

Baseline characterization of production and markets, technologies and preferences, and livelihoods of smallholder farmers and communities affected by HIV/AIDS in Mozambique

Making Agricultural Innovations Work for Smallholder Farmers Affected by HIV/AIDS in Southern Africa (MIRACLE)

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Baseline Report

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IITA Ibadan, Nigeria
Telephone: (234-2) 7517472
Fax: +44 208 7113786
E-mail: iita@cgiar.org
Web: www.iita.org

To Headquarters from outside Nigeria:
IITA, Carolyn House
26 Dingwall Road, Croydon, CR9 3EE, UK

Within Nigeria:
PMB 5320, Oyo Road
Ibadan, Oyo State

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Cover picture: Stakeholders assessing the performance of different soybean varieties during a mid-cropping season evaluation workshop in Malema District.

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Acronyms and abbreviations

ARV	antiretroviral drugs
DFID	Department for International Development (UK)
DID	Difference-in-Difference
FAO	Food and Agriculture Organization
GDP	gross domestic product
GNP	gross national product
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
LID	Livestock in Development
MIRACLE	Making Agricultural Innovations Work for Smallholder Farmers Affected by HIV/AIDS in Southern Africa
NORAD	Norwegian Agency for International Development
NGO	Nongovernmental organization
PLWHA	Persons Living With HIV and AIDS
SPSS	Statistical Package for Social Sciences
SSA	sub-Saharan Africa
STATA	Statistical Package for Professionals
TLU	Tropical Livestock Unit
TV	television set
UNECA	United Nations Economic Commission for Africa
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nations Children Fund
WLSA	Women and Law in Southern Africa

Introduction

Agriculture, health, and nutrition are inherently intertwined and all sectors seek to improve human well-being, but agriculture has rarely been explicitly deployed as a tool to address the poor health and undernutrition in developing countries. Poverty is responsible for poor health and undernutrition, but it is also widely recognized that agriculture has the potential to greatly reduce poverty. Some 75 percent of the world's poor people live in rural areas, and strong agricultural growth could raise the incomes of rural people and help pull millions out of poverty, thus overcoming undernutrition and poor health. Agriculture is the only realistic way for most people to get the nutrition they need. Farmers are now being encouraged to grow more nutritious crops. One example of this approach is already being tried with an effort to promote biofortified crops—that is, staple crops that have been bred to contain high levels of micronutrients, such as vitamin A or iron. The nutritional quality of foods can also be enhanced during processing and retailing. Consumers can be encouraged to accept, and even seek, more nutritious foods as efforts continue to be made to make such foods available and affordable.

It is worth noting, however, that the links between agriculture on the one hand and health and nutrition on the other work both ways. Given that agriculture is highly labor-intensive in many poor countries, productive agriculture requires the labor of healthy and well-nourished people. People who suffer from malnutrition and poor health are less able to do the work required for agricultural production. Nutritional deficits and disease have been shown to impair people's physical and cognitive capacities. The result in many regions of the world has been a downward spiral of low agricultural productivity, low income, poverty, and poor nutrition and health.

In an effort to unleash the potential of agriculture and agricultural research to achieve health and nutritional outcomes in Africa, the International Institute of Tropical Agriculture (IITA) and its partners are implementing a multi-country and multi-year project entitled *Making Agricultural Innovations Work for Smallholder Farmers Affected by HIV and AIDS in Southern Africa (MIRACLE)*. The project is being implemented in HIV/AIDS hotspots in four countries: Malawi, Mozambique, Swaziland, and Zambia. The priority action sites are those where research and development partners already have ongoing activities, such as the provision of antiretroviral drugs (ARVs), and interventions in nutrition or agriculture. The major goal of the project is to improve the health and nutritional status, food security, and income of people affected by HIV and AIDS in Southern Africa through the production, consumption, and marketing of nutritionally enhanced crop and livestock products, advocating supportive agricultural and health policies, and strengthening the capacity of key stakeholders engaged in agricultural activities. Expected outputs of the project include: (1) strengthened institutions and improved partnership and stakeholder capacity to enhance access to rural support services by people affected by HIV and AIDS; (2) dissemination and deployment of farm productivity-enhancing innovations that improve food security, nutrition, and health; (3) enhanced nutrition through dietary improvement and diversification; (4) successful transition to sustainable reliance on own-produced nutritious foods and income generation; (5) development and promotion of value addition and products from diverse nutrient-dense crops; and (6) advocacy for appropriate policy options for linking agriculture and nutrition to improved human health.

As one of the countries highly affected by HIV/AIDS in southern Africa and where agriculture holds the potential for addressing nutrition and health issues, Mozambique is one of the target countries for the MIRACLE project. With nearly 55 percent of the population living below the poverty line (Mozambique Government 2010), Mozambique is one of the world's poorest countries and the economy is overwhelmingly agricultural. An estimated 1.5 million people in Mozambique are living with HIV and, according to recent appraisals, between 500 and 700 new cases occur every day (Oxfam 2003). Over 60 percent of new cases are women; 45 percent of all new infections occur in people below the age of 24, and 23 percent in children under the age of 5. Latest estimates show a national adult HIV prevalence of 14 percent, with the highest prevalence being along the main transport corridors, in border areas and large cities. Studies have shown that there are three key reasons why it is important to look specifically at the relationship between HIV/AIDS and agriculture and

rural livelihoods. First, while prevalence might be higher in urban areas, the absolute numbers of people living with HIV is likely to be much higher in rural areas, not least because two-thirds of the African population are rural (Petty et al. 2004). Secondly, there is a tendency for the the burden of the epidemic to be shifted to rural areas as migrant workers return to their homes once full-blown AIDS has evolved. This cost is increased as support from the urban economy is diminished since urban remittances dry up (Muller 2005). Finally, in macro-economic terms, countries most affected by HIV/AIDS are those heavily reliant on agriculture, with the sector accounting for a significant portion of production as well as employing the majority of workers. In addition, small-scale and subsistence agriculture remains an important component of diverse livelihood strategies for the majority of households living in these countries (Muller 2004).

This report presents the results of the baseline survey of households and communities conducted in three target districts in Nampula and Zambezia provinces in Mozambique in November and December 2011. The purpose of the baseline studies and situation analyses is to establish a strong knowledge base to contribute to an increased understanding of the production and market constraints; the role and constraints to adoption of technologies; and the livelihood strategies and outcomes (food, nutrition, and health) of smallholder producers affected by HIV/AIDS. An important output is a description of the production and market constraints and opportunities and analyses of the livelihood status and strategies of producers as well as the prospects of alternative investments and technological solutions. This guides investments in agricultural research, institutional innovations, and complementary public goods for income gains, food and nutrition security, improved health outcomes, and poverty reduction. The results of the baseline studies form the basis for assessing progress and primary or adopter-level impacts of the project.

The baseline report is organized in nine sections. The following section describes the link between agriculture, nutrition, and health in Mozambique. The study methodology, including a description of the survey areas, sample survey design, and analytical methods, is presented in the third section. The fourth section describes the socioeconomic characteristics as well as resource endowments of the households, whereas the fifth section summarizes crop production and marketing practices of the households, focusing on cropping patterns, production constraints, and market participation. The sixth section presents results relating to improved crop variety adoption practices of the households, whereas the seventh section presents the analysis of poverty and household welfare in the study area. Community analysis is discussed in the eighth section and this includes a description of public services and various coping strategies communities have adopted to mitigate the impact of HIV/AIDS on livelihoods. The last section provides a summary of major results of the baseline survey.

Agriculture, nutrition, and health in Mozambique

Agriculture in Mozambique

Mozambique is heavily reliant on agriculture with the informal, subsistence agriculture segment accounting for over 85 percent of the labor force. The main subsistence crop is cassava; the main export products are cotton, cashew nut, and shrimps and prawns. It is believed that over 60 percent of the population in Mozambique live in extreme poverty, defined as "... the income level below which a minimum nutritionally adequate diet is not affordable". Mozambique's agriculture is strongly bipolar, split between 3.2 million small farmers, producing 95 percent of agricultural gross domestic product (GDP), and about 400 commercial farmers producing the remaining 5 percent (Coughlin 2006).

HIV/AIDS in Mozambique

The first case of HIV/AIDS in Mozambique was diagnosed in 1986. This was followed by a steady increase in the prevalence rate up to an estimated 16 percent among the population aged 15 to 49 years in 2004. The epidemic had reduced life expectancy from 41 years in 1999 to 38 years in 2004. The majority of those infected are women. Due to the imbalance of social, sexual, and physical power, women often have no chance to insist on safe sex. However, a recent study with a sample of over 18,000 people throughout Mozambique showed an HIV prevalence rate of 12 percent among people aged between 15 and 49 (Government of Mozambique 2012). This shows that there is a decrease on the HIV prevalence in the country. But there was a sharp gender difference—the prevalence rate among women was 13 percent, and among men only 9.2 percent.

A number of factors have shaped the spread of the HIV/AIDS epidemic in Mozambique. The extremely high levels and prevalence of poverty in Mozambique have increased vulnerability to HIV/AIDS, through low health and nutritional status, poor education, and economic dependence. These factors are reflected in, and intensified by, gender inequality and the high levels of population mobility (Oxfam 2003). Gender inequality increases the vulnerability of both men and women, partly through a concept of masculinity that encourages high-risk behavior through multiple partners or sexual aggression, through women's economic dependence on men, and a concept of femininity that encourages submission (Save the Children/ACORD/Action Aid 1997). The worst impact of inequality falls on women. This is partly because women are physiologically and socially more vulnerable to infection. Nearly 57 percent of Mozambican adults (15–49) living with HIV/AIDS are women. The gender disparity is most striking in the 20–24 year age group, where women with HIV outnumber men by 4 to 1 (UNFPA 2002). Furthermore, as the principal caregivers in society, the increased burden of care for the sick and the dying as well as for orphans falls mainly upon women. High levels of population mobility have influenced the epidemic. A long history of labor migration from Mozambique to neighboring countries took on new dimensions during the war: almost one-third of the national population was displaced from their homes and many people sought refuge across the border. Post-war resettlement and continued movement between Mozambique and the Southern African region, which has prevalence rates for HIV among the highest in the world, fuelled the epidemic. As migrant workers move back and forth to neighboring countries, families are separated and sexual networking tends to be extensive, increasing the risk of HIV transmission.

Food security, nutrition, and HIV/AIDS in Mozambique

Agriculture plays a major role for the health of African people, not only by providing food for sufficient macronutrients, but also by reducing micronutrient deficiencies and enhancing health. This is particularly important for vulnerable groups such as PLWHA. Food and food fortification are an important entry point for resolving malnutrition, as it is more cost-effective. Food security and nutrition are critical for individuals, households, and communities affected by HIV and AIDS. Lack of food security and poor nutritional status

hastens progression to AIDS-related illnesses and undermine a response to ARVs (Gillespie and Kadiyala 2005). HIV infection itself undermines food security and nutrition by reducing the capacity for work and jeopardizing livelihoods. HIV impairs nutritional status by undermining the immune system and nutrient intake, absorption, and use (Piwoz and Preble 2000). AIDS has the potential to create severe economic impacts in many African countries. It is different from most other diseases because it strikes people in the most productive age groups and is essentially 100 percent fatal. The effects will vary according to the severity of the AIDS epidemic and the structure of the national economies. The two major economic effects are a reduction in the labor supply and an increase in costs. Even though HIV/AIDS is a medical problem, it has social and economic dimensions as well. In most sub-Saharan African countries small farmers are not part of a fully operating medical care system. At the family level, medical costs associated with caring for the sick and bedridden have to be borne along with the funeral expenses of family members who die of the disease. Besides the costs of drugs, conventional and traditional medical treatment, households caring for AIDS patients are often faced with meeting expenses for additional special foods to comfort the sick.

The majority of the population in the countries mostly affected by HIV/AIDS live in rural areas. In many African countries, farming and other rural occupations provide a livelihood for more than 70 percent of the population. Hence, it is expected that the HIV/AIDS epidemic will cause serious damage to the agriculture sector in those countries, especially in countries that rely heavily on manpower for production. HIV/AIDS can affect agriculture in many ways including the following:

- Absenteeism caused by HIV-related illnesses and loss of labor from AIDS-related deaths may lead to the reduction of the area of land under cultivation and to declining yields, resulting in reduced food production and greater food insecurity.
- The loss of labor may also lead to declines in crop variety and to changes in cropping systems, particularly a change from more labor-intensive systems to less intensive systems. Livestock production may become less intensive and weeding and pruning may be curtailed. A shift away from labor-intensive crops may result in a less varied and less nutritious diet.
- The reduction in labor supply through the loss of workers to HIV/AIDS at crucial periods of planting and harvesting could significantly reduce the size of the harvest, affecting food production.
- Loss of knowledge about traditional farming methods and loss of assets will occur as members of rural households are struck by the disease and are not able to pass on their know-how to subsequent generations.
- Loss or reduction of remittances is likely to occur in areas where agricultural workers send money home while working abroad. When the workers become sick, they can no longer earn money to send home.

Clearly, the most important impacts of the HIV/AIDS epidemic on agriculture are food insecurity caused by the reduction of production and loss of income from household members employed in the sector. The HIV/AIDS epidemic may also affect the traditional coping mechanisms that are often found in rural areas. Traditionally, local residents have joined together to offer assistance to those in need during periods of shock or crisis. Indeed, community-based initiatives have become one of the outstanding features of the epidemic and a key coping mechanism for mitigating the impact of HIV/AIDS (Topouzis 2003). However, as the number of HIV/AIDS cases increases, the need for assistance may overwhelm the support system, and traditional coping mechanisms may begin to break down. The impact of HIV/AIDS on crop production relates to a reduction in land use, and a decline in crop yields and the range of crops grown. The reduction in land use is attributed to a number of factors which have occurred as a direct result of the HIV/AIDS epidemic. These include sickness and death in households leading to fewer family members being available to work in the fields and thus in the size of land that can be cultivated; the limitations of land inheritance and land tenure systems, especially as they

may affect widowed and orphaned households; poverty, resulting in malnutrition, which in turn affects the health of family members and their ability to perform agricultural work leading to a reduction in the cash incomes needed to purchase inputs such as seeds and fertilizer; and the loss of soil fertility on farms with limited areas being cultivated. The effect of HIV/AIDS in reducing the number of family members needed to cultivate larger areas of land has led to substantial reductions in land use in many communities. In some communities where land tenure and inheritance traditions favor male inheritance, the effect of the HIV/AIDS epidemic may be especially severe. As increasing numbers of women are left widowed, and their right to land is already constrained by traditional inheritance customs, their access to land becomes extremely difficult (FAO 1994).

Methodology

Sample design and data collection

The baseline survey was carried out over a period of 6 weeks between November and December 2011 in the three districts where the MIRACLE project is being implemented—Gurue district in Zambezia province and Malema and Meconta districts in Nampula province (Fig. 1). The selection of the districts for MIRACLE project intervention was based on the prevalence of HIV/AIDS and malnutrition, the availability of partners and initiatives where this project could leverage resources and information, and the representativeness of the project sites to larger extrapolation domains. IITA and partners have ongoing activities on legume varieties and seed systems as well as on value chains in the three districts in Nampula and Zambezia provinces.

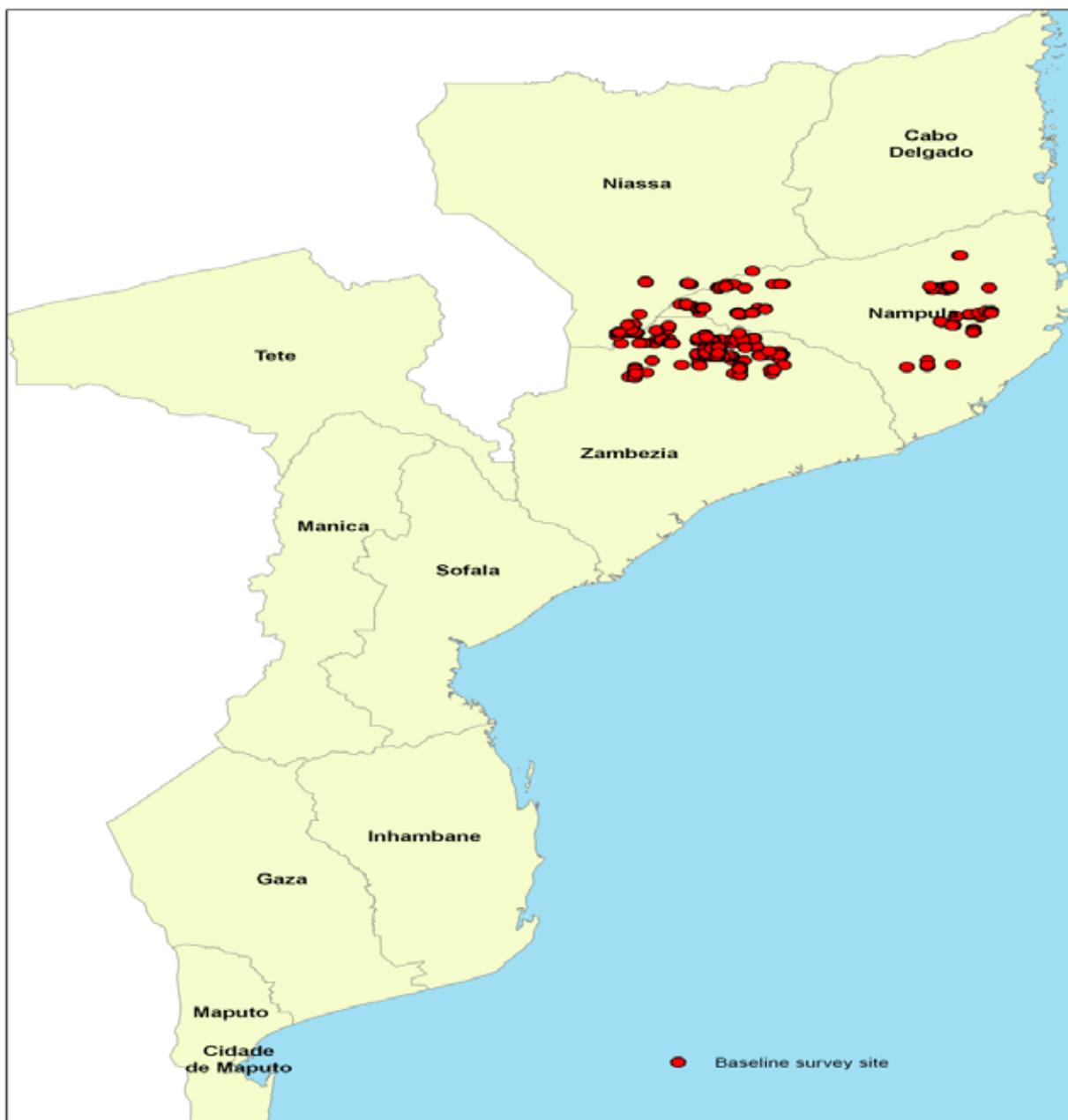


Figure 1. Baseline survey sites in Mozambique.

Table 1. Distribution of the sample households across target districts in Mozambique.

District	Administrative Post (nHH)	Number of households in administrative post	Number of households as a proportion of all households (pHH = nHH/ ΣnHH)	Sample households (N = pHH*nHH)
Gurue	Gurue Sede	33376	0.22	134
	Lioma	20495	0.14	83
	Mepuagiua	15189	0.10	61
Malema	Malema Sede	24881	0.17	100
	Chihulo	3580	0.03	14
	Muatuali	12015	0.08	48
Meconta	Meconta Sede	5993	0.04	24
	Corrane	13927	0.09	56
	Namialo	12249	0.08	49
	Nacavala	7583	0.05	31
Total		149,288	1.00	600

The study was based on a survey of about 600 households distributed across the three target districts of Gurue, Malema, and Meconta (Table 1). The sample size (N) was determined using simple random sampling at the level of households in the project communities in the target districts, but accounting for the clustering applied at the level of districts and administrative posts during selection of project sites. The sample size was calculated as follows:

$$N(srs) = \frac{z^2(p)(1 - p)}{e^2} \dots \dots \dots (1)$$

- Where: p = 25% (HIV/AIDS prevalence rate in Southern Africa)
- z = 1.96 (95% confidence level)
- e = 0.05 (allowance of error at 95% confidence level)

In calculating the sample size, a response rate of 95 percent was assumed to account for a possible non-response rate of 5 percent and a design effect of 2 was used to account for multi-stage clustering in the selection of target areas of the project. This resulted in a sample of 600 households allocated proportionally across the study districts, with the sizes of the administrative posts in terms of the total number of households used as weights (Table 1). The sample households were selected randomly from a sampling frame of households prepared for each target administrative post through a census undertaken prior to the commencement of the actual survey. As not all communities and households in a target administrative post will likely be reached through the MIRACLE project in just three years, each such administrative post is expected to have both target and non-target communities and households.

Detailed household-level data collected between November and December 2011 using semi-structured questionnaires provided most of the information used to address the research questions, whereas community-level analysis provided useful in-depth information on livelihood and infrastructural conditions of the communities in the study areas. The community-level surveys involved focus group discussions in the selected communities and interviews with key informants. The survey collected information on household demographics; farm and household assets; agricultural input use and crop production; marketing of crop and livestock

products; sources of household income (both farm and non-farm income); extension services and technology adoption; farmers' groups and social capital; shocks and coping strategies; and household and livelihood dynamics.

Analytical framework

The MIRACLE project is geographically wide and the beneficiaries have diverse characteristics. It is therefore plausible to evaluate the project impact using the counterfactual impact evaluation framework. Project outcomes are estimated by computing a double difference, one over time (before–after) and one across households (between beneficiaries and non-beneficiaries). This type of evaluation is called the Difference-in-Difference (DID) method. Figure 3 illustrates the Difference-in-Difference impact evaluation framework. Since the work by Ashenfelter and Card (1985), the use of Difference-in-Difference methods has become very widespread. The simplest set-up is one where outcomes are observed for two groups for two time periods. One of the groups is exposed to a treatment in the second period but not in the first period. The second group is not exposed to the treatment during either period. In the case where the same units within a group are observed in each time period, the average gain in the second (control) group is subtracted from the average gain in the first (treatment) group. This removes biases in second period comparisons between the treatment and control group that could be the result from permanent differences between those groups, as well as biases from comparisons over time in the treatment group that could be the result of trends.

The information captured in this study will therefore be used as a benchmark for subsequent assessments of efficiency in project implementation and the eventual impacts of the project. The baseline study aims to contribute to an increased understanding of production constraints, the role and constraints to adoption of improved technologies, and the preferences and livelihood status and strategies of farmers affected by HIV/AIDS. Descriptions of crop and livestock production constraints and opportunities, and analyses of the livelihood status and strategies of producers as well as the prospects of alternative investments and

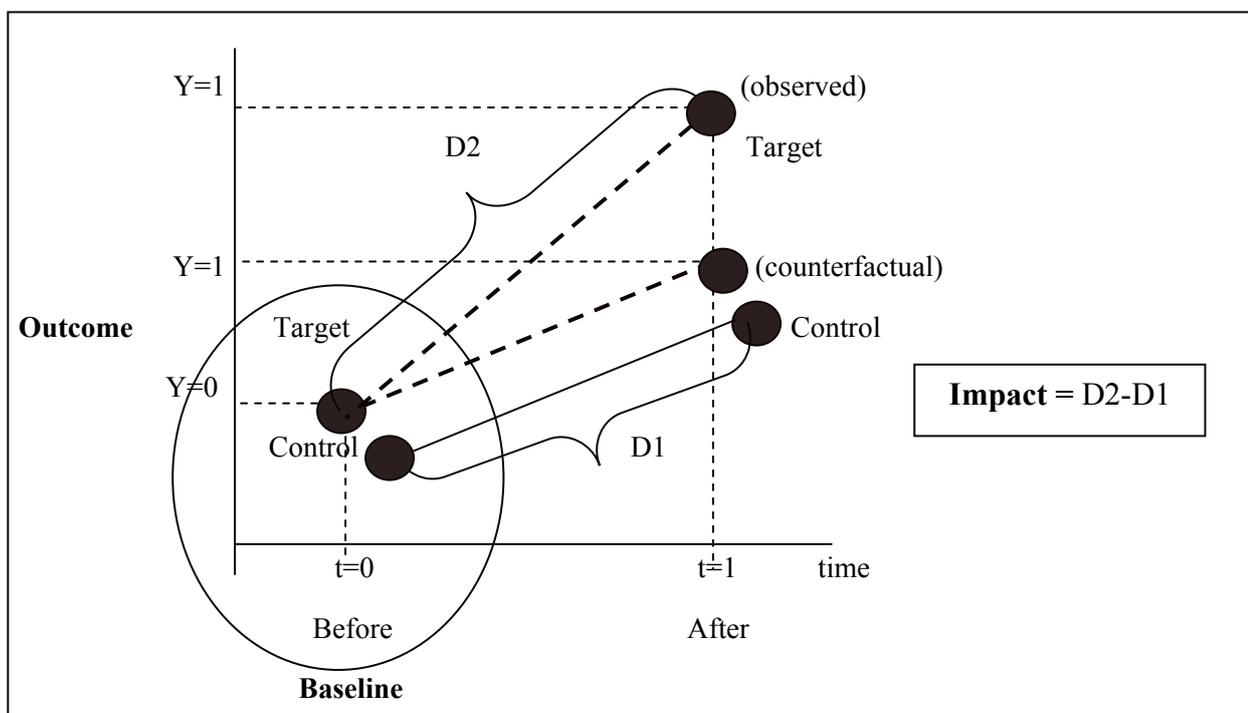


Figure 2. Difference-in-Difference impact evaluation method

technological solutions will guide investments in research, institutional innovations, and complementary public goods for income gains and poverty reduction.

Early adoption and impact studies will be conducted to assess the extent, pathways, and determinants of technology adoption as well as the farm-level or primary impacts of maize–legume technologies among adopters in the target areas where there is significant early adoption at the end of the project. Using standardized protocols, early adoption and impact studies will be conducted across the target/pilot sites to identify the extent, determinants, and pathways of adoption of improved varieties and management practices. The timing of these surveys will be towards the end of the project when significant adoption of improved varieties and practices will be likely to have taken place in the pilot sites and communities. Research hypotheses will be formulated to test and explain gender differentials in the adoption and impacts of improved technologies with a view to enhancing the intra-household distribution of the benefits from major staple crops research and extension. Indeed, not only are there gender differentials in technology adoption but technology adoption may also have differential effects within and across households due to the influence of social structures as well as gender imbalances in access to productive assets and support services.

Quantitative and qualitative methods are employed in the baseline study. In addition to descriptive analysis, an econometric logistic regression model was developed and estimated for analysis of the determinants and correlates of household poverty in the study area. Community analysis is carried out to get an in-depth assessment of key community issues.

The logit model

This study employs a logistic regression model to assess the determinants and correlates of poverty in the study area. This is a univariate binary model in which it is assumed that the probability of being poor (captured by a dichotomous variable) is determined by an underlying latent variable that captures the true economic status of an individual household. This dichotomous variable is regressed on a set of supposed explanatory variables hypothesized to influence poverty in the area. To identify key determinants of poverty in the study area we therefore first computed a dichotomous variable indicating whether the household is poor or not (that is, 1, if household is poor and 0, otherwise). On the basis of Pearson’s Chi-square statistic, we determine whether the predictors including gender of household head, age of household head, size of household, educational level of household head, presence of an orphan in the household, dependency ratio, value of farm assets, livestock ownership, land ownership, off-farm income share of the total household income, access to credit, access to extension services, and presence of a sick person in the household were associated with the poverty index.

Denoting the latent variable of the *i*-th household as Y^* , the combined effect of the explanatory variables inducing or reducing poverty can be expressed as a linear function as follows:

$$Y^* = X_i' \beta + \varepsilon_i \dots \dots \dots (2)$$

where β is the vector of unknown parameters to be estimated and X_i is the vector of explanatory variables. The error term ε_i represents factors that are unobservable to the researcher but are relevant in determining whether or not a household is poor. It is assumed to be random, independently and normally distributed, with zero mean and a constant variance σ^2 .

Since Y^* is not observable, the model is specified using the observed poverty status denoted as Y , relating to the classification of sample households into poor and non-poor based on whether they are above or below the purchasing power parity exchange rate poverty line of MZN3,653/capita/year (US\$1.25/capita/day). It is related to the latent variable as follows:

$$Y = 1 \text{ if } Y^* > 0 \text{ (poor household)}$$

$$= 0 \text{ otherwise (non-poor household)} \dots \dots \dots (3)$$

The probability that a given household is poor can be defined as

$$\Pr(Y = 1) = G(X_i'\beta) \dots \dots \dots (4)$$

where $G(\cdot)$ is the cumulative distribution of the error term, with the assumption that it has a symmetric distribution. The value of $G(\cdot)$ has to be between 0 and 1 since it represents the probability (Wooldridge 2009). The logit model follows a logistic distribution and so the probability of a household being poor is expressed in terms of the cumulative function for a standard logistic random variable. Thus, this probability is given by

$$\Pr(Y = 1) = \Omega = \frac{\exp(X_i'\beta)}{[1 + \exp(X_i'\beta)]} \dots \dots \dots (5)$$

where Ω is the conditional probability of a household being poor.

In the form of the ratio of the probability of being poor to the probability of being non-poor (log odds ratio), the

$$\ln\left(\frac{\Omega}{1 - \Omega}\right) = X_i'\beta + \varepsilon_i \dots \dots \dots (6)$$

This ratio will give the odds that a household is poor. A positive sign of estimated coefficients would mean that the probability of being poor is higher than reference category and vice versa keeping all other characteristics constant.

According to Hoffman (2004), a number greater than one of log odds indicates a positive association between independent and dependent variable, while a number between zero and one indicates negative association among both. The marginal effect of a given explanatory variable j on the probability of household i being poor is

$$\frac{\partial \Omega_i}{\partial X_{ij}} = \Omega_i(1 - \Omega_i)\beta_j \dots \dots \dots (7)$$

The dependent variable was a dummy that equals 1 if the household is poor and 0 if the household is not poor. Poor households are those households living below US\$1.25 per capita per day converted to local currency using purchasing power parity exchange rates at the time of the survey. Thus, factors that negatively influence the dependent variable are those that reduce poverty, while those with positive effects increase prevalence of poverty.

The explanatory variables are related to the socioeconomic and demographic characteristics of households whose description and expected direction of influence are given below:

- The gender of the household head is measured as 1 if the head is male and 0 if the head is female. Poverty is expected to be more pronounced among female-headed households. In Africa, more women than men are involved in rural economic activities, such as farming. However, at the same time, the majority of women in Africa have no rights to property, a factor that infringes on their access to either input or credit markets and this drags their households towards poverty (Apata et al. 2010).
- The age of the household head is measured in years. We expect a positive relationship between the age of the household head and poverty status. Agricultural productivity is expected to decline with the age of the farm managers and consequently the household is expected to get poorer as the head of the household grows older (Mukherjee and Benson 2003).
- The education of the household head was also included in the model, based on the hypothesis that human capital contributes positively to higher living standards and it was measured as years of schooling (Anderson et al. 2006). We therefore expect a negative relationship with poverty. In other words, access to education is hypothesized to reduce poverty, implying that the more educated the decision-maker the better skilled and productive he or she is and consequently experiences less poverty.

- Household size was measured by total number living in a household. We expect a positive relationship between household size and whether the household is poor or not (based on Mukherjee and Benson 2003).
- The presence of an orphan in a household (yes = 1, No = 0). We expect a positive relationship between poverty level of the household and presence of an orphan in that particular household (De Waal and Whiteside 2003). Along the same line, we also include the number of sick people in the household which was measured as whether a household had a sick person (1 = yes and 0 otherwise). We hypothesized that the presence of sick persons in a household increases its likelihood of being poor because the household expenditure increases and the productive time of the household members is reduced and invested instead in taking care of the sick (Salinas and Haacker 2006).
- The dependency ratio of a household was measured as a ratio of the number of children to the number of adults. Other things being equal, we expect households with a higher ratio of children to adults to have lower living standards and so be poorer.
- The value of farm assets was also part of the explanatory variables and we expected it to have a negative relationship with poverty. In a study conducted to explore how farm productivity affects household poverty in Tanzania, Sarris et al. (2006) reported that poorer households not only possess fewer assets, but are also less productive.
- Livestock ownership was measured by the number of different animals, such as cattle, sheep, goats, pigs, rabbits, and chickens, that the household owns, which are combined using a set of tropical livestock units (TLU).
- Land per capita was included as an explanatory variable with the hypothesis that, other things being equal, households with larger landholdings per capita are less likely to be poor. Literature on land ownership indicates that land enhances the chances of diversification into varieties of enterprises and thus improves the total farm profitability and reduces poverty levels (Jayne et al. 2005). Landholding size was not measured, but was estimated by the respondents.
- Off-farm income was included in the model as a share of total household income. The expectation was that the higher the share, the lower the odds that the household is poor hence a negative relationship was anticipated. Engagement in non-farm activities presents households with additional income for productive investment and/or consumption smoothing, and this is expected to have a negative impact on poverty. A study of resource-poor farmers in *Striga*-infested areas of western Kenya, (Manyong et al. 2007) found that an increase in the share of off-farm income in the total household income would reduce the household's probability of being poor.
- Access to credit (measured as a dummy that equals 1 if a household had access to credit facilities and 0 otherwise) is theoretically expected to reduce poverty through cash investment in productive activities and also in smoothing consumption. Policies and institutions that facilitate easier access by farmers to seasonal credit for intermediate inputs were cited as important in increasing agricultural productivity and reducing poverty in Tanzania (Sarris et al. 2006).
- Similarly, agricultural education, extension, and advisory services are critical means of addressing rural poverty since such institutions have a mandate to transfer technology, support learning, assist farmers in problem-solving and enable farmers to benefit from the agricultural knowledge and information system (Christopolos and Kidd 2000). Access to extension services was measured as 1 if a household had access to extension information and 0 otherwise. Farmers that readily have access to extension services are hypothesized to perform better in agricultural production, thus reducing poverty.
- To account for location differences in poverty among different communities, the logistic regression analysis used district-level fixed effects by incorporating district dummies in the model.

Socioeconomic characteristics of the sample households

Household characteristics

Table 2 shows the demographic characteristics of the sample households in the three target districts in Mozambique. On average, 66 percent of the sampled households were male-headed (ranging from 60 percent in Meconta to 70 percent in Gurue). This is consistent with the national figure that female-headed households represent one-third of all households in Mozambique and this also has implications for orphaned children, as they are more often found in female-headed households (UNICEF 2006; 2011). Distinction of household heads by sex is important because inequalities in households' socioeconomic characteristics are often gender-based. Female-headed families among Mozambican households are poorer than families headed by men (UNICEF 2006). Studies have also shown that female-headed households, besides being poorer than male-headed households in monetary terms, have reduced "social access" as a consequence of the predominantly patriarchal societal structures in Mozambique. The average number of persons per household in the study area is five. This is consistent with national average of five persons per household according to 2007 estimates. The mean age of the household heads is 42 years.

The age dependency ratio (percent of working-age population) in Mozambique was last reported at 90 in 2010, according to a World Bank report released in 2011. Age dependency ratio is the ratio of dependents—people younger than 15 or older than 64—to the working-age population, those in the age range 15–64. Data are shown as the proportion of dependents per 100 of the working-age population. This statistic gives an indication of how much responsibility economically active persons have in providing for the needs of those dependents. In the studied area, the average age dependency ratio is 120, implying that every 100 working persons are providing for 120 persons. It is worth noting that this is higher than the national average in 2010. Another important issue to be assessed is that of widow-headed households and its implications. The HIV/AIDS pandemic has substantially increased the number of widow-headed households in Africa. Boughton et al. (2006) noted in their study that the disadvantaged groups of female-headed and widow-headed households were increasing over time. Given the importance of these groups in the population, any broad-based poverty reduction strategy will therefore need to consider specific interventions to help them overcome production and economic constraints. In the study area, the average percentage of households headed by widows is almost 14 percent. Meconta has the lowest prevalence of widow-headed households at 11 percent while the highest rate is 18 percent for Malema. This has serious implications when it comes to inequalities in property ownership. Various conceptual and qualitative studies highlight gender inequalities in property rights and that widows face difficulties in retaining access to land after the death of their husbands (Milimo 1990; Armstrong 1992; Mutangadura 2004; WLSA 1997; UNECA 2003; Shezongo-Macmillan 2005). In addition to a high rate of widow-headed households, most households (43 percent on average) had at least an orphan living within the household. In Malema, the results show that over half of the households are living with (taking care of) at least an orphan.

The majority of the household heads in the study area were literate, as shown by an average illiteracy rate of 36 percent. However, this is still a worrying rate, especially in Gurue where the illiteracy rate is at 44 percent. Knowing how to read and write is important for understanding different information that is promoted for the betterment of the rural livelihood status. They had an average number of years of schooling of three, which is very low. This is not good in terms of the uptake of extension knowledge or adoption of innovative technologies in the area. The more literate people are literate, the higher the adoption of innovations.

Productive assets

Land ownership

Access to arable productive land in Africa has been in decline due to the pressure from the growing population trends and worsening land degradation as a result of climate change. Many low-income rural households are dependent on land to gain access to limited sources of credit, with land providing the only means to enter financial markets. Recent high-profile land purchases covering thousands of hectares of prime agricultural land have raised concerns over equitable access to land. Increasing numbers of the rural poor face the prospect of land displacement and landlessness as a result of diminishing land resources, forest, and protected areas, suggesting severe land deficits in relation to population trends.

Unequal access to land and low absolute levels of land per capita of households are shown to be problematic for poverty reduction and growth as a result of the strong link between access to land and household income, particularly for farm sizes below 1 ha/capita. In Africa, on average, households in the highest per capita quartile control between five and fifteen times more land than those in the lowest quartile (FAO 2010). Landless households or those who own less than 0.1 ha constitute 25 percent of rural agricultural households. Restrained access to land limits the ability of landless groups to graduate from poverty through agricultural productivity (Jayne et al. 2005). Expanding crop production is largely associated with issues of equitable asset distribution. This means land equality can promote food security. Research has demonstrated that relatively egalitarian land distribution patterns have tended to generate higher rates of economic growth than those that are highly concentrated. The reason for this is that equitable land distribution is more likely to produce broad-

Table 2. Socioeconomic characteristics of the sampled households in Mozambique.

Characteristics	District			All (n = 598)
	Gurue (n = 311)	Malema (n = 189)	Meconta (n = 98)	
Demographics				
Male-headed households (%)	70	61	60	66
Female-headed households (%)	30	39	40	34
Household size	5	5	4	5
Dependency ratio (all)	1.2	1.4	1.1	1.2
Age of the household head (years)	43	42	39	42
Widowed household heads (%)	13	18	11	14
Households with orphans (%)	38	56	34	43
Education of head				
Years of schooling	3	4	4	3
Illitera (%)	44	28	26	36
Asset ownership				
Total cultivated land (ha)	2.4	1.9	1.7	2.1
Livestock ownership (TLU)	0.4	0.5	0.3	0.4
Hoe (%)	100	100	100	100
Radio (%)	73	38	41	57
Bicycle (%)	73	42	37	57
Mobile phone (%)	40	7	14	25
TV (%)	35	3	3	20
Irrigation pump (%)	32	3	2	18
Housing				
House roofed with iron sheets (%)	25	7	9	17
House with cemented floor (%)	5	1	4	3

Note: TLU = Tropical Livestock Unit.

based and inclusive agricultural growth. Broad-based agricultural growth tends to generate greater demand for goods and services produced in rural areas and towns. In this way, rural and urban populations create a market for each other. These beneficial growth effects tend to be much weaker when the source of agricultural growth is concentrated in relatively few hands. Thus the rate of growth is likely to be affected by the distribution of assets in the agricultural sector, particularly land.

Mozambique has about 36 million ha of arable land suitable for agriculture. Approximately 3.9 million ha, about 10 percent of the arable land, are under cultivation with 97 percent being cultivated by smallholder farmers. While land availability is abundant, the expansion of land under effective use is limited by constraints including labor, suitable farming systems based on agroecological zones, the absence of draught power, and access to water (FAO 2007). The mean land-holding size for the study area is 2.1 ha per household which is consistent with what was reported by Jayne et al. (2003) for the national average. Households in Gurue have significantly larger cultivated land-holdings (2.4 ha) than households from the other two districts.

Livestock ownership

Livestock play multiple roles in the livelihoods of people in developing communities, especially the poor. They provide food and nutrition, work, economic and social status, and ensure environmental sustainability. Globally, livestock contribute about 40 percent to agricultural GDP and constitute about 30 percent of the agricultural GDP in the developing world (World Bank 2009). These estimates highlight the important contribution of livestock to sustainable agricultural development. The contribution of livestock to the world's food supply, family nutrition, incomes, employment, soil fertility, livelihoods, transport, and sustainable agricultural production continues to be a subject of significant review and debate (LID 1999; ILRI 2002; Ellis and Freeman 2004; Kitalyi et al. 2005; Chilonda and Otte 2006; Thornton et al. 2006; Perry and Sones 2007, and Randolph et al. 2007). Furthermore, estimates show that, globally, livestock provide animal traction to almost one-quarter of the total area under crop production (Devendra 2010). Households with different levels of income have incentives to keep livestock because of the wide spectrum of benefits these provide, such as cash income, food, manure, draft power and hauling services, savings and insurance, and social status and social capital (Bebe et al. 2003; Upton 2004; Moll 2005). At the bottom of the pyramid there are the poor farmers who, in the absence of formal insurance markets, tend to diversify (including into livestock) to achieve a balance between potential returns and the risks associated with climatic variability and market and institutional imperfections (Alderman and Paxson 1992).

Livestock also provide a safety net in times of need in the form of liquid assets and a strategy of diversification for food production (Freeman et al. 2007). There are various studies as listed above that have shown that livestock play multiple roles in the livelihoods of people in developing communities, especially the poor. Beyond the important role that livestock play in the provision of food and nutrition in people's diets, they also have important social functions. They raise the social status of owners and contribute to gender balance by affording women and children the opportunity to own livestock, especially small stock such as goats, sheep, and chickens (Waters-Bayer and Letty 2010). The general livestock prevalence in the study area is 0.4 tropical livestock unit (TLU) with the range of 0.3 to 0.5 TLU. We speculate that livestock units are very low in the study area because the heart of Mozambique's livestock activities is the southern region because animals there are less prone to diseases (World Bank 2006).

Household assets

We refer to household assets as all of the household's productive and non-productive property, including farm tools and implements, communication materials, as well as the housing condition. In sub-Saharan Africa (SSA), the number of hand tools varies according to the size and wealth of the household. Most households own an essential range of hand tools that differs slightly according to farming system and region. The universal tools

are the hand-hoe (usually short-handled), axe, panga/machete, sickle, and the cutlass. Even tractor-owning households maintain a full complement of hand tools because so few operations are mechanized. Ideally, households own a few axes, pangas/machetes or cutlasses and a sufficient number of hoes and sickles for each member of the family who is able to work with them. In practice, poorer households do not have enough of the essential implements for all household members and some resort to borrowing from neighbors. Worn-out hoes and cutlasses are usually passed on from men to their wives and children for use for lighter tasks. It is therefore not surprising to see that all of the households in the study area owned at least a hoe. On average, 18 percent of the sampled households had an irrigation pump. However, it is Gurue that had the majority (32 percent) of households owning an irrigation pump compared to Malema where there were hardly any (3 percent) and Meconta (2 percent). This shows that either irrigation is not commonly practiced in the latter two districts or people lack the capital to purchase an irrigation pump because it is mostly expensive. It is clear for Gurue that farmers there do practice considerable irrigated farming.

Ownership of radio, television set (TV), and mobile phone is an important factor when it comes to information dissemination. Almost all innovations are announced or advertised through different radio and television stations in addition to different newsletters, flyers, and magazines. Consequently, a household with either of these assets has a higher comparative advantage when it comes to technology acceptance and adoption than those without. While it is good to see that slightly above half of the households in study area own radios, the ownership of TV is still low at 20 percent. Gurue has the most households with a radio while Malema is the second at 41 percent. The scenario is different when we talk of TV prevalence among the studied districts. We see that 35 percent of Gurue households owned TV while those of Malema and Meconta are both at 3 percent. This implies that most people in the area are still poor, because ownership of a TV is related to being wealthy in most rural areas of Africa. About 25 percent of households own a mobile phone which is important for communication. Just like the TV ownership, we can speculate that people are relatively poor in the study area, especially those from Malema and Meconta.

Transport is a key element for sustainable development. Poor access to transportation services greatly hinders economic and social development and contributes to poverty. Affordable, appropriate, and reliable transport can lead to a "virtuous cycle", improving livelihood strategies of the rural poor. It also strengthens the "exchange of information, social awareness and the promotion of social unity" (Omar 2001). Transport also facilitates access to social services, income-generating opportunities, and community activities. Many people living in Mozambique face a major problem when it comes to mobility. For people who make enough money, this isn't nearly as much of a problem as for those who don't. Those individuals get around by walking because taxis and buses are too expensive and the roads in those parts of the country are in a poor condition. As a result, bicycle use is more beneficial to the locals. In rural SSA, the most common means of transport are the legs, heads, and backs of African women (Peters 2001).

One of the major barriers to improving the health of people living with HIV/AIDS, orphans and vulnerable children, and youth-headed households is their lack of access to health care. Access is particularly difficult in rural areas with poor transportation and communication. In most rural areas of Africa, most individuals travel long distances on foot to have access to services, help those in need, or collect water. The time spent making long journeys limits other, potentially more fruitful activities, such as farming, small business development, regular attendance at school, and caring for community members in need. Therefore bicycle ownership improves their livelihoods. About 60 percent of the sampled households in the study area own a bicycle. In Gurue, up to 73 percent of households have a bicycle while the prevalence rate of bicycle ownership for Malema is 42 percent and for Meconta 37 percent. This means that transportation is a big problem in Meconta as many households still have no bicycle to ease the transportation problems.

Although development efforts have created extensive road networks in much of SSA, wheeled transport remains unavailable to most farmers. The inability to transport their crops to market prevents many farmers

from entering the market economy (Wendroff 1993). Without access to efficient and affordable transport, farmers in eastern and southern Africa have little choice but to “carry farm inputs and produce on their heads and shoulders,” work that is “slow, difficult and tedious” (Kumwenda 1998). If African farmers, restricted by the limitations of human muscle power, are ever to succeed in extending their cultivation beyond the subsistence level, it is imperative that they use wheeled devices to increase their work efficiency (Dibbits 1993; Kumwenda 1999). Animal-drawn vehicles are far beyond the means of most African farmers. Smallholder farmers live on their farms and engage in a variety of agricultural and non-agricultural transport activities. It has been estimated that the typical household in SSA spends annually 200 to 450 hours on agricultural transport, and 600 to 1500 hours on domestic transport, mainly in providing itself with water and firewood. “About 75 percent of the transport activity involves short trips, less than 6 km, in and around the village, e.g., to and from the fields” (Dennis 1993). Water collection is a daily activity in most households, and firewood is gathered every few days. Both tasks are almost exclusively carried out by women using head loading (Barwell 1996). This burdensome domestic transport uses up time and energy that could otherwise be applied to productive agricultural activity. Its never-ceasing demands leave African women with that much less leisure time (Bishop 1995) and further erodes their quality of life (Clarke 2000).

In relation to housing, all households own at least a house. Although, there is universal ownership of a house, the quality of those houses differs. On average, only 17 percent of households live in iron-roofed houses in all the three districts under study, while 3 percent of households dwell in houses with a cemented floor. Just like all other physical assets discussed above, it is Gurue that has higher percentage of people with houses roofed with iron sheets.

Crop Production and Marketing

Cropping patterns

In this section we assess the cropping patterns of the households in the study area during the 2010/2011 cropping season. Table 3 shows a portfolio of major crops in the study area including the proportion of households growing each crop by gender of the household head. Major food crops grown in the study area by both male- and female-headed households are maize, cassava, and sorghum; the major cash crops are maize, beans, soybean, and groundnut. Male-headed households dominate the production of maize, cassava, and soybean; female-headed households dominate the production of sorghum, beans, and groundnut. This is not surprising because maize is the main staple food in Mozambique.

Results in Figure 3 indicate the proportion of households producing selected major crops in the study area. The majority of households produce maize in all the three districts. Other crops that are equally produced by almost similar proportions in the study area are cassava and cowpea. Otherwise, great variations are seen in the proportion of households producing other crops, such as sweetpotato. The results show that soybean was produced only in Gurue.

Table 3. Major food and cash crops grown by sample households in Mozambique (%).

Food crop	Male-headed	Female-headed	Cash crop	Male-headed	Female-headed
Maize	61	52	Maize	34	23
Cassava	21	13	Beans	18	20
Sorghum	7	20	Soybean	10	6
			Groundnut	9	11

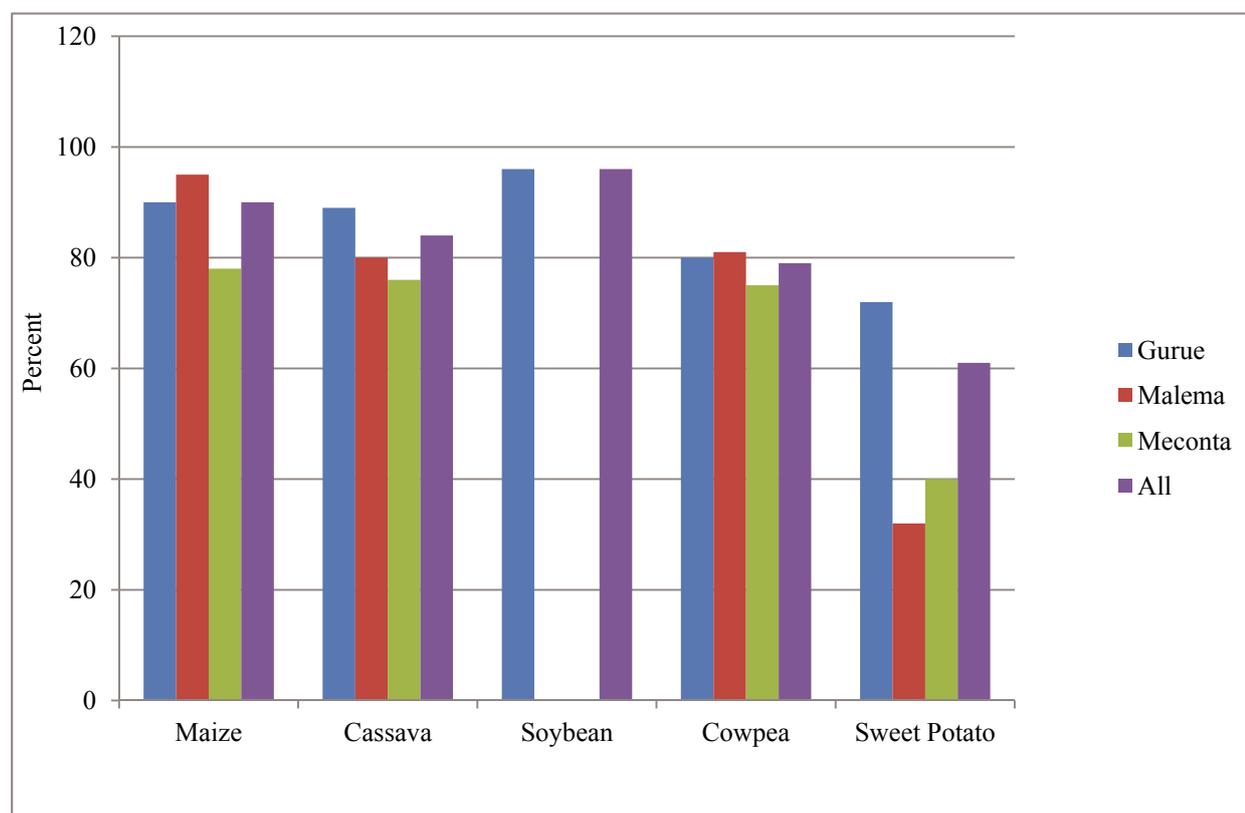


Figure 3. Proportion of households that produced major crops (%).

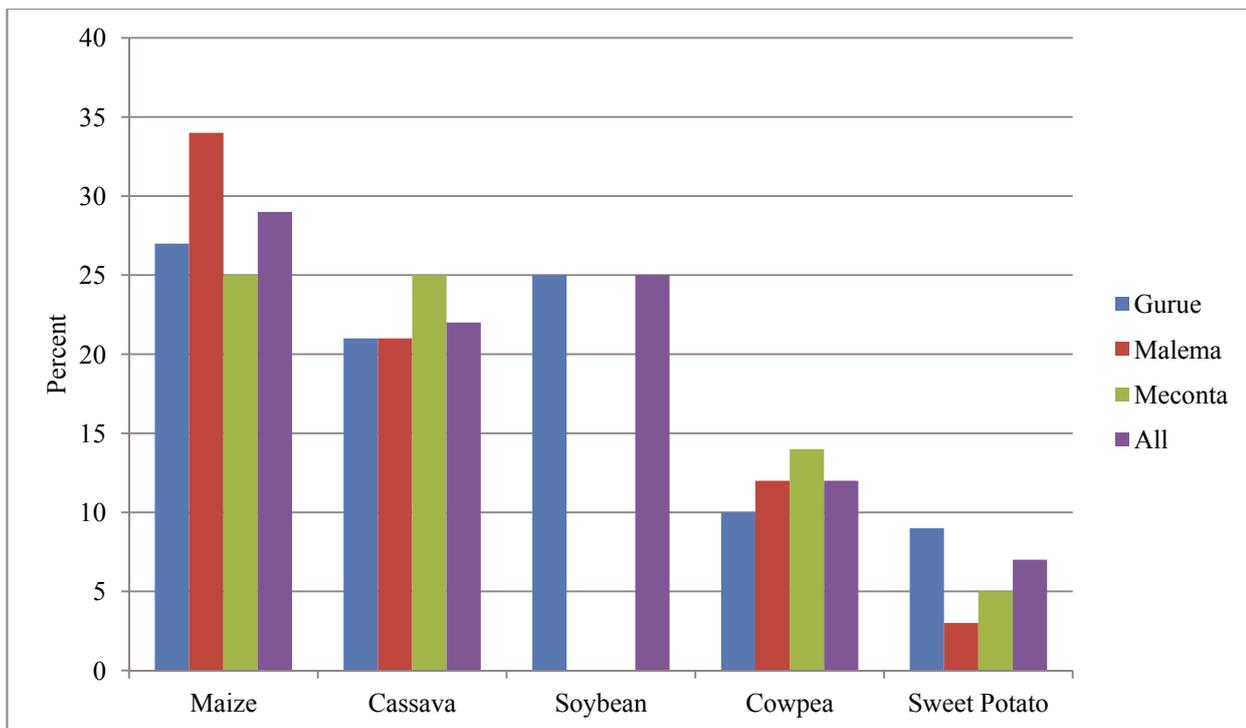


Figure 4. Share of major crops in total cultivated land in Mozambique (%).

The results for share of major crops in the total cultivated land in the study area are presented in Figure 4. The results reveal that households in Malema district allocated more land to maize as compared to other districts and any other crop (Fig.4). For cassava, more land was allocated to the crop in Meconta district unlike Malema and Gurue districts. There is great variations in the share of land for major crops such as cowpea and sweetpotato. However, more land was allocated to both cowpea and sweetpotato in Meconta district. The results further show that land was only allocated to soybean in Gurue district, i.e., the crop was only grown in the district.

Market participation

Crop market participation

Access to regular buyers who pay fair and stable prices motivates marginalized rural households to diversify and invest more of their labor and available capital in market-oriented farming and processing activities, thus increasing their food security and total income. Many of Africa's most marginalized rural populations live in areas that are cut off from main roads or transport infrastructure, and are therefore potential consumers of their farming output. They lack access to finance, and the organizational, business, marketing, and technical skills, as well as to the information and technology that could help them meet the quantity and quality requirements of buyers, such as supermarkets, agricultural processing enterprises, wholesalers, or export firms. This is compounded by the very small sizes of their individual landholdings—the result of unequal land distribution—and their insecure land tenure arrangements. Therefore, too often farmers who try to sell their surplus remain susceptible to the vagaries of farm-gate traders who offer below-cost prices, or localized markets that can become saturated very quickly if too many local producers try to sell the same produce at the same time. From Tables 4–6 we see a summary of how producers from the study area handled their produce in terms of marketing. In Table 4, the results indicate that only about one-third of the major crop production was sold within Mozambique. The commonly sold crops are soybean and maize but also a good percentage of households sold cowpea, sweetpotato, and cassava. At the same time, Table 5 indicates some producers who were buying sweetpotato, cowpea, and maize. We presume that this was mainly the buying of produce from the same locality. We can therefore speculate that in the study area we are dealing with subsistence farming and they only sell the surplus. Those producers who buy the produce could be those that want to supplement their consumption needs, thus the proportions of households buying and selling crops are hardly countable (Table 6).

Table 4. Producers of major crops who also sold in Mozambique (%).

Crop	District			All
	Gurue	Malema	Meconta	
Maize	37	37	5	32
Cassava	22	12	3	16
Soybean	89	–	–	89
Cowpea	23	23	8	20
Sweet potato	24	5	11	19

Table 5. Households that bought crops in Mozambique (% of households).

Crop	District			All
	Gurue	Malema	Meconta	
Maize	26	20	49	28
Cassava	10	17	20	14
Soybean	3	–	–	3
Cowpea	20	17	25	20
Sweet potato	27	68	67	39

Table 6. Households that bought and sold crops in Mozambique (% of households).

Crop	District			All
	Gurue	Malema	Meconta	
Maize	3	2	0	2
Cassava	–	1	–	0
Soybean	–	–	–	0
Cowpea	–	–	–	0
Sweet potato	1	–	–	1

Table 7. Major buyers of crops across districts in Mozambique (% households).

Buyer	District			All
	Gurue	Malema	Meconta	
Rural assembler/middle-men/traders	78	76	74	77
Consumers/other farmers	18	19	17	17
Processors	2	2	3	2
NGOs	1	2	3	2
Government/parastatal	1	1	3	2

Major buyers of crops

Most of the crops produced in the study area are sold to small-scale business men (rural assemblers/middle-men and traders) who mostly act as brokers for large-scale traders dwelling in big towns or cities (Table 7). The other major buyers of the produce from farmers in the three districts are fellow farmers or rural households who buy to supplement what they produced in their own households. There is little market participation in the study area from Government, parastatals, processing companies, and other private companies. This shows that farmers lack access to good quality markets which can offer reasonable prices for their produce. This might lead to the exploitation of farmers by the brokers.

When we assess the self-sufficiency status of the households in the study area with regard to food production, we find that, on average, 43 percent are self-sufficient in maize. These are the households that produce enough

Table 8. Self-sufficient producers of major crops in Mozambique (%).

Crop	District			
	Gurue	Malema	Meconta	All
Maize	41	45	46	43
Cassava	68	73	77	71
Soybean	8	–	–	8
Cowpea	57	61	67	60
Sweet potato	50	27	22	43

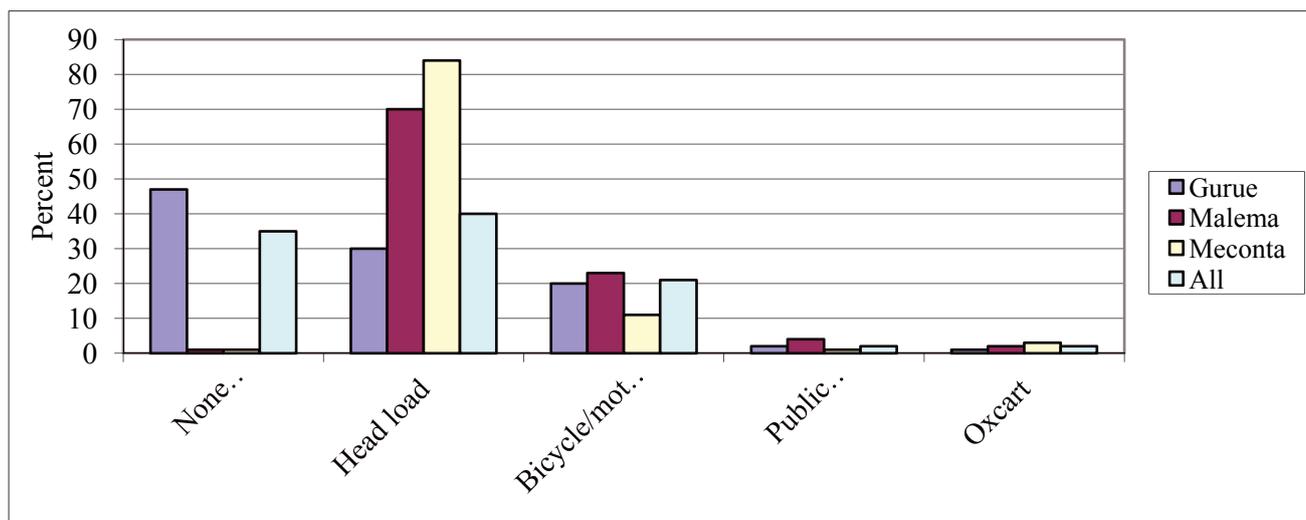


Figure 5. Mode of transport used for marketing by sample households in Mozambique (%).

maize to feed themselves throughout the year and they never sell any to traders. When it comes to the root crops, cassava, and sweetpotato, results in Table 8 show that 71 percent of the households are self-sufficient producers of cassava and 43 percent of sweetpotato. The majority (60 percent) of cowpea producers never bought or sold any cowpea grain; only 8 percent of soybean producers are self-sufficient. This is attributed to the fact that soybean is grown mainly for cash purposes so if any is kept then it's meant to be used as seeds in the next growing season.

Mode of transport for marketing

Respondents that sold some of their produce were asked to provide information regarding the main transportation mode that they used to go to the market. As shown (Fig. 5) the majority did not use any transport as they either sold their products at the farmgate (especially for Gurue) or they used head loads (carrying on head and walking on foot) as the means of carrying their produce to the market. The head load is dominant in Meconta and Malema. In all districts, we observe some proportions of households that rely on either bicycles or motorcycles for transport. Ox-carts and public transport are other means of transport to market used across the study area.

Technology preferences and adoption

Farmers' preferences

Farmers were asked to provide information on their preferences pertaining to different traits for the varieties of major crops grown in the study area. One of the reasons for the low adoption of improved varieties is argued to be the fact that most improved varieties lack the characteristics valued by farmers. This has been, in turn, due to the failure of crop improvement programs to involve farmers in the process of designing and developing improved varieties with a view to meeting their priorities and preferences. Figure 6 shows that high yield is the most-preferred trait that farmers look for in any variety of the major crops grown. The second most-preferred trait in a variety is that it commands high prices. Farmers prefer varieties that would fetch high prices at the market because this would mean more income to them. Other traits mentioned to be preferred in improved crop varieties are earliness of maturity, taste, color, size, resistance to pest and diseases, drought tolerance, short cooking time, and high starch content.

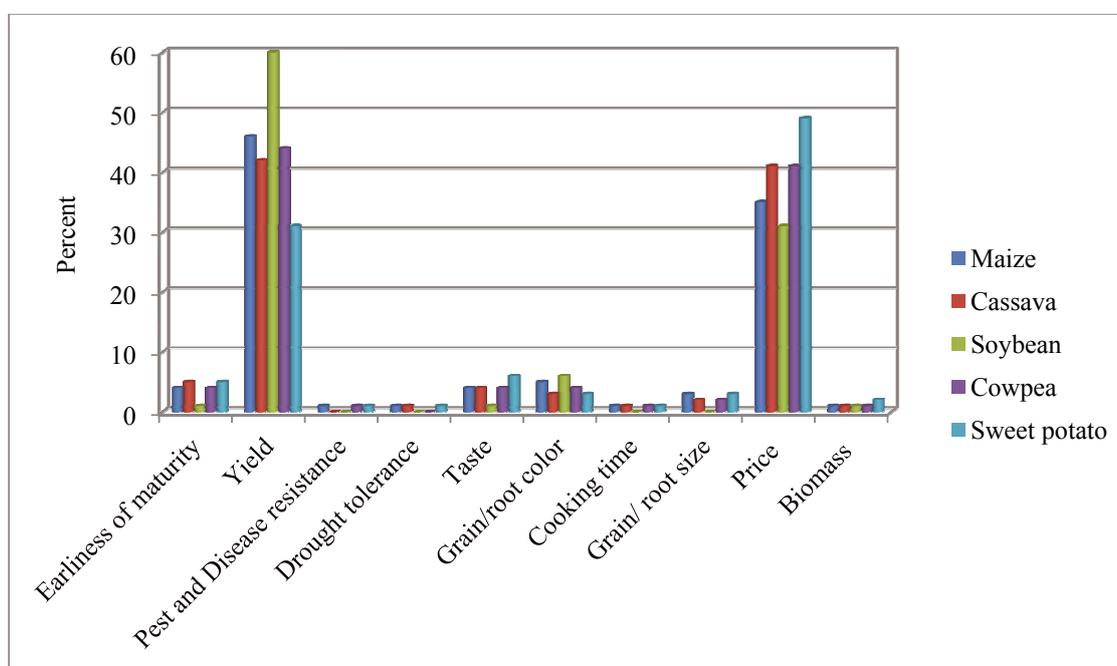


Figure 6. Most-preferred traits for major crops in Mozambique (%).

Sources of information on improved crop varieties

Variety knowledge is a necessary condition for variety adoption although it does not guarantee that just knowing about a variety would cause adoption to occur. In this study, farmers provided sources of information on the modern varieties that they knew. Results (Fig. 7) indicate that extension agents played a greater role in communicating with farmers about the new existing modern varieties. This is evidenced by the higher proportion (43 percent) of households reporting that they heard about modern varieties from extension agents. Meconta has the highest percentage at 71 percent; Gurue rates the lowest at 17 percent. Generally, neighbors or other farmers and NGOs are the second main source of information about modern varieties. Seed traders/ agro-dealers and radio/TV rank third with regard to extending messages about available modern varieties of different crops in Gurue, Malema, and Meconta. Information on modern varieties was also relayed through farmers' cooperatives and a research center. The results further indicate that in Meconta, TV/radio and farmers' cooperatives do not apply as being sources of information on new improved varieties.

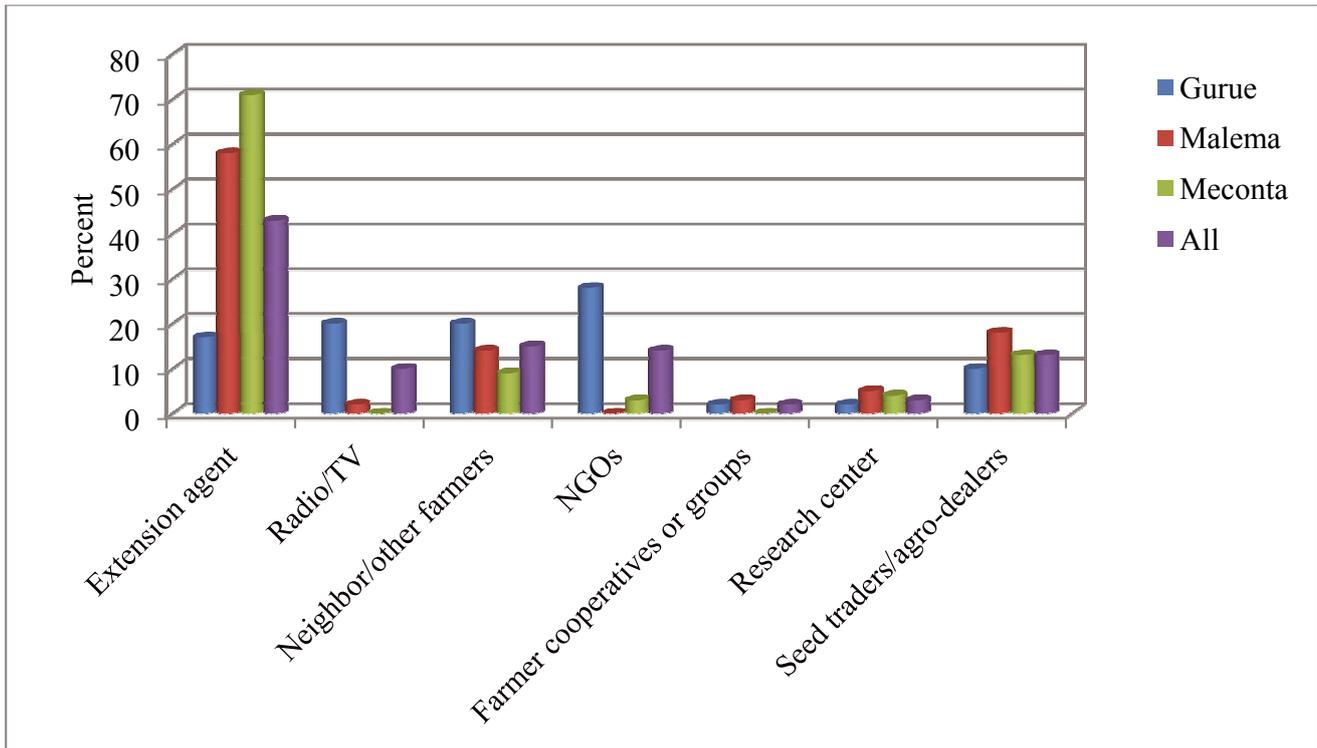


Figure 7. Source of information on modern varieties in Mozambique.

Adoption of improved crop varieties

Feder et al. (1985) conducted a comprehensive literature survey on the adoption of agricultural innovations. They list factors that have frequently been identified as influential in determining the adoption of an agricultural innovation. These include farm size, risk exposure and capacity to bear risks, human capital, labor availability, credit constraint, tenure, and access to commodity markets. We note that there is little adoption of modern varieties of different crops by households in the study area. In Gurue, the adoption of improved varieties was higher than in the other two districts. About 37 percent of households adopted an improved soybean variety, 28 percent adopted modern maize varieties; the same trend continues with cowpea, cassava, and sweetpotato (see Table 9). The average adoption rate for maize in the study area was 20 percent. The adoption rate for improved varieties of cassava, cowpea, and sweetpotato was second to that of maize. It is worth noting that soybean modern varieties were adopted only in Gurue district. We can therefore speculate that, within the study area, there is some adoption of improved varieties for cereals, roots and tubers, and legumes as well.

Table 9. Adoption of improved varieties of major crops among the sample households (%).

Crop	District			
	Gurue	Malema	Meconta	All
Maize	28	11	15	20
Cassava	21	10	12	16
Soybean	37	0	0	22
Cowpea	27	14	14	16
Sweetpotato	16	20	0	16

Reasons for non-adoption of improved varieties

Since we found out that adoption of improved varieties was not universal, we went further to find out the reasons for the non-adoption of improved varieties by some households within the study area. Based on results from the study presented in Table 10, we found that the major reason for the non-adoption of improved maize varieties is the non-availability of the seeds in the area. This is the same main reason why improved varieties of all other crops were not widely adopted in these three districts. Secondly, some farmers also indicated lack of cash to purchase the seeds, especially for sweetpotato in Malema. This means that if seeds for improved varieties and credit facilities can be made available to farmers at the same time, the extent of adoption of these improved varieties would improve for all crops.

Table 10. Reasons for non-adoption of improved varieties of major crops (% of households).

	District			All
	Gurue	Malema	Meconta	
Maize				
Lack of seeds	79	87	91	86
Lack of cash for seeds	16	11	9	12
Local varieties are better	5	2	0	2
Cassava				
Lack of seeds	86	97	87	88
Lack of cash for seeds	12	2	13	11
Local varieties are better	2	1	0	1
Soybean				
Lack of seeds	91	0	0	91
Lack of cash for seeds	5	0	0	7
Local varieties are better	4	0	0	2
Cowpea				
Lack of seeds	70	89	94	84
Lack of cash for seeds	11	7	6	10
Local varieties are better	19	4	0	6
Sweetpotato				
Lack of seeds	89	38	0	82
Lack of cash for seeds	7	62	0	14
Local varieties are better	4	0	0	3

Poverty and household welfare

Household income

Financial capital normally refers to the stocks of money to which the household has access (Ellis 2000). These include savings held in the bank, credit, stocks, and fungible assets such as livestock, jewelry, and food stocks. At the farm household-level, financial capital refers to savings held in the bank and access to credit in the form of loans and stocks. Financial capital becomes a useful asset in the household only when it is converted into other forms of capital or is used directly for the purchase of food. This ease of switching between uses makes financial capital one of the fundamental assets. In this study we assess the financial capital of households in terms of their strategies to build up this type of capital. Table 11 shows different strategies that households in the three target districts employ to raise income for their livelihoods.

Crop income

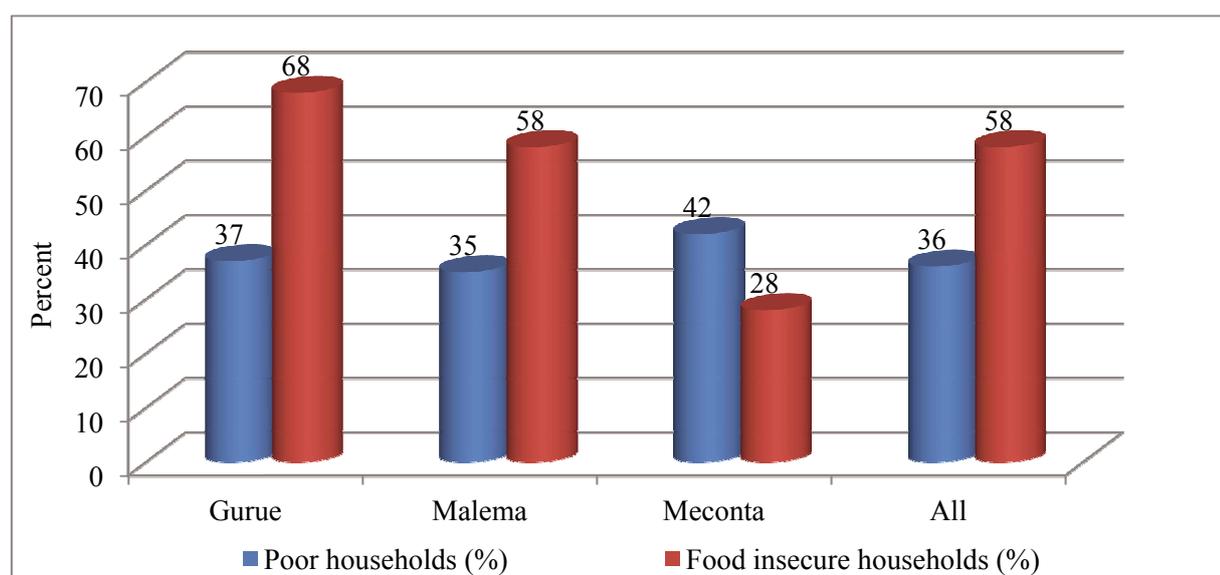
Farming is the main occupation through which 92 percent of all households earn their living in all the three districts. The average annual per capita income for the study area is US\$643 (ranging from US\$502 for Meconta to US\$695 for Malema). We can therefore speculate that, on average, households in the study area are not poor because the average income/day is above the World Bank poverty line of US\$1.25/day. Further analysis of poverty, taking each household separately, shows that on average 36 percent of the households live under the poverty line. Meconta has the poorest population in the study area because over 40 percent of the households live under the poverty line. This implies that we are dealing with a considerable group of poor people whose livelihood situation would be worsen if hit by the negative effects of the HIV/AIDS pandemic. From the figures we can also deduce that there is a big gap within the districts between the well-to-do households and the poorest, which is why we end up with an average indication of the households not being poor when we put them together. The average gross value of production is US\$258 and average net returns/ha are US\$181 (Table 11).

Off-farm activities

Although farming is the main occupation in the study area, results in Table 11 show that 85 percent of the households also engage in off-farm employment. On average, about 92 percent of households in Gurue seek off-farm employment, 79 percent in Malema, and 78 percent in Meconta. We find that in Gurue more households have off-farm employment compared to being primary farmers and this is the opposite for Malema and Meconta districts. This could be attributed to the fact that Gurue is known as an area with increasing pressure on land and a number of land conflicts, with a series of external investors coming in recently. This scenario can force households out of farming. The land conflict that has received most attention so far is the one resulting from the grant in 2009 of 10 000 ha to Quifel Energy (a company owned by the Portuguese locally known as Hoyo Hoyo) in the Ruace area (Kaarhus and Martins 2012). Apart from earning a living from farming and off-farm employment, households complement their livelihood strategies with other non-farm activities, such as artisan work/handicrafts, unskilled and skilled wage labor, petty trading, Food for Work and also, most importantly, they get remittances from other members of the household or relatives who live away from the communities.

Table 11. Income strategies and outcome of the sample households in Mozambique.

Strategies/Outcomes	District			
	Gurue	Malema	Meconta	All
Farming as primary occupation (%)	88	98	96	92
Household income (US\$/capita/year)	665	695	502	643
Gross value of production (US\$/ha)	269	276	189	258
Net returns (US\$/ha)	231	148	91	181
Crop income share in household income (%)	73	76	74	76
Livestock income share in household income (%)	25	22	23	22
Off-farm income share in household income (%)	2	2	3	2
Off-farm employment (%)	92	79	78	85
Artisan work/handicrafts	14	13	14	14
Unskilled wage labor (e.g., daily laborer)	13	21	30	20
Skilled wage labor (e.g., carpentry)	12	8	9	10
Petty trade (e.g., retail shop, vending)	20	14	17	17
Drought relief	1	1	1	1
Food for Work	11	14	6	10
Remittances	29	29	23	28

**Figure 8. Household poverty and food security in Mozambique.**

Income shares

Crop income represents the highest share of household income. This shows that the main source of income in the study area is crop production. The second highest share of household income comes from livestock income which takes slightly over a 20 percent share of household income (Table 11). Off-farm income represents only 2 percent of the income share of total household income.

Poverty profile

Poverty is widespread in the rural areas where the people are in a state of human deprivation with regard to incomes, clothing, housing, food, health care, education, sanitary facilities, and human rights (Simler et al. 2004; Fox et al. 2005). Food security is when people have a year-round access to the amount and variety of safe foods required by all household members to lead active and healthy lives, without undue risk of losing such access. The opposite of food security is food insecurity. The study investigated how food-secure people

in the study area are. This is the self-reported perception of food insecurity based on the judgment of the head of a household. Figure 8 profiles the poverty in the study area, based on income, and compares it to food insecurity. The results indicate that 36 percent of people in the study area live below the poverty line. This is below the national figure of 54 percent as reported by the World Bank (2010). Meconta has the highest rate (42 percent) of households living under the poverty line compared with the other two districts that were studied. However, in terms of food insecurity, Meconta has the lowest rate (28 percent) of households which are unable to provide enough food for the members to last the whole year, even though in Gurue, 37 percent of households are poor but almost double this figure are food-insecure. This can be attributed to the fact that the incidence of poverty in Mozambique is highest in the central region where Gurue is situated compared with the northern and southern regions (Simler et al. 2004). So although we did not find Gurue to have highest percentage of poor households in the three districts, the high incidence of food insecurity could indirectly reflect how households are deprived of food in the area, reflecting the general poverty level of the area.

Determinants and correlates of poverty

Poverty is a multi-faceted phenomenon which affects not only the ability to purchase goods, but also vulnerability to various pressures that may prohibit an individual from enjoying life. This vulnerability may be gauged from living conditions, such as employment, health, education, and housing. It is important to monitor inter- and intra-household differences in poverty, vulnerability, and living conditions, and also to understand the causes of these differences, in order to prepare strategies for more efficient intervention schemes aimed at poverty reduction. The measurement and analysis of poverty, inequality, and vulnerability are crucial for cognitive purposes (to know what the situation is), for analytical purposes (to understand the factors determining this situation), for policymaking purposes (to design interventions best adapted to the issues), and for monitoring and evaluation purposes (to assess the effectiveness of current policies and to determine whether the situation is changing) (Coudouel et al.2002).

Empirical results

The logit maximum likelihood estimates and marginal effects are presented in Table 12. Marginal effects from the logit model provide a good approximation of the amount of change in the dependent variable produced by a unit change in each explanatory variable while holding all other factors constant. The marginal effects were computed only for the significant variables in the model and converted into percentages. Goodness-of-fit tests were carried out to determine strength of the model. The Likelihood Ratio chi-squared value is highly significant indicating that the model is a good fit of the data while the Hosmer-Lemeshow chi-squared is not significant. In addition, the percentage of correct predictions is also high (85 percent).

The multivariate analysis (Table 12) shows that improvements in access to credit have an important impact on reducing the probability that a household is poor. Households who are able to have access to credit are 12 percent less likely to be poor. Simler et al. (2004) did not find any significant relationship between economic infrastructure and poverty level in Mozambique but when the economic infrastructure variable was interacted with adult female literacy, the coefficient was positive and significant, suggesting that at least some basic educational background was necessary to realize the benefits of improved economic infrastructure. However, other studies have found similar results that improving access to credit services can help to remove the poor from the poverty trap (Mukherjee and Benson 2003; Apata et al. 2010).

The results also show that increases in the off-farm share income of total household income have a positive influence on decreasing the probability that a household is below the poverty line. This finding implies that households who diversify their income strategies in off-farm income activities are less likely to be poor. This is incoherent with the findings of other studies (Mukherjee and Benson 2003; Simler et al. 2004) which found that adult employment of any kind leads to higher consumption per capita than unemployment or unpaid housework. They found that the incremental gain in per capita consumption was smallest for those employed in agriculture and fisheries and largest for those employed in other sectors. However, our findings could also mean that poor households are those who solely depend on farm income for their livelihoods (Apata et al. 2010). A 10 percent

Table 12. Logit model estimates of the determinants and correlates of poverty in Mozambique.

Variables	Estimate	T-ratio	Marginal effect	% change in probability of being poor
Constant	-1.763	-1.54		
Gender of household head (male = 1)	0.287	1.08		
Age of household head (years)	0.011	1.21		
Education of household head (years)	-0.030	-0.66		
Household size	0.012	0.20		
Orphan in the household (yes = 1)	0.051***	3.61	0.006	0.6
Dependency ratio (child/adult)	-0.025	-0.33		
Log of value of farm assets (MZM)	0.015	0.12		
Livestock ownership per capita (TLU)	-0.524	-0.63		
Land per capita (ha)	0.049	0.48		
Off-farm income share in total income	-1.564**	-2.79	-0.189	-19
Access to credit (yes = 1)	-1.009*	-2.02	-0.122	-12
Access to extension services (yes = 1)	-0.440	-0.97		
Sick person in the household (yes = 1)	-0.000	-0.00		
District				
Malema	-0.200	-0.73		
Meconta	-0.244	-0.62		
Goodness of fit tests				
Hosmer-Lemeshow chi-squared (560)	580			
Likelihood Ratio chi-squared (15)	31.06***			
Pseudo R-squared	0.06			
Correct prediction	85%			

Note: Statistical significance at the 99%(***) , 95%(**) and 90%(*) confidence levels.

increase in the share of off-farm income in the total income of a household will almost certainly make an average household come out of poverty.

The results further indicate that an addition of an orphan to a household, *ceteris paribus*, raises the chance of being poor by 0.6 percent. This implies that a household taking care of 10 orphans is 6 percent more likely to be poor. This result is consistent with the expectation that rural household poverty is exacerbated by care for orphans due to the HIV/AIDS pandemic (De Waal and Whiteside 2003). Similar results are found in Mozambique and Malawi, that an addition of a number of children to a household increases its chances of being poor due to the increased dependency burden (Mukherjee and Benson 2003; Fox et al. 2005). The addition of orphans into an already impoverished household drains the household's financial resources. However, taking in an orphan, depending on the age, gender, and health, may also bring a net economic benefit to household income or food production (Save the Children 2004).

Household shocks and coping strategies

We assessed self-reported trends of economic well-being in the study area by asking the households how they perceived the change in their economic well-being for the past year and what they expected in the coming year. In general, 31 percent reported that their well-being had worsened since a year ago, while 40 percent reported that their economic well-being had improved. The rest had seen no change in their economic status. However, it is a little different when we analyze this across the districts. From Table 13, Gurue and Meconta had more households whose economic status had improved; for Malema, the proportions for those who felt it had

Table 13. Sources of household welfare shock and economic well-being trends (%).

	District			
	Gurue	Malema	Meconta	All
Changes in economic well-being from a year ago				
Better off	42	35	45	40
Worse off	32	31	30	31
Same	26	34	25	29
Expected economic well-being a year from now				
Better off	43	32	50	40
Worse off	31	49	30	37
Same	26	19	20	23
Source of shock				
Falling crop prices	26	8	2	24
Poor harvest due to pests and diseases	24	24	2	24
Sickness/death of household head/member	19	25	4	20
Poor harvest due to drought	13	15	86	14
Rising food prices	12	8	2	11
Coping strategy				
Reducing quantity of meals	46	34	64	42
Eating foods other than staples	25	47	28	32
Migration to urban areas	11	1	1	8
Borrowing food in kind	5	8	1	6
Engaging in small-scale businesses	6	1	1	4

changed for the better were almost equal to those who felt their well-being had worsened and those whose status had not changed. It is worth noting that when it comes to expectations for the year to come, the majority (40 percent) expect that their economic status would improve and 37 percent perceive that their economic status would deteriorate. This is not good for the study area because the indication from the results is that the better-off percentage will not change but the percentage of worse-off households would increase.

Most of the welfare shocks for the households in the study area result from falling crop prices, a poor harvest due to pests and diseases, and the loss of a member or the head of the household. Falling crop prices and a poor harvest due to pests and diseases are the leading sources of shock in Gurue while the leading sources of shock in Malema are a poor harvest due to pests and diseases, and the loss of a member or the head of the household. The majority (86 percent) in Meconta indicated that a poor harvest due to drought was the main source of shock. The effects of the death on farm production could be sensitive to the gender and position in the household of the deceased. According to Chapoto and Jayne (2005), the death of a male can result in a 13 percent decline in cultivated land and the death of a female in a 5 percent decline. The death of a male household head results in a 21 percent reduction in land cultivated. This can be attributed to the loss of land, capital, and livestock assets to other relatives after the death of the husband. It was also found that relatively wealthy widow-headed households are particularly vulnerable, as they have more land and assets that can be claimed by relatives than afflicted households that are poor to begin with.

Poor harvests have a direct impact on food security with the result that farm families are not able to be food self-sufficient. Falling crop prices directly affect the household's income. As discussed earlier, the majority of households in the study area depend on farming and crop sales for their livelihood. Apart from the above-mentioned sources of shock, rising input and food prices are also a source of shock to the households welfare. Rising input prices indirectly affect what a household can produce. Low input use can limit the maximization of

productivity of other inputs, such as land and labor. On the other hand, an increase in food prices affects what farming households can purchase to supplement their own production. The higher the prices, the less they are able to purchase with their income, so this directly affects consumption patterns.

Devereux (2001) defines coping strategies as a response to adverse events or shocks. The definition by Snel and Staring (2001) captures the broad notion of coping strategies, namely, that “all the strategically selected acts that individuals and households in a poor socioeconomic position use to restrict their expense or earn some extra income to enable them to pay for basic necessities (food, clothing, shelter) and not fall too far below their society’s level of welfare” (Snel and Staring 2001). The latter definition implies that coping strategies involve a conscious assessment of alternative plans of action. This does not necessarily mean that the choice of strategies is always successful in achieving the intended objectives. In fact, the coping strategies often have unintended negative effects. In the study area, households deal with shocks by eating foods other than staples, reducing the quantity and number of meals they eat, engaging in petty trading, borrowing food in kind, and migrating to urban areas.

Household livelihood dynamics

The concept of livelihoods has gained wide acceptance as a valuable means of understanding the factors that influence people’s lives and well-being, particularly those of the poor in the developing world (Bernstein et al. 1992; Davies 1996; Rennie and Singh 1996; Carney 1998). Rural people in southern Africa make a living in diverse ways, often in harsh physical and economic environments. Such contexts are fast-changing, requiring shifts in livelihood strategies and mixes of activities. Chambers and Conway (1992) define a livelihood system as comprising the capabilities, assets (including both material and social resources), and activities required for a means of living. The chosen combination of assets and activities, undertaken usually at the household level, is often referred to as the household’s “livelihood strategy”. A livelihood strategy encompasses not only activities that generate income but many other kinds of elements, including cultural and social choices (Ellis 2000). Livelihood approaches illustrate how, in different contexts, sustainable livelihoods can be achieved through access to a range of livelihood assets (e.g., natural, social, financial, physical, and human capital) which, within the context of personal, institutional, and environmental provisions and constraints, are combined in the pursuit of different livelihood strategies. Within the sustainable livelihoods framework (Chambers and Conway 1992; Scoones 1998), context is framed within the “vulnerability context”, which includes issues of “seasonality”, “trends”, and “shocks”.

Table 14. Livelihood dynamics of households over the last 10 years in Mozambique (%).

	District			
	Gurue	Malema	Meconta	All
Cultivated land				
Increased	60	48	90	57
Decreased	22	43	9	28
No change	18	9	1	15
Household size				
Increased	56	58	6	57
Decreased	32	36	92	33
No change	12	6	2	10
Sick people				
Increased	52	56	92	53
Decreased	22	24	4	23
No change	27	20	4	24
Non-farm activities				
Increased	44	35	58	42
Decreased	21	42	36	27
No change	35	23	6	31

In this section we examine the livelihood changes of the study area over the past 10 years. We use self-reported changes in different parameters of livelihood to assess the livelihood dynamics of households over a period of ten years. The results in Table 14 show that the cultivated land increased in 57 percent of households over the ten-year period while 28 percent indicated a decrease in the area they were cultivating and 15 percent of households said there was no change. With regard to household size, about 60 percent of the households in the study area increased in size. We see a two-way scenario when it comes to the number of sick people. There is not much difference in the proportions of households whose number of sick people had not changed and those who reported that the number of sick people had decreased in their households. However, slightly over half of households had increased the number of sick people in their households over the past ten years. About 40 percent of the households in the study area had increased their engagement in off-farm activities. From these results we can see some interesting trends in the proportions of the above parameters in relation to sick people. The proportion of households with an increase in household size is 57 percent which is the same as the proportion of households which reported an increase in cultivated land.

Community analysis

Community

The term “community” is used extensively in almost all areas of our lives. It refers to both the development of a social grouping and also the nature of the relationship among the members. Today, three main types of communities are usually identified; geographic communities, communities of interest, and virtual communities. In this report we talk about geographic communities. These share physical space, so that residents come into contact with one another by virtue of proximity, rather than intent. A community is therefore viewed in spatial terms: a group of people living in the same area or close to the same risks. This, however, overlooks other significant dimensions of “community” which are to do with common interests, values, activities, and structures. Communities are complex and they are often not united. There will be differences in wealth, social status, and labor activity between people living in the same area, and there may be more serious divisions within the community. From a hazards perspective, the spatial dimension is an essential element in identifying communities at risk, but this must be linked to an understanding of the socioeconomic differentiations, linkages, and dynamics within the area at risk, not only to identify vulnerable groups but also to understand the diverse factors that contribute to vulnerability. Community businesses, services, and infrastructure must also be taken into account. Communities do not exist in isolation. The level of a community’s resilience is also influenced by capacities outside the community, in particular by emergency management services but also by other social and administrative services, public infrastructure and a web of socioeconomic and political linkages with the wider world. Virtually all communities are dependent on external service providers to a greater or lesser extent (FAO 1997).

Public support services

Improving smallholder farmers’ access to agricultural services in SSA is a central challenge facing governments in the region. Structural adjustment and a commitment to market-based agricultural development have reduced the direct role of the state in providing services. In most countries, publicly financed marketing boards have disappeared and access to unsecured and subsidized credit through government lending institutions is no longer available (Stringfellow et al. 1997). Private systems are emerging but there remains a question mark about their ability to fill adequately the gap left by state withdrawal, especially in the short term.

Community infrastructure and services

Infrastructure

Infrastructure comprises roads, housing, electrification, communication, schools, water facilities, and the other support services that are required for a community to be vibrant. Road connectivity is an extremely important aspect of development in rural areas. Rural infrastructures constitute the necessary components or ingredients for motivating rural residents to be more productive and achieve relative self-reliance. They also aid and enhance the realization of improved rural life. In this section we discuss whether the selected infrastructures were available in the study area and their proximity.

As depicted (Fig. 9) considerable numbers of primary schools were available in various communities in all the districts under study. It is worrying that Gurue registered a very small number of primary schools. The average distance to the nearest primary school in the study areas is 8 km. Proximity to school has an effect on children’s academic participation and performance and has tremendous potential for reducing existing gender disparities in rural areas. However, with the distance of 8 km in the focus area, many children would not be able to start participation in school at an early age or even at all. In turn, this increases the illiteracy rate of the area. There

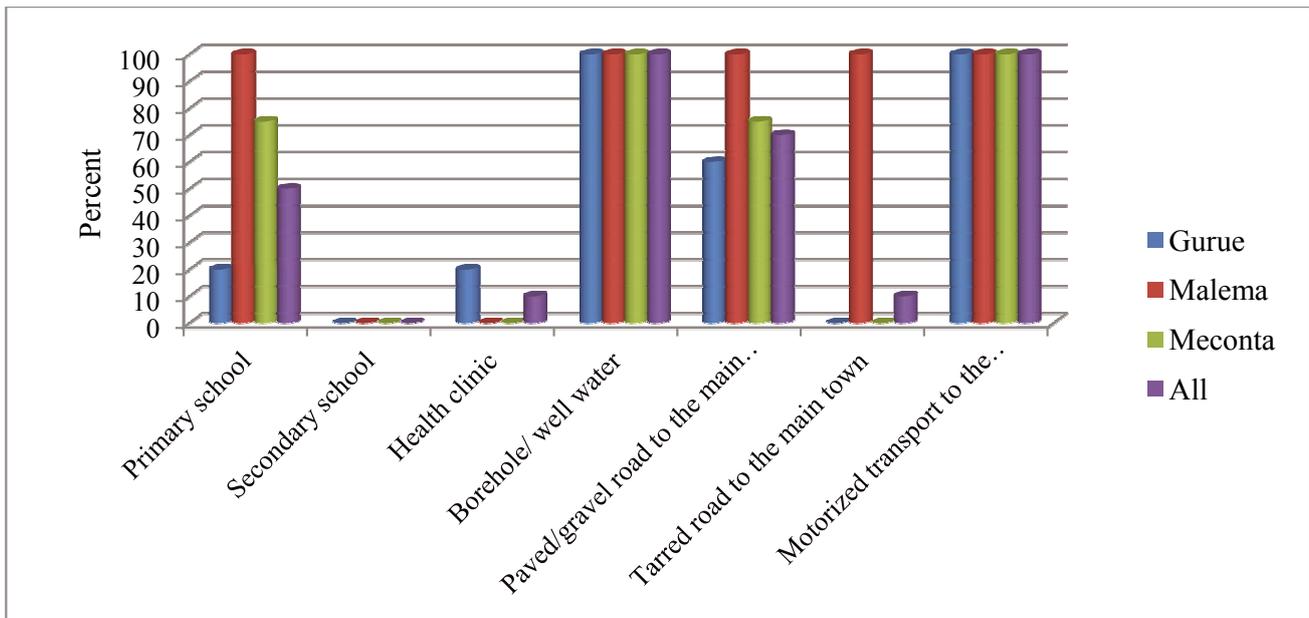


Figure 9. Access to different types of infrastructure (% of communities).

is no secondary school available to all the representative communities that were assessed. In terms of a health clinic, we observe that it is available within the communities only in Gurue while in the other two districts people have to walk/travel about 7.5 km, on average, to find a health facility. With regard to water supply, we found that there is 100 percent availability of a water sources in all communities. However, the inhabitants of these communities still have to walk long distances (average of 14 km) to fetch water from a well or borehole. We further discovered that the study area has a very good road network, especially Malema district where there are mostly good paved/graveled and tarred roads leading to the main town. Gurue and Meconta have no tarred roads that lead to the main town but the road network is either paved or graveled. All three districts have access to motorized transport to the nearest main town. This is an advantage when it comes to having access to health and market services from the town.

Services

Since the advent of technology, the ability for man to do work has been enhanced by the discovery of various forms of energy and the efficient management of these energy resources. Thus, all over the world, the GNP of a nation depends on the energy consumption per capita and the growth in the macroeconomics of the locality. Energy is closely linked to poverty reduction because it is central to practically all aspects of the core conditions of poverty— such as poor health, lack of access to water, sanitation, and education. Electrification of rural communities can bring about development through changes in the following areas among others: effective sociopolitical awareness; economic growth; industrial revolution (i.e., offspring of small-scale industries and agro-allied Industries, for example, cassava processing); mechanized farming and irrigation schemes; reduced rural–urban drift; information technology at the doorstep of the people; enhancement in health sector control and management, thus population growth; improved infrastructural development schemes; and a reduction in forestation problems. Unfortunately none of the communities in the study area is electrified. Table 15 below presents different types of services found in the study area. The average nearest point where they can have access to electricity is about 25 km away.

Table 15. Availability of community infrastructure and services (% of communities).

Infrastructure and services	Availability (%)				Distance to nearest service facility (km)
	Gurue	Malema	Meconta	All	
Electricity	0	0	0	0	25
Mobile phone reception	100	100	100	100	1
Extension services	100	100	100	100	27
Credit facilities—formal (e.g., banks)	0	0	0	0	45
Credit facilities—informal (e.g., moneylenders)	20	100	0	20	46
Credit facilities—informal (e.g., NGOs)	0	0	0	0	25
Output market (e.g., for fresh cassava, <i>gari</i> , etc.)	100	100	100	100	24
Fertilizer market (agro-dealer shops)	20	100	0	20	32
Seeds/planting material market (agro-dealer shops)	60	100	100	80	35

Mobile phone reception and extension services are readily available in all the districts under study. This means it is easier for people to communicate with one another but also to get any assistance they would want from extension agents. It is therefore a good enabling environment for the promotion and adoption of newer technologies that can help in improving people's livelihoods. With regard to the availability of credit facilities, however, the story is different because there are no formal or NGO credit facilities available. Only the informal credit facilities can be found in some districts of the study area. This would hinder the adoption of capital-intensive technologies as farmers would lack the capital start-up to try such technologies.

Output markets for both fresh products such as cassava and dry products such as maize grain are available in most places in the study area. Availability of markets can drive an increase in the supply of the products demanded at such markets if the pricing is good. The study area is also served with some input markets for fertilizer and seeds/planting materials although these are not readily available (Table 15).

Access to credit

Access to credit can be defined in many ways. Some scholars have said access to credit occurs when there is no non-price or credit rationing (Perderson and Khitarishvili 1997). We therefore define access to credit here to include the availability of finance (when needed, convenience, continuity, and flexibility are guaranteed) and willingness to pay the price of the loan. Credit access can be defined as a situation whereby a borrower is able to obtain some amount of capital (in cash or in kind), regardless of his/her willingness to pay a higher price for credit (interest rate at which a loan is granted) from the particular source of capital, though he/she may choose not to borrow. Although there is no consensus on the extent to which the provision of financial services especially credit, can help reducing poverty in the developing world, it is generally accepted that rural financial services may benefit poorer people either directly or indirectly. This therefore justifies why financial institutions need to channel their financial products to those who are in need to invest in productive assets, particularly in rural areas.

Evidence shows that access to credit facilities may assist smallholder farmers to tap financial resources beyond their own means and take advantage of potentially profitable small business opportunities. Access to credit can also help landless smallholder farmers to establish or expand their existing family enterprises (Zeller and Sharma 1998). Hence, credit contributes to the productivity and incomes of rural households, thereby contributing to poverty alleviation. Only 14 percent of the households in the study area were able to have access to credit (Table 16). In Gurue district, only 18 percent of households used credit facilities; 13 percent in Malema and 4 percent in Meconta. This is a very low rate which means it very difficult for farmers to build up their financial capital to make more investments in their livelihood earning activities. The credit was mainly used for family health and the acquisition of seeds/planting materials for different crops. Other uses that were highlighted are the purchase of inputs such as fertilizer and the establishment of a small business.

Table 16. Access to credit by households in Mozambique (%).

Credit use	District			
	Gurue	Malema	Meconta	All
Credit access in terms of actual borrowing (%)	18	13	4	14
Credit use (%)				
Family health	8	4	0	6
Seeds/planting material	6	3	1	5
Fertilizer	2	2	0	2
Business	2	1	1	1

Table 17. Group membership and activities of the sample households in Mozambique.

	District			
	Gurue	Malema	Meconta	All
Group membership (%)	18	7	15	14
Activity				
Input-output marketing	46	70	–	49
Labor exchange	17	–	–	14
Counseling/Nutrition	15	–	90	14
Crop and livestock production	10	30	–	13
Safety nets	8	–	–	6
Credit and saving	2	–	–	2

Farmers' groups and social capital

Farmers' cooperation, especially among those having commercial potential, is widely perceived as one mechanism for improving their access to agricultural services. By working together farmers can realize the scale economies of bulk acquisition and enter into more stable relationships with suppliers or traders. By pooling resources to invest in transport or processing operations they can become more active participants in the marketing systems, adding value to their production. In recent years this view has influenced the design of many programs of assistance to smallholders in Africa to the extent that donors and NGOs have often made group formation a prerequisite for obtaining access to project resources. Additionally, from the donors' perspective, there are significant advantages in distributing project resources to groups rather than to individuals, as costs are lower and resources can be disbursed more rapidly.

Table 17 presents the statistics of households' group membership in the study area and the type of activities done in such groups. The results show that, on average, only 14 percent of the sampled households belonged to a certain group. Input and output marketing dominate as the activity done in groups. This implies that the few people that make a decision to belong to a certain group in the study area are there because they want to benefit from collective action for marketing. Farmers come together so that they can purchase inputs or sell their produce as a group. In doing so they are able to buy in bulk and at wholesale prices. This can also help to curb the transaction and transportation costs. Collective action is equally important for the marketing of crop and livestock products. Other activities that are done in groups are the production of crops and livestock, obtaining access to counseling and nutrition lessons, carrying out safety nets programs, and exchanging labor to carry out farming activities. We also have a small percentage in Gurue who come together to obtain access to credit facilities. In Malema district, collective action exists for the production and marketing of crops and livestock but also the purchase of inputs; in Meconta, it is because of counseling and nutrition.

Table 18. Access to extension services by the sample households in Mozambique (%).

	District			
	Gurue	Malema	Meconta	All
Modern varieties	32	23	34	29
Pests and diseases	13	17	30	17
Soil and water conservation	29	28	35	29

Table 19. Crop production constraints in Mozambique (% of communities).

Production constraints	District				Most affected crop	Varieties/Practices
	Gurue	Malema	Meconta	All		
Pests and diseases	0	0	25	10	Beans	Applying chemicals
Drought	60	0	0	30	Maize	Irrigation
Weeds	20	0	0	10	Maize	Weeding
Low soil fertility	0	0	25	10	Maize	Compost manure/cultivating in <i>dambo</i>
Low yielding varieties	20	100	50	40	Maize	Crop rotation

Access to extension services

In this study we established that farmers had access to extension services during the 2010/2011 season. Table 18 highlights the type of extension services that were offered. Below one-third of the sampled households had contact with extension agents. Mostly, the services that were offered were to do with information regarding modern varieties of different crops, how to control pests and diseases, and also on soil and water conservation. This is an advantage because it means that if an innovation was to be disseminated in the study area, extension agents would play a greater role with the dissemination of the new technology. However, it is also worrying because the proportion of households that benefited from the extension services is low, as was expected. The contact rate is too low; there is a need to encourage farmer–extension agent linkage in all the three districts under study.

Production and marketing constraints

Crop production constraints

In this section we will discuss the major crop production constraints faced by producers in the study area and the practices that farmers adopt to address them. Low yielding varieties are the most important constraint for maize production in the study area which farmers address by practicing crop rotation. In Gurue district, the major production constraint was drought as reported by the majority as it was ranked number one by 60 percent of the communities (Table 19). Maize was the crop most affected by drought and farmers address drought by irrigating their crops. Pests and diseases attack most beans, and farmers usually control this problem by spraying chemicals. Another two problems experienced in maize production are the prevalence of weeds and low soil fertility. Weeding by hand, hoe, or herbicides gets rid of the weeds while *dambo* cultivation and manure use help to improve the fertility of the soil in their gardens.

Major institutional, infrastructural, and marketing constraints in Mozambique

Through focus group discussions, community members in different districts were asked to give insights on the constraints they faced pertaining to various items. With regard to access to improved seeds, 40 percent of all communities in the study area indicated that they are constrained by the unavailability of improved seeds. About 20 percent of communities cited the high price of seeds as also a hindrance for them in acquiring improved seeds. This implies that if adoption of improved seeds is to increase or take off, mechanisms need to

Table 20. Major institutional, infrastructural, and market constraints in Mozambique.

Constraints	District			
	Gurue	Malema	Meconta	All
Unavailability of improved seeds	40	100	25	40
High price of seeds	20	0	25	20
Unavailability of fertilizer	20	0	25	20
High price of fertilizer	0	100	0	10
Lack of access to credit	20	0	25	20
Unavailability of extension services	20	0	0	10
Lack of market information	0	0	33	17
Low output prices	0	0	50	20
Lack of physical access to markets	20	0	0	10

Table 21. Preferences for improved technologies in Mozambique (% of communities).

Improved technology	District			
	Gurue	Malema	Meconta	All
High yielding varieties	60	100	100	78
Pest and disease resistant varieties	20	0	0	17
Drought tolerant varieties	20	0	100	44
Nutrient-dense varieties	40	0	-	40
Soil fertility enhancing technologies	40	0	100	50
Weed management technologies	0	100	0	14
Postharvest storage technologies	0	0	100	17
Postharvest processing technologies	0	0	100	17
Harvest and pre-harvest mechanization	0	0	100	17

Table 22. Preferences for nutritious crops in Mozambique (% of communities).

Crop	Preference (%)
Quality protein maize	67
Yellow maize (e.g., pro-vitamin A)	67
Yellow cassava	33
Orange-fleshed sweetpotato	14
Amaranthus	100
Pumpkin	100
Cleome	-
<i>Moringa</i> tree	100
Cowpea	100
Soybean	20

be put in place to ensure that improved seeds for different crops are available within the proximity of the study area's communities. With reference to Table 20, unavailability and high prices are major constraints that limit the farmers' use of fertilizer in the study area to boost their crop production. Lack of fertilizer usage in areas with soil fertility problems can lead to low yields where no other alternatives are taken to mitigate soil fertility problems. Communities in Gurue (20 percent) and Meconta (25 percent) also mentioned lack of access to credit as one of the institutional constraints they meet. Unavailability of extension services was a difficulty only for Gurue district. In terms of marketing constraints, Gurue district faces lack of physical access to markets; Meconta district experiences most of the marketing problems, such as low output prices and a lack of market information. Based on our data, Malema district is better off than others as it does not have many community constraints.

Improved agricultural technologies to be introduced

During the community survey, we also asked farmers to indicate the types of improved technologies they would like to be introduced, based on their potential impact on their (farmers') livelihoods. Table 21 gives the results. The majority (about 80 percent) indicated that high yielding varieties should be introduced and the expectation is that this would have the most positive impact on their livelihoods. The second highly prized technology with 50 percent of the sampled communities wanting it, is soil fertility-enhancing technologies so that their land productivity can improve which, in turn, would increase their average crop production. The third item is drought-tolerant varieties of different types of crops. Other improved technologies that were listed are pest and disease resistant varieties, nutrient-dense varieties, weed management technologies, and also postharvest handling technologies. From this we can speculate that farmers would easily adopt new technologies that are meant to improve their production, productivity, and nutrient consumption.

The study also captured the nutritious crops grown in the study area that farmers would like to have introduced or expanded. Table 22 shows that almost all communities indicated that they grew Amaranthus, pumpkin, *Moringa*, and cowpea and they would like to have an expansion of these crops. Two-thirds of the communities also grew quality protein maize and yellow maize whereas some were growing yellow cassava and orange-fleshed sweetpotato. These are the nutritious crops that would benefit farmers if their adoption can be scaled up. Currently, none of the communities is growing cleome. However, farmers would like this crop to be introduced in their areas.

HIV/AIDS vulnerability and coping strategies

HIV/AIDS has become increasingly understood as a development issue and, moreover, to have a “bi-directional” relationship with the processes related to development. HIV/AIDS has an impact on the socioeconomic dynamics of households and communities, while socioeconomic change itself may have a negative or positive effect on the spread of HIV/AIDS. General research findings suggest that HIV/AIDS is creating new problems and challenges for rural development, including the dramatic increase of vulnerable groups such as grandparent-, widow-, and youth-headed households.

HIV/AIDS can be characterized as a “shock”. Most individuals who live in rural areas in SSA do not know whether or not they are HIV-positive. Hence, although the literal impact for a rural household occurs when an individual becomes infected with the HIV virus, the “shock”, in terms of both physical and psychological impact, is manifested when the individual develops AIDS. Furthermore, HIV/AIDS has long-term effects at both micro- and macro-levels. As Barnett and Blaikie describe, it is a “long-wave disaster” (Barnett and Blaikie 1992). The impact of HIV/AIDS and the coping strategies pursued by households are inextricably linked. Household resource allocation is adapted as soon as a household becomes AIDS-afflicted or AIDS-affected, and each of these adaptations has a “down-stream effect”. Mutangadura et al. (1999) provide a comprehensive review of the research that has been undertaken concerning household and community responses to HIV/AIDS in rural areas, and the policy implications of the findings of this research. While this review reveals how scanty the baseline data are, it provides a useful summary of some of the strategies pursued by households to overcome the impact of HIV/AIDS. The strategies are grouped in three categories according to the aim, as follows: (1) strategies aimed at improving food security; (2) strategies aimed at raising and supplementing income to maintain household expenditure levels; and (3) strategies aimed at alleviating the effects of loss of labor.

In this section we present the different coping strategies adopted by households in the study area when afflicted by HIV/AIDS. When an adult member of a household is ill for a long time or dies from HIV/AIDS, households in the community raise cash by doing piecework and getting assistance from fellow-villagers. Some households resort to borrowing or begging to raise money for basic needs. Generally, households cope with labor shortages by hiring labor in exchange for food; withdrawing children from school and involving them in farming activities;

Table 23. Social safety net programs in Mozambique (% of communities).

Safety net program	Gurue	Malema	Meconta	All
Free seeds/fertilizer	48	39	16	42
Food/Input for Work	16	16	49	19
Free food	9	13	19	18
Direct cash transfers	8	21	12	20

being assisted by well-wishers, and using labor-sharing. Other households reduce the area cultivated by renting out land. Household assets (including access to land), when a man dies, are mostly given to the wife and children. However, 30 percent of the communities in study area indicated that the assets are taken by the man's relatives. A similar scenario exists when both parents are dead; 70 percent of the communities revealed that the property goes to the children (Table A-2). The study further shows that surviving household members after the death of a key adult remain in the household, taking care of the children. But if the surviving members are only children, then they go and live with relatives. Coping strategies employed by surviving members to deal with food shortages in the study area are doing piecework in other people's farms for food or cash payment that they can use to buy food. Alternatively, the surviving members engage in non-farm activities, selling livestock, and borrowing. Finally, the study investigated whether there are any activities taking place in the community to help households to cope with the impacts of HIV/AIDS during sickness and after death. It was found that, generally, no interventions are taking place. However, in some instances, the households can receive assistance from family and friends during the funeral only. There are also some communities which have community-based organizations that help people with HIV/AIDS, together with other NGOs.

Social safety nets

Safety net programs are designed to reduce the impact of disasters on vulnerable populations and to prevent them from falling into poverty. Like the Supplemental Nutrition Assistance Program (formerly Food Stamps) in the United States, these programs help vulnerable people in developing countries meet their basic needs during difficult times. For example, consider a poor family that has just purchased its first cow after months or years of saving. In the wake of a famine, a safety net program helps ensure that family is able to keep its cow, rather than having to slaughter or sell it. By helping vulnerable people to maintain a basic level of self-sufficiency and food security, these programs reduce the need for more costly emergency interventions and help to provide a foundation for future development efforts. From Table 23, we see that there are several safety nets programs that were being conducted in the study area. Slightly above two-fifths of the households in the study area participated in the free seeds/fertilizer safety net program. The idea is to provide with poor farmers the essential inputs when it comes to maize production and the production of other crops. There was also a Food/Input for Work program whereby people work on a project and are paid in kind by being given food items or different types of inputs. In addition to the above-mentioned programs, some households benefited from free food donations and direct cash transfers for them to cope with various economic shocks to their household welfare.

Community dynamics

Household composition dynamics over past 10 years

The composition of households frequently change due to births, deaths, divorces, marriages, the departure of children from home, and other such changes. A typical household usually consists of several individuals with different characteristics, including economic capacity, which ultimately determine the economic capacity of the household as a unit. Consequently, a change in a household's composition will affect its economic capacity and

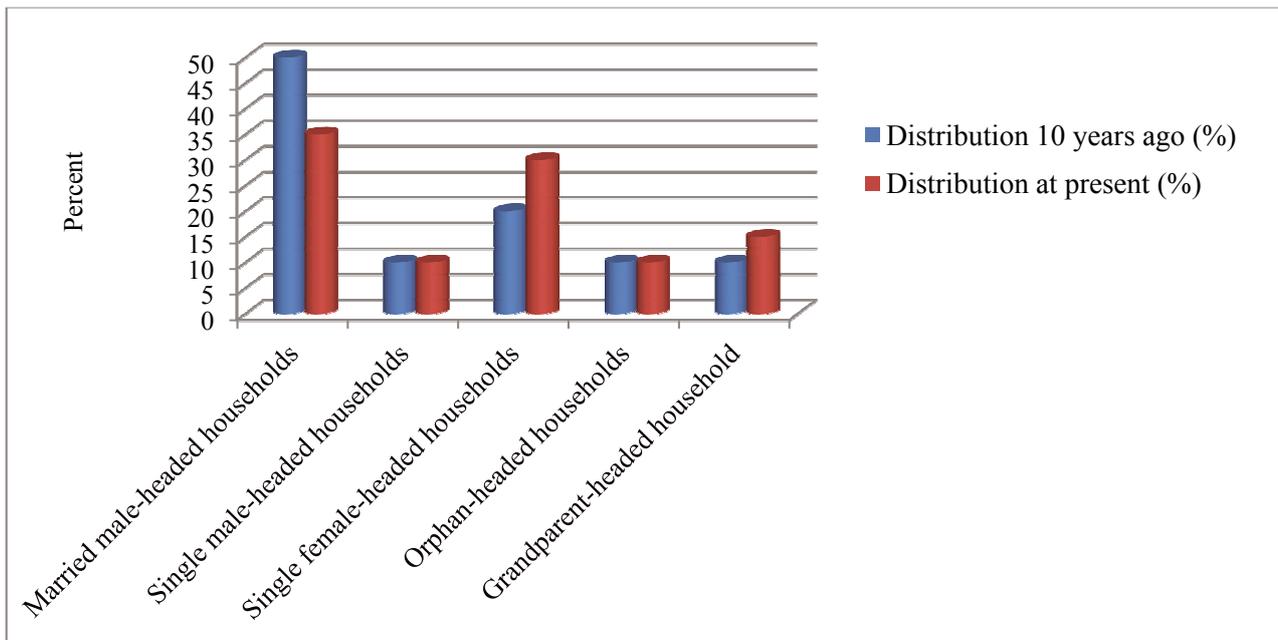


Figure 10. Household dynamics over the past 10 years in terms of household composition.

condition. The degree to which these change due to variations in household composition depends very much on the nature of the change in composition. The death of a small child in a household may have little effect on the economic capacity and condition of the household, but the death of a breadwinner can have a profound effect (Widyanti et al. 2009).

It is most likely that a change in household composition will simultaneously produce both positive and negative effects on a household's economic capacity and condition. The net effect, therefore, will be determined by the difference between these off-setting effects. For example, the addition of a working adult to a household will most likely have a positive effect on a household's economic capacity and condition. When a working adult joins a household, he or she brings additional earning capacity, but at the same time, adds to the consumption needs of the household. As long as the gain in earning capacity exceeds the increase in consumption needs, the household benefits from the addition to its members. Figure 10 shows the household composition dynamics over the period of ten years in terms of who was heading the household. The results show that there was a reduction in married male-headed households while single male-headed households and orphan-headed households have remained static. We further found out that the numbers of single female-headed households and those headed by grandparents have increased. We can deduce that, over time, the headship of the household has shifted from having more married males heading households to single females and grandparents being the heads. This can be attributed to several factors: either there have been more deaths of men and/or married couples due to HIV/AIDS or the divorce rate has increased. It is also possible that men could have migrated to other areas for greener pastures.

Community dynamics over the past ten years

Another matter of consideration is the dynamics within the communities, which are too often treated as

homogeneous entities of poor villagers with similar goals and needs. On the contrary, rural communities are ethnically, socially, and economically diverse (Banerjee and Duflo 2007), consisting of residents “divided by factors such as caste, ethnicity, length of residence, gender, wealth, age, status, and power”. Elucidating community contextual factors is fundamental to designing community-based agricultural programs for increasing production or health programs for the prevention and treatment of infectious diseases.

In this section we discuss the community dynamics in terms of the different processes that have occurred over the period of ten years. In general, in terms of crop and livestock production, we see that cultivated land has increased whereas livestock production has decreased. Human population has, in general, increased; so has the number of sick people in the communities especially due to the high rise of HIV/AIDS infection. Even though a rise in population has led to an increase in community savings, it is also noted that community expenditure on medical care has increased with the increasing number of sick people. The inclusion of vegetables and roots and tubers in people’s diets in the study area has increased over the past ten years. This is a good change because it means people are now diversifying their diets and would be able to get more nutrients from different types of food. With regard to labor-sharing, the results show that the use of this social safety net in the community in times of hardships has been reduced in many communities (70 percent). On the other hand, the use of labor-saving technologies has increased in some communities and been reduced in others by the same proportion. There has been a reduction in off-farm activities in half of the communities in the study area while it has increased in the other half (Table A-3).

Conclusions

The sample is dominated by male-headed households and about 14 percent of households were headed by widows. The average age of the household head is quite high (about 42 years) while the average number of years of schooling for the household head was quite low (about 3 years), revealing that younger and educated people do not stay in farming. The average dependency ratio was 1.2 with 43 percent of households having orphans. There is not much difference across districts in terms of land-holding sizes with respondents in Gurue having the land-holdings of the largest sizes. The rate of livestock ownership is very small with an average of less than 1 TLU. Almost all households own a hoe and slightly above half of the households have a radio and a bicycle. Ownership of other assets and houses roofed with iron sheets or with a cemented floor was very low.

Major food crops grown by both male- and female-headed households are maize, cassava, and sorghum; the major cash crops are maize, beans, soybean, and groundnut. In terms of gender, we find that the female-headed households allocate more land to food crops than the male-headed households. Most of the crops produced are sold to small-scale business men (rural assemblers/middle-men and traders) who mostly act as brokers for large-scale traders. There is little market participation from government, parastatals, processing companies, and other private companies. The major mode of transporting produce to market is the head load. Farmers also use bicycles (or motorcycles), ox-carts, and public transport.

Farmers mostly prefer varieties with traits such as high yields and marketability. Other traits mentioned as preferred in improved crop varieties are earliness of maturity, taste, color, size, resistance to pest and diseases, drought tolerance, short cooking time, and high starch content. Extension agents play a major role in disseminating information about existing and new improved varieties and their availability. In relation to the adoption of new technology, we found that respondents in Gurue had a higher adoption rate than those in Malema and Meconta. Improved varieties of soybean, maize, cowpea, cassava, and sweet potato were adopted across the districts. Respondents that did not adopt the new varieties indicated non-availability of the seeds and lack of cash to purchase the seeds as the major reasons for non- adoption.

Households generate income by selling crops and livestock. Farmers also raise income through other non-farm activities, such as artisan work/handicrafts, unskilled and skilled wage labor, petty trading, Food for Work and also, most importantly, they get remittances from other members of the household or relatives who live away from the communities. The main source of income is from crop sales, as indicated by the fact that crop income has the highest share of the total household income. Slightly above one-third of the households live below the poverty line while slightly above half are food-insecure. The main correlates of poverty include the presence of an orphan in the household, poor access to credit, and no off-farm income share in the total household income.

The most common household shocks were falling crop prices, a poor harvest, and sickness or death of a member or the head of a household. To mitigate the shocks, the households adopted coping strategies such as reducing the number and quantity of meals, diet diversification, migration to urban areas, borrowing food, and participating in small-scale businesses. Self-reported changes in different parameters of the household livelihood over a period of ten years showed that the cultivated land and household size had increased in over half of the households. In terms of the number of sick people, there was not much difference in the proportion of households whose number of sick people had not changed and those who reported that the number of sick people had decreased.

Most of the communities had access to public infrastructure and services. However, electrification was still not available and issues of credit facilities and farmers' groups were still lagging behind. Major crop production constraints were pests and diseases, drought, weeds, low soil fertility, and low crop yield. With

regard to institutional constraints, farmers mentioned the unavailability of improved seeds, high price of seeds, unavailability of fertilizer, high prices for fertilizer, lack of access to credit, and extension services as major constraints. Lack of physical access to markets, lack of market information, and low output prices are major marketing constraints. In terms of community dynamics, we found that cultivated land had increased whereas livestock production had decreased. The human population had, in general, increased; so also had the number of sick people in the communities. Even though there is an increase in community savings, it is also noted that community expenditure on medical care has increased. There is an increase in diet diversification over the past ten years while labor-sharing has reduced. On the other hand, the use of labor-saving technologies has increased in some communities and been reduced in others by the same proportion.

It was discovered that when an adult member of a household is ill for a long time or dies from HIV/AIDS, households in the community raise cash, food, and labor by doing piecework, being assisted by fellow-villagers, and borrowing or begging, hiring labor, involving children, labor-sharing, reducing cultivated land, and selling livestock. Household assets are given to wife and children when a man dies. When both parents are dead, the property goes to the children. We found that, in most cases, there are no interventions taking place to help households to cope with the impacts of HIV/AIDS during sickness and after death. However, in some instances, the households can receive assistance from family and friends during the funeral only. Sometimes there are community-based organizations which help people with HIV/AIDS together with other NGOs.

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Annex

Table A-1. Producer and consumer prices in Mozambique.

Crop	Producer price at peak selling time (Meticais/kg)	Consumer price at peak buying time (Meticais/kg)
Maize	11	7.7
Cassava	11	11
Soybean	14	11
Cowpea	14	14
Sweetpotato	12	14
Aramanthus	–	12
<i>Moringa</i>	–	–
Cleome	–	–
Pumpkin	–	–
Tomato	12	–
Paprika	124	12
Potato	13	124
Beans	12	13
Pigeon pea	11	12
Sorghum	11	11
Millet	11	11
Rice	19	11
Groundnut	13	19
Sesame	–	13
Tobacco	116	–
Cotton	57	116
Cashew	24	57

Table A-2. HIV/AIDS vulnerability and coping strategies in Mozambique.

	District			
	Gurue	Malema	Meconta	All
Raising cash if an adult member of a household is ill for a long time or dies				
Borrow cash	0	100	0	11
Begging	20	0	0	11
Get assistance from villagers	20	0	33	22
Piecework	60	0	67	56
Coping with labor shortage				
Hire labor in exchange for food	20	100	50	40
Involve children	20	0	25	20
Assisted by well-wishers	20	0	0	10
Rent out land	0	0	25	10
Use of labor-sharing	20	0	0	10
Nothing is done	20	0	0	10
Household assets when a man dies				
Given to wife and children	100	0	50	70
Taken away by man's relatives	0	100	50	30
Household assets when both parents die				
Left with children	80	100	50	70
Property grabbed from children	20	0	50	30
Surviving household members after death of a key adult				
They remain at the house looking after the children	60	100	50	60
Children live with relatives	40	0	50	40
Coping with food shortages				
Piecework in other people's fields	40	0	75	50
Non-farm activities	20	100	0	20
Selling livestock	20	0	25	20
Borrowing	20	0	0	10
Coping with impacts of HIV/AIDS in the community				
No interventions	20	0	25	20
Church interventions	20	100	0	20
Support from NGOs	20	0	50	30
Community-based organizations	20	0	25	20
Nothing	20	0	0	10
Coping after HIV death				
Assistance from family during the funeral only	0	100	50	30
Support from Community-based organizations	0	0	50	20
Support from NGOs	20	0	0	10
Nothing	80	0	0	40

Table A-3. Community dynamics over the past 10 years in Mozambique.

	District			
	Gurue	Malema	Meconta	All
Cultivated land				
Increased	80	0	100	80
Decreased	20	0	0	10
No change	0	100	0	10
Livestock population				
Increased	40	0	25	30
Decreased	60	100	75	70
No change	0	0	0	0
Human population				
Increased	100	100	100	100
Decreased	0	0	0	0
No change	0	0	0	0
Community savings				
Increased	60	100	50	60
Decreased	40	0	50	40
No change	0	0	0	0
Expenditure on medical care				
Increased	80	100	100	90
Decreased	20	0	0	10
No change	0	0	0	0
Vegetables in the diet				
Increased	80	100	100	90
Decreased	20	0	0	10
No change	0	0	0	0
Roots/Tubers in the diet				
Increased	60	100	50	60
Decreased	40	0	50	40
No change	0	0	0	0
School attendance				
Increased	100	100	75	90
Decreased	0	0	25	10
No change	0	0	0	0
Use of labor-sharing				
Increased	40	0	0	20
Decreased	60	100	75	70
No change	0	0	25	10
Use of labor-saving technologies				
Increased	20	100	50	40
Decreased	80	0	0	40
No change	0	0	50	20
Non-farm activities				
Increased	60	100	25	50
Decreased	40	0	75	50
No change	0	0	0	0
Number of sick people				
Increased	60	100	75	70
Decreased	40	0	25	30
No change	0	0	0	0

