business benefits. Sensitizing local communities is a powerful way to convey information about alternative crops that are more resilient in their locality, and that could bring in more revenue year-round. Such was the experience in Benin, where a UNDP-supported intervention helped business owners adopt new business models to move away from highly climate-sensitive industries. Now former fishing businesses have learned about and switched to rabbit breeding. The support offered for this transition involved a number of actions including initial upfront training and start-up materials to engage in this new business (see Box 6).

Financial Capacity

When a business case is made for adaptation and MSEs have the capacity to understand and assess risks and viable adaptation options, limited financial capacity can still impede implementation of adaptation measures. According to the International Finance Corporation (IFC), small and medium enterprises worldwide face a US $2.1 to US $2.6 trillion gap in financing. Put another way, roughly 200 to 245 million formal and informal businesses need loans, insurance, and credit, but are unable to access these financial and risk management instruments (Stein et al. 2010).

As noted before, some adaptation investments involve large upfront costs, relatively long payback time, and uncertainties related to climate impacts. Consequently, banks and other financial intermediaries can be reluctant to invest in adaptation because the risks of lending appear too high. In rural areas, banks themselves might not have the policies or technical ability to assess these kinds of risks. Therefore, the capacity of bank employees in developing countries can also be a significant barrier to businesses accessing finance to invest in adaptation.

In addition, commercial banks can be risk-averse when it comes to new MSE investments because contract enforcement frameworks in many low- and middle-income countries are ineffective (World Bank 2010). Many countries have weak judicial systems, where the rules of the market and economic rights are not effectively upheld (World Bank 2015). When contracts are not protected under the legal system, banks and other businesses are less likely to conduct business transactions. In such countries, the private sector is often less developed and grows more slowly than in countries where a strong contract enforcement framework is in place.

Ultimately, in sectors where all these risks (both direct and indirect) are priced into financing costs, the financing costs of equity and debt tend to be relatively high. These high costs can limit investments in adaptation. This leaves MSEs with few financial services options and makes business owners focus more on short-term survival and less on long-term resilience and profitability. Innovation related to climate-resilient technologies and services is subject to even higher risks and financing costs because the policies and regulations, research and development capacity, commercialization incentives, and market linkages for such technologies are in their infancy in most developing countries. Coupled with lack of technical capacity, MSEs will face major challenges to developing climate-resilient businesses.

It is already well recognized that most MSEs, be they formal or informal, have to rely on social networks and family members for small loans and start-up cash (Dalberg 2011). Existing banking structures in low- and middle-income countries do not always reach rural villages, they might not support microfinance, and many banks charge smaller enterprises higher interest rates and fees (Stein et al. 2013). During the development of new products and services, the type of finance required changes over time. Initially, there is usually very little money for research and development of new products and services in developing countries (Grueber and Studt 2013; Naseem et al. 2010). Furthermore, the development of an idea into a prototype is often risky, because there is a high chance that the product or service will fail. Lastly, MSEs often have few assets that can be used as collateral. These three issues make it hard for businesses to access finance in the early stages of product and service development, and they limit the commercialization of new products and services.

BOX 7 | NAMIBIA: LACK OF AFFORDABLE CREDIT AND MARKET ACCESS

The terminal evaluation of the UNDP-supported intervention in Namibia to promote the production of guinea fowl highlighted the lack of finance and market access as barriers to economic sustainability.[20] The review noted that, because of these factors, the pilot activities on crop and livestock farming are unlikely to be sustained or scaled up. For example, while the intervention secured livelihoods by developing guinea fowl products, "little has been done to develop sales and marketing channels." As a result, most beneficiaries sold their eggs to individual farmers or in informal markets.

Similarly, for most farmers, the start-up costs needed for an investment in drip irrigation, estimated at US $11,000 for one to two hectares, were prohibitive for many smallholders. Currently, no financing scheme exists to reach these smallholder farmers and reform of existing financing schemes and identification of viable financing models would be required.

The same problem applied to the introduction of plastic granaries. These granaries provide better protection against loss and diseases, which might increase because of climate change. However, current financial barriers were too high to allow investment in these granaries. The evaluation therefore recommended developing a subsidization mechanism in the form of a (soft) loan so that farmers can purchase the granaries on credit or at reduced rates.

Source: MAWF 2012.

In Nicaragua and Namibia, the financial capacity challenge played out in a couple of adaptation interventions. In Nicaragua, lack of finance was a major challenge to supporting MSEs in the development and implementation of agro-ecological transformation plans. An intervention supported by UNDP improved MSEs' business models. However, it did not improve the formal credit or banking system that serves MSE owners in rural areas. Without access to finance, MSEs are not able to make the investments that are needed to implement their plans (see Annex 4). In Namibia, MSEs were unable to develop the production of crops and livestock (such as guinea fowl) because of a lack of credit and market access, which limited their choices in terms of sustainable livelihoods (see Box 7).

Technical Capacity

In addition to understanding climate risks and available adaptation options, MSEs must also have the technical capacity to implement adaptation options that will climate-proof their operations. Adopting new business processes, developing new products or services, and implementing new practices and technologies for increased resilience often involve technical skills that require upfront investment.

First, new business processes and operations require systematic planning if they are to be both climate-resilient and profitable investments. New systems require technical knowledge that MSEs in developing countries might not be able to access. The diffusion of relevant technical and operational knowledge could greatly benefit owners of MSEs who try to integrate climate change risks into their businesses.

Second, MSEs might have promising business ideas but find it difficult to develop a credible business model for full-scale commercialization of their product (PwC 2013). Development of new products and services, in particular, requires specific skills and knowledge of how to guide and implement the process from idea to commercialization that are often not readily supported in developing countries.

Third, capacity constraints can discourage MSEs from adopting new climate-resilient practices and technologies in their business. For instance, technological options in the agriculture sector have been shown to improve productivity. However, without capacity building and proof-of-concept, MSEs will not be willing to invest or indeed may not even know that such investments are possible. In Ethiopia, several approaches were tried in various states to show MSEs the benefits of new crops and how to build the expertise needed to grow them (see Box 8). Various kinds of enterprises and associations between farmers provided the training and resources necessary to diversify their incomes and become more resilient to climate change. Such experimentation is vital to develop cost-effective, locally adapted solutions.

BOX 8 | ETHIOPIA: PROMOTING AUTONOMOUS ADAPTATION IN COMMUNITIES

The Promoting Autonomous Adaptation (PAA) project, funded by the Least Developed Countries Fund (LDCF), is working in four regional states in Ethiopia. The project established green enterprises for farmers who want to undertake climate change adaptation actions within their locality.

In Oromiya regional state, 17 farmers became members of the Batu Keltu Irrigation Water Use Association. They benefited from the enterprise's efforts to introduce solar pumps, the provision of drought-resistant seeds, and the organization of successive skills trainings on climate-smart agriculture. With an investment of US $1,380 in new techniques, the farmers generated US $3,480 in one season, largely due to increased sales of maize and tomatoes. This enterprise helped support their community's livelihood through income diversification.

In Tigray Ederta regional state, the establishment of the Maichelfo Small-Scale Irrigation Farmers Association has benefitted 54 farmers through small irrigation projects and the production of a variety of vegetables. This intervention is generating diversified incomes for the community, strengthening their resilience to climate change. Thanks to this intervention, wheat production has greatly increased, from 12 quintals per hectare to 35 quintals since the project began. The project also introduced multiple cropping using Irish potatoes, carrots, and cabbage.[21]

In addition to improved cropping, this intervention established fattening associations for livestock and animal farming. The 46 beneficiaries—24 of them women—benefited from increased sales of oxen and education on new livestock-farming techniques in fattening. The Freyat Dairy Farming Association helped increase incomes, too. The association purchased six cows, each producing 30 liters of milk a day, which sells at the market for US $87 per day. That income rapidly covered the initial investment in the cows of US $6,391.

In Gambela regional state, the intervention established a green enterprise to support 34 youth farmers to grow fruits and vegetables. The farmers received training on agricultural practices and small-scale irrigation management. They subsequently planted 600 banana seedlings on six hectares of land, which was donated by the district. In one season, they harvested 1,200 bunches of bananas, which sold for more than the initial capital investment.

In Benishabgul Gumuz regional state, the intervention helped establish the Balbel Kerim Irrigation Youth Association, comprising 85 members. The association initiated trainings in climate-smart agriculture, installed solar pumps, and provided improved sorghum seeds, vegetable seeds—such as red pepper, onion, and tomato seeds—and improved varieties of banana plants. The project also supported access to nine hectares of land for planting. During the first harvest, teff and sorghum crops generated US $3,147 in revenue, largely exceeding the initial capital of US $823.

Various kinds of enterprises and associations between farmers provided the training and resources necessary to diversify their incomes and become more resilient to climate change.

BOX 9 | INDIA: OVERCOMING DEPENDENCE ON GOVERNMENT SUBSIDIES FOR IRRIGATION

Jain Irrigation Systems, a large private company based in India, attempted to market drip irrigation technologies in India's water-stressed regions as a water-saving technique. The company viewed drip irrigation as an important tool to alleviate poverty in these areas and reduce the use of groundwater. However, despite the failing irrigation infrastructure in several regions, farmers are not willing to invest in new technologies such as drip irrigation. This is because of the widespread use of small-scale water pumps that run on subsidized energy. Farmers have little incentive to invest in expensive equipment to save water, even though the low cost of operating pumps, coupled with poorly defined groundwater rights, has led to an unsustainable increase in the use of groundwater.

Jain experienced another constraint on the introduction of drip irrigation. Although the government subsidized investment in drip irrigation by 50–90 percent, payments from the government to Jain for equipment already sold were very slow to arrive. This put an enormous strain on Jain's working capital. In 2012, Jain invested in its own non-banking finance company (NBFC) in an effort to provide credit to the agriculture sector. The NBFC will lend to farmers so that Jain gets the full price at sale. The farmer then assigns the subsidy to the NBFC. The NBFC will take some pressure off Jain's balance sheet, and Jain will be able to pass the benefits of lower working capital loans to farmers. Jain hopes that this will alleviate the financial strain that is slowing down sales.[22]

Policy and Regulation

Given limited information and financial and technical capacity, government institutions can play an important role in encouraging adaptation practices, incentivizing investments, and communicating information and knowledge to local businesses. However, in many developing countries, national and local government institutions struggle with formulating and implementing policies for climate change adaptation. While many governments have committed to climate change adaptation as part of their development strategies, private sector engagement is limited in sectoral planning and budgeting at the national and sub-national levels. MSEs, in particular, are absent from these exercises.

Uncoordinated and unclear inter-sectoral policies can frustrate adaptation efforts by the private sector. For example, pricing subsidies for water can result in low costs to the consumer but high costs to society. This often leads to wasteful use, especially in the agriculture sector, depletion of the resource, and potential loss of livelihoods in the event of extreme weather changes. For example, in India, a combination of water policies, energy subsidies, and non-payment of subsidies by the government made it difficult for a large private enterprise in India to introduce and scale up a water-saving adaptation option. Jain Irrigation Systems brought to market its drip irrigation technology, but found it difficult to become profitable in drought-stricken areas of India because farmers were paying very low prices for water. They did not see the benefit in investing in drip irrigation technologies (see Box 9).

Other examples of government policies that can hinder investment in adaptation are policies that mandate specific land uses, which can limit possibilities for crop diversification (Knox et al. 2010). In the Philippines, there are various examples of indirect and direct subsidies that increase the vulnerability of people, including subsidies that promote development in high-risk areas or conversion of forests or watersheds to other uses (IBRD 2013). Identifying and removing policies that have negative consequences can change incentives on both the supply and demand sides of adaptation technologies and increase the financial attractiveness of adaptation activities (Kato 2014).

The presence of counter-productive policies that discourage adaptation can thus be an obstacle to business investment (IFC and EBRD 2013). Without a clear national adaptation policy that describes the government's intentions and activities for the long term, there can be uncertainty over legal and regulatory implications as well as uncertainty about investment incentives. However, national and sub-national governments and institutions are themselves often hindered by lack of technical and financial capacity to mainstream climate risks in policies, regulations, and investment decisions.

Social Dimensions of Adaptation

Adaptation to climate change is a process influenced by more than just financial and technological development. Class, gender, and culture also play a large role when deciding whether to implement one adaptation option rather than another. Although often overlooked, the social context can be a significant barrier to adoption of new technologies and production methods. Adaptation is often viewed as a behavioral change that will alleviate climate impacts or open new windows of opportunity (Nielsen and Reesberg 2010). Because people's decisions are influenced by social factors, such as gender, class, or race, the adaptive capacity of individuals varies considerably.

In the 2014 *World Disasters Report*, the authors analyze complex issues of culture and how they can hinder disaster preparedness. The report provides numerous examples of how culture affects risk perception and risk management and proves to be a significant barrier to adapting to climate change. Another study, by Davidson et al. (2003), suggests that women tend to have a higher risk perception than men and would be more likely to invest in adaptation. Social barriers can range from believing that uncertainty is too great to take action now to institutional and social discriminations within certain groups (Jones 2010).

BOX 10 | NAMIBIA: CONSERVATION AGRICULTURE METHODS
TASHIYA'S STORY[23]

Fukuile Tashiya's neighbors laughed when they first saw her farmland, ripped up like an "elephant's playground." "Can you even grow plants in these big holes?" they teased. Tashiya's small plot had deep furrows next to dark heaps of freshly dug earth, running across the length of the plot. Her plot was converted as part of a government technical assistance initiative, supported by UNDP with financing from the Special Climate Change Fund. The project showed farmers how to plow, weed, plant, and use fertilizer in a hundred demonstration plots across Namibia. Namibia, the driest sub-Saharan country, struggles with water scarcity. The intervention applied conservation agriculture techniques to produce a better yield while saving both water and labor.

"Instead of just planting the crops on top like we always do, last year I sowed my mahangu [pearl millet] in these lines and the result was great," Tashiya explains. "My yield was much better and the size of the grain was big compared to other plots [where traditional practices were applied]."

Because social and cultural factors determine how people respond to climate change, they translate directly into how business decisions are made in MSEs (Jones and Boyd 2011). Factors such as socioeconomic status, age, gender, and culture have a profound influence on the outcome of a decision-making process (Nielsen and Reenberg 2010; Jewitt and Baker 2012). Some MSEs might be skeptical about adopting new ideas because of innate cultural or societal factors affecting their choices.

Owners of MSEs do not usually make adaptation decisions in isolation; departure from tradition is difficult. For example, in Namibia, a farmer was teased for adopting new farming techniques never before seen in the community (see Box 10). Over time, the new techniques could catch on as the rest of the community witnesses their success. An example from Cambodia shows how cultural attitudes and habits are surmountable through a collaborative approach that offers participants first-hand experience of the advantages of adaptation (see Box 11). Overcoming social and cultural barriers requires a good understanding of MSE dynamics in communities and requires long-term investment in private sector engagement. For this purpose, it helps for the public sector to engage business owners and community members as participants early on, share information with the public in an accessible way, and conduct demonstrations so participants can see the benefits of adaptation for themselves.

Summary

Enterprises need to become more resilient, through better management of their climate risks and harnessing new opportunities that arise as a result of climate change. However, they face numerous barriers that vary with location and economic sector. Many business owners in developing countries, especially those at the MSE scale, lack the capacity and resources to assess climate risks affecting their business. Even when climate risks are known, MSEs often lack the tools and training to assess available adaptation options best suited to their context, such as climate-proofing existing operations, or diverging to another business model. Often, risks lead to high financing costs and adaptation options are more costly than the MSE can afford, creating an additional barrier. In other cases, MSEs lack the technical capacity to implement an adaptation option. Some countries lack coordinated policies and regulations that could enable adaptation, making it more costly or disadvantageous to invest in adaptation. Finally, social behaviors based on cultural and socioeconomic factors can hinder the adoption of new technologies and processes.

BOX 11 | CAMBODIA: CHANGING ATTITUDES

In Cambodia, a critical success factor in assisting farmers in Preah Vihear and Kratié provinces to adopt adaptation measures was to change existing attitudes and preconceptions. Initially it was difficult to convince farmers to participate in the intervention, which provided general in-class awareness-raising and capacity-building exercises related to climate-resilient agriculture, home-gardening support, participation in water-user committees, and the use of resilient rice varieties.

According to UNDP staff working in the region, poorer farmers—lacking financial buffers and social safety nets—were inclined to be more risk averse. This often led to suboptimal decisions, which resulted in less variable but minimum return. Women commonly lacked the confidence to seek support for implementing new projects in which other villagers were engaged, because they felt they lacked knowledge and experience. The project staff persisted in trying to persuade them that the intervention presented a "life improvement opportunity."[24] As noted in the Terminal Evaluation, "culture and habits are not easily modified, and there was a risk of non-acceptance of the new facilities by the local communities."[25]

The intervention was ultimately successful, firstly, because it engaged beneficiaries in a dialogue from its inception. Using video materials, the project team facilitated discussions of perceptions related to climate risks and encouraged farmers to articulate their experiences with changing weather patterns, their expectations, the barriers to adaptation, and how they could improve their situation. The second tactic for persuasion was using "demonstrations" as learning sites from the beginning of the project. Demonstrations of new technologies recorded the expenses and incomes of trial users, and calculated the monetary benefits; by tangibly showing the costs and benefits, the project could convince farmers to adopt these technologies.[26]

The positive business case for adaptation persuaded farmers that improving irrigation capacity is one intervention that not only helps to insure the business against climate risks in the future, but also increases agricultural yields and efficiency. Such a no-regrets approach makes sense in the primarily rural economy of Cambodia, where building climate resilience among MSEs in the agriculture sector contributes substantially to the resilience of the most vulnerable communities.

In fact, the benefits of the initiative went beyond eventual recognition that new methods were required to manage the uncertainties associated with rainfall patterns. Communities who benefited from the irrigation system went on to form collectives to manage the improved system. This allowed them to start realizing a number of co-benefits immediately. Most prominent among them was the resale of saved water to neighboring villagers, thereby establishing a revenue stream to maintain the enhanced water-management system. Some communities also invested in extending the water system to connect each of the houses to running water. Others invested in biogas digesters to convert excess farm waste (the result of improved productivity) to energy that could be distributed to households. Thus, health benefits (cleaner air associated with indoor cooking), and time savings (from not having to walk long distances to fetch water) also emerged as results of the initial intervention aimed at agricultural practices.