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

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

A.D. Alene, M. Khonje, J. Mwalughali, C. Chafuwa, A. Longwe, R. Khataza, E. Kapalasa, I. Madzorera, T. Gondwe, M. Mussagy, P. Ntawuruhunga, S. Boahen, B. Maziya-Dixon, and D. Chikoye

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

Baseline Report

The International Institute of Tropical Agriculture (IITA)
Southern Africa

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Cover picture: Stakeholders assessing the performance of different cassava varieties during a field day at a PVS plot at Matuta Village, Chigodi EPA, Lilongwe District.

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Acronyms and abbreviations

ADMARC	Agricultural Development and Marketing Corporation of Malawi
ARV	antiretroviral drugs
CSIACEDCA	Civil Society Input to the Africa Commission on Effective Development Cooperation with Africa
DARS	Department of Agricultural Research Services
DID	Difference-in-Difference
FANRPAN	Food Agriculture and Natural Resource Policy Analysis Network
FAO	Food and Agriculture Organization
GDP	gross domestic product
GoM	Government of Malawi
HIV/AIDS	human immunodeficiency virus/acquired immune deficiency syndrome
IFAD	International Fund for International Development
IITA	International Institute of Tropical Agriculture
IM&E	impact monitoring and evaluation
MCCI	Malawi Confederation of Chambers of Commerce
MIRACLE	Making Agricultural Innovations Work for Smallholder Farmers Affected by HIV/AIDS in Southern Africa
MoAFS	Ministry of Agriculture and Food Security
MRFC	Malawi Rural Finance Company
MSB	Malawi Savings Bank
NASSPA	National Smallholder Seed Producers Association
NGO	nongovernmental organization
NSO	National Statistics Office
PLWHA	People Living With HIV and AIDS
ROSCA	Rotating Savings and Credit Associations
SAP	Structural Adjustment Program
SSA	sub-Saharan Africa
TLU	tropical livestock units
USAID	United States Agency for International Development
WTO	World Trade Organization

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 poor health and under-nutrition in developing countries. Poverty is responsible for poor health and under-nutrition, 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 to pull millions out of poverty, thus overcoming under-nutrition 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 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.

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 MIRACLE project adds value to the existing initiatives by improving linkages between agriculture, nutrition, and health. As one of the countries highly dependent on agriculture and affected by HIV/AIDS in southern Africa, Malawi is one of the target countries for the MIRACLE project. Globally, Malawi is ranked eighth in terms of HIV/AIDS prevalence. Women are particularly disproportionately affected by the epidemic (Simwaka et al. 2011). There is a consensus that among the adverse impacts of HIV/AIDS on smallholder agriculture is a reduction in crop production (Asingwire and Kyomuhendo 2003; Yamano and Jayne 2004; Thangata et al. 2007) and ultimately food and nutrition insecurity. This is mainly due to loss of labor resulting from HIV/AIDS morbidity and mortality.

This report presents the results of the baseline survey of households and communities conducted in six target districts in Malawi in January and February 2012. 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, 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 HIV/AIDS in Malawi. 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 and demographic characteristics as well as resource endowments of the households, whereas the fifth section summarizes the 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 in the study area. 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 that 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 HIV/AIDS In Malawi

Agriculture in Malawi

Growth in agriculture is twice as effective in reducing poverty in sub-Saharan Africa as growth in other sectors. The agricultural sector employs 65 percent of the labor force and generates about 32 percent of the total GDP in the region (CSIACEDCA 2008). Eighty percent of the rural population depends on agriculture for their livelihoods (Calzadilla et al. 2009). In addition to contributing directly to food security, it supports poverty reduction at both micro and macro levels of the economy. However, many of the least developed countries, particularly in sub-Saharan Africa and in marginal production environments across the developing world, continue to experience low or stagnant agricultural productivity, rising food deficits, and high levels of hunger and poverty (Wik et al. 2008).

In Malawi, agriculture remains the backbone of the economy. In 2010, it was stated by the Malawi Confederation of Chambers of Commerce (MCCI) that agriculture is the mainstay of the economy, contributing about 34 percent to economic growth and accounts for more than 80 percent of the country's export earnings.

The agricultural sector is subdivided into large-scale estate farmers and smallholder farmers. Malawi's agriculture is predominantly smallholder agriculture, accounting for 78 percent of the total cultivated land and generating 75 percent of the total agricultural output. The smallholder subsector contributes more than 70 percent while the large-scale estate subsector contributes less than 30 percent to GDP from the agricultural sector. With the growing population, insufficient landholding has become a characteristic of smallholder farmers. The Malawi Poverty and Vulnerability Assessment report (GoM 2006) indicated that over 90 percent of the total agricultural value-added comes from about 1.8 million smallholders who own on average less than 1 ha of land. Land pressure is particularly intense in the southern region where the per capita average landholding size can be as low as 0.1 ha, whereas the average per capita landholding size in the other regions is 0.2 ha and more.

The main crops grown by smallholder farmers include maize, tobacco, pulses, groundnut, cotton, sorghum, millet, and rice. Except for tobacco, traditional export crops such as tea, sugar, and coffee are mainly grown by large-scale estate farmers. The dominant crop is maize, which is the main staple food grown and consumed by the majority of the population. Smallholder farmers grow maize primarily for subsistence, and any surplus is sold for income. Figure 1 summarizes the trends in yield of selected crops in Malawi. Over the years, the yield of maize has been very high (average tonnes) compared to that of other crops. However, there have been some fluctuations. This has been a matter of concern to the country as these fluctuations have sometimes negatively affected the food security situation and performance of the economy as a whole (USAID 2007).

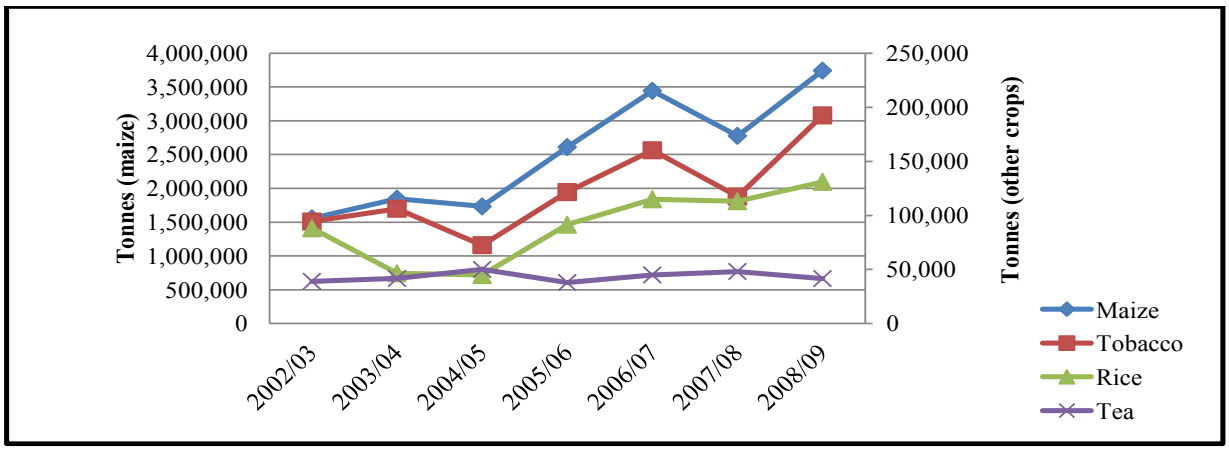

Figure 1. Production of selected agricultural products in Malawi (2002/2009)[1].

Source: World Trade Organization (2010).

[1]Maize is plotted on the left axis while tobacco, rice, and tea are plotted on the right axis.

HIV/AIDS, among other factors, has been found to worsen the situation as it erodes food security, increases malnutrition, damages rural livelihoods, and exacerbates poverty in the country. The impacts of HIV/AIDS on the agricultural sector include reduced farm productivity due to an acute shortage of household and farm labor, a substantial reduction in the cultivated area, delays in farm operations, a decline in livestock production, and a loss of agricultural knowledge and management skills which result in an increased vulnerability to food shortages and poverty. HIV infection creates a vicious cycle, limiting productivity and exacerbating malnutrition and food insecurity. In turn, malnutrition and food insecurity synergistically limit a person's ability to cope with the disease and worsen its impact (Nkambule 2011).

HIV/AIDS in Malawi

HIV/AIDS is no longer perceived as just a health issue. It was designated as a cross-cutting issue, and the Malawi National HIV/AIDS Strategic Framework 2000–2004 called for "an expanded, multi-sectoral national response to the epidemic" (Ngwira et al. 2001). By the end of 2007, there were 930,000 people living with HIV/AIDS in Malawi, of which 490,000 were women and 68,000 were children. Around 68,000 AIDS-related deaths occurred and 560,000 children were orphaned after AIDS-related deaths (UNAIDS 2009). According to the 2010 Malawi Demographic and Health Survey (NSO/ICF 2011), the prevalence rate of HIV/AIDS varies across different socioeconomic groups. The prevalence rate among the population aged 15–49 years is 11 percent with that of women being higher (13 percent) than that of men (8.1 percent). The southern region has the highest prevalence rate (15 percent) for the same population. This is about twice that of the central region (8 percent) and the northern region (7 percent).

In its earlier stages, the HIV/AIDS epidemic was predominantly an urban problem. Now the pandemic has rapidly moved into the rural areas, where a significant portion of the population is among the least privileged and bears the greatest burden of its impact. The prevalence rate for men and women aged 15–49 years in urban areas is 17 percent, about twice that of the same population in rural areas (8.9 percent). As the majority of the population is rural and their livelihood depends largely on agriculture, HIV/AIDS has affected the agricultural sector in Malawi.

Food security, nutrition, and HIV/AIDS

According to Ngwira et al. (2001), the impact of HIV/AIDS on household welfare starts at the physiological level. HIV/AIDS creates a vicious cycle by weakening the immune system, nutrient intake, absorption, and use. This increases the susceptibility to opportunistic infections such as malaria and tuberculosis that eventually hinder the individual from undertaking productive activities such as agricultural work. As a result, food production and household income decrease, leading to low nutritional levels and worsening the HIV infection. Adults living with HIV have 10–30 percent higher energy requirements than a healthy adult without HIV, and children living with HIV have requirements 50–100 percent higher than normal. Good nutrition and sufficient food are therefore essential in keeping people living with HIV/AIDS healthy for a longer time (UNAIDS 2008).

The household labor pool for both commercial and subsistence agriculture is also affected. The deaths of productive adults aged 15–49 years due to HIV/AIDS, reduce productivity and caring capacity. Family members spend most of their time taking care of the sick and have little time to focus on agricultural pursuits. In assessing the impact of HIV/AIDS on improved fallow adoption and rural household food security in Malawi, Thangata et al. (2007) found that the impact on food production depends on the gender of the patient. Field labor is reduced when the male household head is sick and eventually dies, since other household members have to take care of him. Food and cash crop production lessens, bringing about household food insecurity. Loss of labor also results in some households shifting to less labor-intensive crops which are also less nutritious, and sometimes leaving the land fallow or abandoned (Arrehag et al. 2006).

The cost of care for people living with HIV/AIDS (PLWHA) is considerably higher than that of most common diseases as they require good nutrition to stay healthy, and this has to be sustained in the long run. They also require regular treatment for the opportunistic infections that come with the disease. In addition, when adults in their productive ages (15–49 years) are infected and labor supply is reduced, the households resort to hiring farm labor for work which they could have undertaken on their own if they had been healthy. Cash income and labor are partly diverted to cope with and/or compensate for the effect of HIV/AIDS, leaving less labor for farm and off-farm activities as well as reducing the amount of money available to the household. Where households own livestock and there is no cash income, cattle may be sold to pay for medical and funeral expenses (Haslwimmer 1994). Deaths due to HIV/AIDS represent an added strain on grandparents and extended families that have to look after the orphans left behind. Thus HIV/AIDS brings about economic losses to the household.

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 six districts where the MIRACLE project is being implemented. These are Lilongwe, Dowa, Kasungu, and Dedza in the central region, Nkhata-bay in the northern region, and Blantyre in the southern region (Fig. 2). The study was based on a survey of 600 households distributed across the target districts (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 Extension Planning Areas (EPAs) during the selection of project sites. The sample size was calculated as follows:

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)

The sample size was determined based on a response rate of 95 percent to account for a possible non-response rate of 5 percent and a design effect of 2 to account for multi-stage clustering in the selection of the target areas of the project. This resulted in a sample of 600 households allocated proportionally across the study districts, with the sizes of the EPAs 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 EPA through a census undertaken prior to the commencement of the actual survey. As all communities and households in a target EPA will not be likely to be reached through the MIRACLE project in just three years, each such EPA is expected to have both target and non-target communities and households.

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

District	Extension Planning Area (EPA)	Number of households in EPA (nHH)	Number of households as a proportion of all households (pHH= nHH/ ΣnHH)	Sample households (pHH*ΣnHH)
Blantyre	Lirangwe	23,600	0.18	107
Dedza	Kaphuka	16,923	0.13	77
Dowa	Nachisaka	20,590	0.16	93
Kasungu	Kululuma	31,078	0.23	141
Lilongwe	Chitekwere	24,270	0.18	110
Nkhata-bay	Chikwina	7,264	0.05	33
Nkhata-bay	Chintheche	8,816	0.07	40
Total		132,541	1.00	600

Detailed household-level data collected 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 the livelihoods 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.

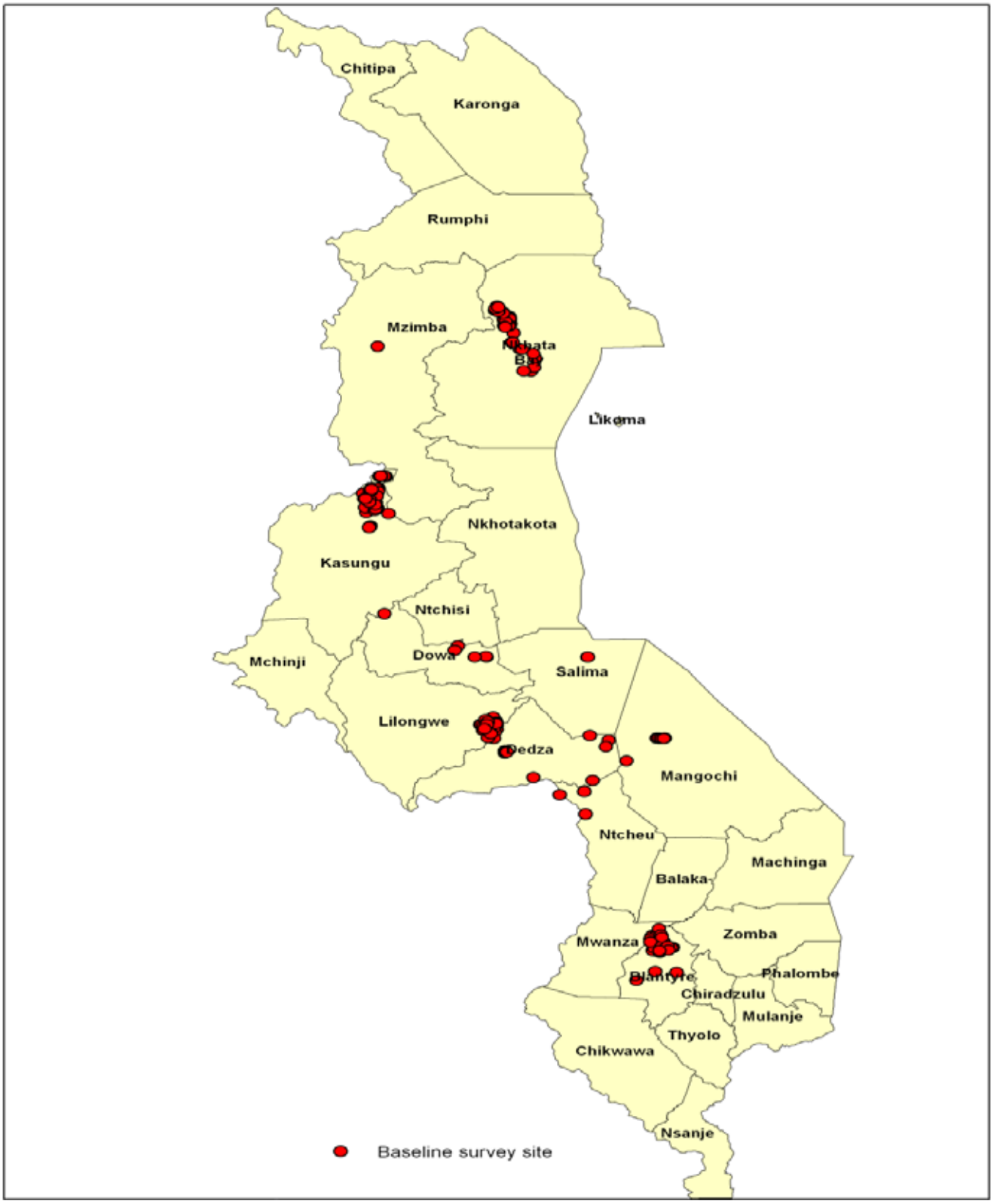

Figure 2. Baseline survey sites in Malawi.

Analytical framework

The MIRACLE project is geographically wide and the beneficiaries have diverse characteristics. It is therefore plausible to evaluate the project's 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. 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 groups 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.

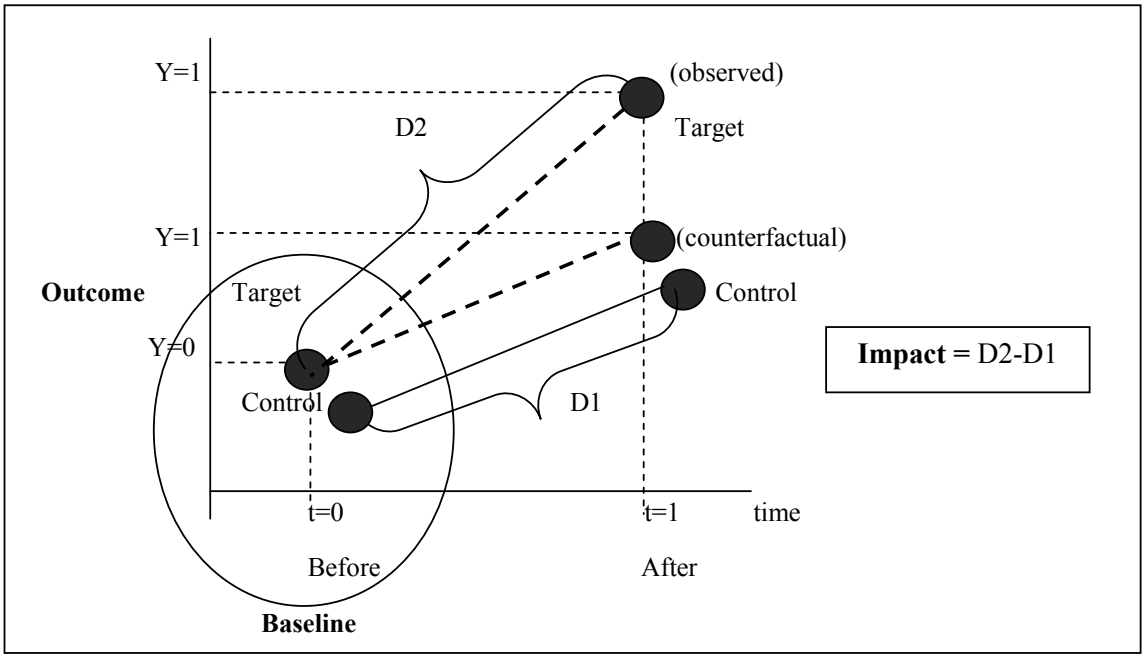

Figure 3. Difference-in-Difference impact evaluation method.

The information captured in this study will therefore be used as a benchmark for subsequent assessments of efficacy 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 of and constraints to the 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 technological solutions, will guide investments in research, institutional innovations, and complementary public goods for income gains and poverty reduction.

Early studies of adoption and impact 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 research and

extension in major staple crops. 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 the 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 logistic regression model of determinants and correlates of poverty

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.

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:

where is the vector of unknown parameters to be estimated and is the vector of explanatory variables. The error term 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 .

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 MK18,615/capita/year ($1.25/capita/day). It is related to the latent variable as follows:

Y= 1 if Y* > 0 (poor household)

= 0 otherwise (non-poor household)…..…… (3)

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

where is the cumulative distribution of the error term, with the assumption that it has a symmetric distribution. The value of 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

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 logistic regression model can be expressed as

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 the 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 given by

- Limited access to land, low education levels, poor health status, limited off-farm employment, and lack of access to credit are seen as the principal causes of poverty in Malawi (GoM 2002). However, some of these causes are also the consequences of poverty, e.g., poor education and ill-health (Bwalya et al. 2004). Based on the Malawi Poverty and Vulnerability Assessment report, some of the possible determinants of poverty in Malawi can be categorized broadly as follows:

Demographic: Indicators of household size and structure are important in that they show a possible correlation between the level of poverty and household composition. Age and sex of the household head, dependency ratio, and household size were included in this analysis. It is hypothesized that household poverty is positively correlated with the age of the household head, dependency ratio, household size, and female household headship. Mukherjee and Benson (1998) reported that households headed by older individuals in rural areas, holding other variables constant, will tend to be poorer than those headed by younger individuals. Similarly, poor households tend to be larger than non-poor households, have higher dependency ratios, and a greater number of children (GoM 2006). Furthermore, the economic vulnerability of poor African women flows mostly from their weakly defined property rights to major productive assets, such as land or livestock, in countries where a combination of customs and laws restrict their ability to own and manage land (McFerson 2010). It is therefore expected that female headship will positively influence household poverty.

- Education: This is captured by the household head's total number of years in school. Poor households tend to be headed by persons with little or no education (GoM 2006). A negative correlation is expected between education and poverty.
- Employment and occupation: The share of off-farm income in total household income captures the effects of the distribution of different sorts of occupation at the household level. In an analysis of the livelihood strategies 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 total household income would reduce the household's probability of being poor. We therefore expect a negative relationship between poverty and the share of off-farm income in total household income.

Agriculture: In a study 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. In addition, agricultural productivity directly affects household consumption and hence total poverty and welfare. Variables, such as the total cultivated land held by the household, estimated value of farm assets, and household livestock ownership, were included to capture the link between agriculture and poverty. In any country as highly agricultural as Malawi, ownership of land will play an important role in determining the levels of poverty. A negative relationship is therefore hypothesized between agriculture and the household poverty status.

- Access to public support services: This is captured by household's access to credit and extension services. 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 a critical means of addressing rural poverty, since such institutions have a mandate to transfer technology, support learning, assist farmers in problem-solving, and enable them to become more actively embedded in the agricultural knowledge and information system (Christopoulos and Kidd 2000). Access to credit and extension services are therefore hypothesized to have a negative correlation with poverty.
- HIV/AIDS: In a study to simulate the impact of HIV/AIDS on poverty and inequality in selected sub-Saharan countries, Salinas and Haacker (2009) found that the epidemic lowers average income and increases poverty. Proxy variables were therefore used in this study to capture the influence of HIV/AIDS on household poverty. Variables included in the analysis are whether or not the household keeps orphans and sick people. Orphans are one of the groups most affected by poverty. Most of them live with grandparents who are in most cases single and resource-constrained, thereby being more vulnerable to poverty. It is worth noting that these proxies may over/underestimate the presence of HIV/AIDS in

households, given that it is impossible to ascertain from the survey if someone is infected or has died of AIDS, due to the sensitivity of that information

- Location fixed effects variables: District dummies are included to capture fixed differences in agricultural production potentials among the study districts.

Socioeconomic characteristics of the sample households

Household characteristics

Household-specific characteristics comprise the demographic descriptors of a representative individual— in this case the household head (e.g., age, gender, number of years of schooling) as well as broadly defined household-level characteristics (e.g., household size and dependency ratio).These play a key role in determining the livelihoods of rural households. Table 2 presents the socioeconomic characteristics of the sample households in Malawi. The results show that 22 percent of the sample households were female-headed, with Nkhata-bay having the highest percentage (38 percent) and Dowa having the lowest (11 percent). This is lower than the national average of 28 percent, portraying the incidence of female-headed households as reported in the Malawi Demographic and Health Survey 2010 (NSO/ICF 2011). However, both studies are consistent on the fact that households in Malawi are predominantly male-headed. Table 2 indicates that 13 percent of the sampled household heads were widowed. As with the female headship of the household, the percentage of widows is highest in Nkhata-bay (32 percent) and lowest in Dowa (4 percent).

The average size of households in the study area is five members. This is consistent with the national average of 4.6 persons per household (NSO/ICF 2011). The average age of the household head is 44 years, and there is little variation across the sampled districts. Of the sampled households, 16 percent support orphans[2], with the highest incidence being in the northern region district of Nkhata-bay (40 percent). The dependency ratio is defined as the ratio of the number of dependent persons (children below 15 years and adults over 64 years of age) to the working-age population (15–64 years) in the population. By relating the group of the population most likely to be economically dependent (net consumers) to the group most likely to be economically active (net producers), the ratio highlights the potential dependency burden on workers. A dependency ratio of 1.1 in the study area indicates that for every 10 workers, there are 11 persons dependent on them. This means that there is a burden on the economically active population to support children and the elderly in the population. This figure is consistent with the national dependency ratio as reported by NSO (2005).

Table 2. Socioeconomic characteristics of the sample households in Malawi.

	District						
Characteristics	Blantyre (n = 92)	Dedza (n = 78)	Dowa (n = 93)	Kasungu (n = 140)	Lilongwe (n = 114)	Nkhata-bay (n = 74)	All (n = 591)
Household demography							
Male-headed households (%)	75	72	89	87	75	62	78
Female-headed households (%)	25	28	11	13	25	38	22
Household size	6	5	5	5	5	7	5
Dependency ratio (all)	1.1	1.0	1.0	1.0	1.1	1.3	1.1
Age of the household head (years)	47	42	42	44	42	49	44
Widowed household heads (%)	8	17	4	11	12	32	13
Households with orphans (%)	20	6	4	20	11	40	16
Education of household head							
Years of schooling	5	3	12	7	5	6	7
Illiterate (%)	26	53	32	11	32	12	26
Asset ownership							
Total cultivated land (ha)	1.5	1.0	1.7	1.8	1.1	1.6	1.5
Livestock ownership (TLU1)	1.0	1.1	1.2	1.3	1.1	0.5	1.0
Hoe (%)	100	100	100	100	100	100	100
Radio (%)	66	36	51	47	52	51	51
Bicycle (%)	59	35	42	36	44	24	40
Mobile phone (%)	64	28	31	36	40	74	44
TV (%)	13	1	3	4	7	16	7
Irrigation pump (%)	14	1	2	4	7	1	5
House roofed with iron sheets (%)	39	5	15	20	13	46	21
House with cemented floor (%)	29	4	10	17	8	40	16

[2]Under 18 years of age.

Literacy is the ability to read and write. It is crucial for exploring social and economic opportunities during an individual's lifetime. Program planners therefore use literacy statistics to put health and other messages across to men and women of different subgroups (NSO/ICF 2011). The average number of years when the household head attended school is 6.6 years and 26 percent of the household heads are illiterate in the sampled households. At the district level, there is some variation in these indicators. Household heads in Dowa attended the greatest number of school years (12 years). Dedza has the lowest number of school years attended by the household head (2.9) as well as the highest percentage of illiterate household heads.

Productive assets

Land

Malawi has a land area of approximately 9.4 million ha; 28 percent is in the northern region, 38 percent is in the central region, and the remaining 34 percent is in the southern region. Forty percent of the total land is suitable for agriculture (Reynolds 2006). The 1992–1993 national sample survey of agriculture indicated that 78 percent of households in the smallholder subsector owned or controlled less than 1 ha of land (FANRPAN 2003). However, the average cultivated landholding size for the sampled households is higher than the national average (1.5 ha). This can be attributed to the fact that only about 15 percent of the sampled households were located in the southern region where land pressure is particularly high. Therefore the average for the sampled households is pulled upwards because of the large landholding sizes in the central and northern regions. The results also indicate that households in Kasungu have the largest cultivated landholdings (1.8 ha) while those in Dedza have the smallest (1.0 ha).

Livestock ownership

The livestock industry in Malawi contributes about 8 percent to the total GDP and about 36 percent to the value of total agricultural products. About 1.2 million farm families own one or more of various types of livestock; 15 percent of all the livestock owners are commercial and the rest are subsistence (MoAFS 2006). Livestock can provide income, quality food, fuel, draught power, building material, and fertilizer, thus contributing to households' livelihood, food security, and nutrition (FAO 2009). To describe livestock numbers of various species as a single figure that expresses the total amount of livestock present—irrespective of the specific composition— there is the need to use a common unit of measurement. The concept of Tropical Livestock Units (TLU) provides a convenient method for quantifying a wide range of different livestock types and sizes in a standardized manner.

The Malawi Demographic and Health Survey reported that about 60 percent of the households in Malawi own farm animals (NSO/ICF 2011). The study on Rural Income Generating Activities by FAO (2009) found that the average livestock holdings in 2004 tended to be as small as 0.3 TLU per household in Malawi. Table 2 shows that in the study area, the average TLU per household is higher than the national average (1.0). Households from Kasungu district have the largest value of livestock (1.3 units) and households from Nkhata-bay have the smallest value of livestock, with 0.5 TLU per household.

Household assets

The availability of durable consumer goods is a good indicator of a household's socioeconomic status. In addition, particular goods have particular benefits to the household. For instance, owning or having access to a radio or television exposes the household to innovative information while a means of transport, such as a bicycle, provide better access to many services within and away from the local area.

Data were collected on the roofing and flooring material of the households' dwelling areas. Such information is important as it may influence environmental conditions that have a direct bearing on the members' health and

welfare. Only 16 percent of the households have houses with floors made of cement. This is lower than the national proportion of about 23 percent as reported in the Malawi Health and Demographic Survey (NSO/ICF 2011). Similarly, a small proportion of the households (21 percent) owned houses roofed with iron sheets.

Study results show that there is universal ownership of hoes, indicating that all the sampled households undertake some form of agricultural activities. This emphasizes the importance of agriculture to the livelihoods of households in Malawi. This is consistent with the results from the Integrated Household Survey (NSO 2005) which showed that ownership of hoes was the highest compared with all other household assets. Irrigation pumps, however, were owned by a very small proportion of the households (5 percent).

About half of the sampled households (51 percent) owned radios, with the highest proportion found in Blantyre (66 percent) and the lowest in Dedza (36 percent). Across all the sampled districts, there is, however, very little variation in the ownership of radios. Bicycles are a common means of transport for households. Forty percent of the households in the study area own a bicycle, with the highest being in Blantyre (56 percent) and the lowest in Nkhata-bay (24 percent).

A very small proportion of households own a television set. NSO (2005) found that only 3.74 percent of the households in Malawi own a television set. Although the results indicate that a slightly higher proportion of the study households own a television set (7 percent), the figure is still considerably low compared with the number of those that own radios. This could be attributed to affordability and thus to necessity. Mobile phones are rapidly becoming an important mode of communication and information sharing. Of the sampled households, 44 percent own a mobile phone. As with bicycles, there are more households in Nkhata-bay (74 percent) that own a mobile phone and the fewest are in Dedza (28 percent).

Crop Production and Marketing

This section describes the crop production and marketing practices of the households, focusing on their cropping patterns and market participation. The reference period for the cropping season covered during the survey period is that of 2010–2011.

Cropping patterns

As the majority of the active population aged 15 years and above in Malawi is classified as subsistence farmers, the analysis of cropping patterns is crucial in advising on policies aimed at increasing agricultural productivity at the household level as well as national levels. Table 3 summarizes the proportion of households growing major crops. Since Malawi is a predominantly maize-growing nation, maize is grown by almost all the households in the study. This is consistent with the national proportion of 97 percent of households growing maize (NSO 2005). This trend is evident across all the sampled districts, with all households from Blantyre, Dowa, Kasungu, and Dedza growing maize. Maize is the main staple food, grown and consumed by the majority of the population. Smallholder farmers in Malawi grow the crop primarily for subsistence; any surplus is sold for income.

Table 3. Proportion of households that produced the major crops in Malawi (%).

	District						
Crop	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Maize	100	100	100	100	99	99	100
Groundnut	93	95	93	96	95	65	91
Sweet potato	49	67	82	97	43	86	73
Soybean	50	100	97	98	91	71	95
Cassava	61	0	25	67	8	99	51
Cowpea	78	79	35	100	66	67	69
Tobacco	100	100	94	95	93	100	95
Rice	21	0	0	5	0	55	16

Despite the consistency in maize production across the districts, there are some variations in the proportion of households growing other major crops, such as groundnut, cowpea, sweetpotato, soybean, cassava, tobacco, and rice. Groundnut (91 percent) and soybean (95 percent) are the major grain legumes that are most frequently grown in the study area. The central region districts of Lilongwe, Kasungu, and Dedza have the highest proportions of households growing groundnut. This is so since the Lilongwe–Kasungu plains are among the leading groundnut-producing areas in Malawi, along with the Mzimba-Henga valley plains, and the Phalombe plains.

About three-quarters of the sampled households grow sweetpotato (73 percent). Fifty-one percent grow cassava, with Nkhata-bay having the highest proportion of households (99 percent) growing the crop. None of the sampled households in Dedza grew cassava. Cowpea is grown by 69 percent and tobacco by 95 percent of the sampled households. Since the liberalization of burley tobacco to smallholders, many farming households have adopted tobacco production. Rice is the crop least often grown in the study area, being grown by only 16 percent of the households. Fifty-five percent of the households in Nkhata-bay grow rice; households in the central region districts of Dowa, Dedza, and Lilongwe do not grow it at all.

Although there are no substantial differences in the proportion of households growing the major food crops by gender of the household head in the study area, more male-headed households grow maize (87 percent) and cassava (9 percent) than female-headed households. Sweetpotato, on the other hand, is grown by more

female-headed households (3 percent) compared with 1 percent of male-headed households. These results (Fig. 4) are consistent with those reported by NSO (2005), indicating similar trends in the production of maize, cassava, and sweetpotato by gender.

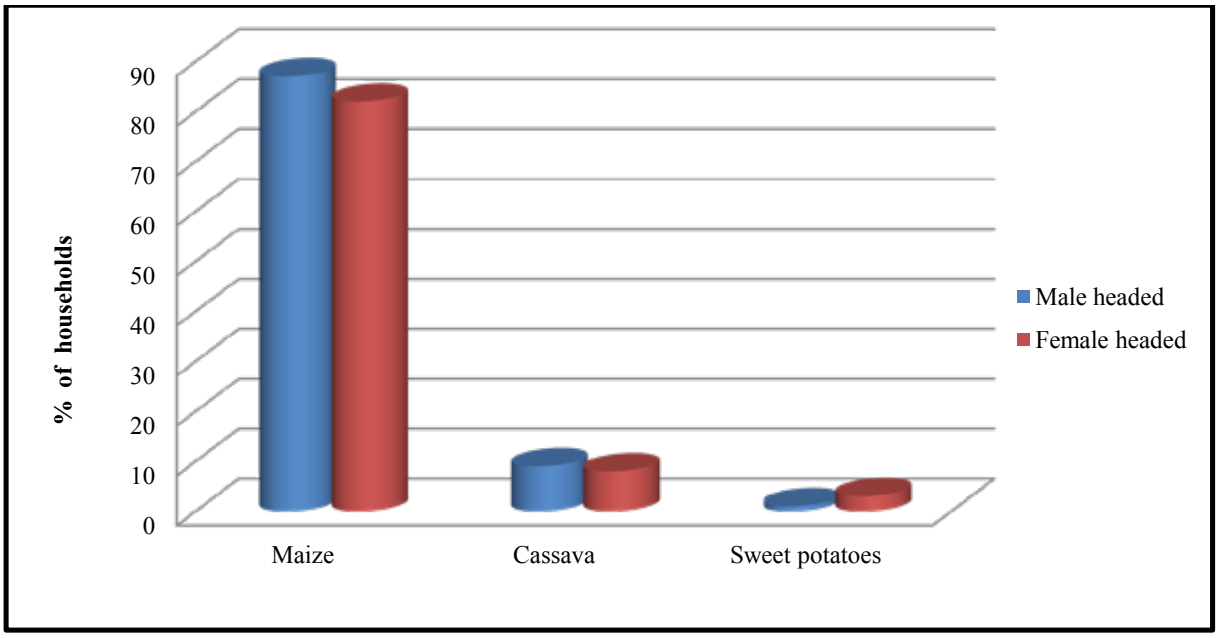

Figure 4. Major food crops grown by the sample households in Malawi.

Of the major cash crops grown in the study area, male-headed households have the largest proportion growing tobacco (41 percent) compared with 13 percent of female-headed households. NSO (2005) attributed this to the labor-intensive nature of tobacco production. As indicated (Fig. 5), groundnut is also grown in more male-headed households (11 percent) than in female-headed households (9 percent).

Soybean, on the other hand, is grown by more female-headed households (52 percent) than male-headed households (11 percent). Similar results were reported by Coulibaly et al. (2010) who found that soybean is the third most important crop, next to maize and groundnut, especially among female-headed households in Malawi. They also found it to be the most important source of cash income, accounting for one-third of the total cash income for female-headed households whereas male-headed households rely on tobacco.

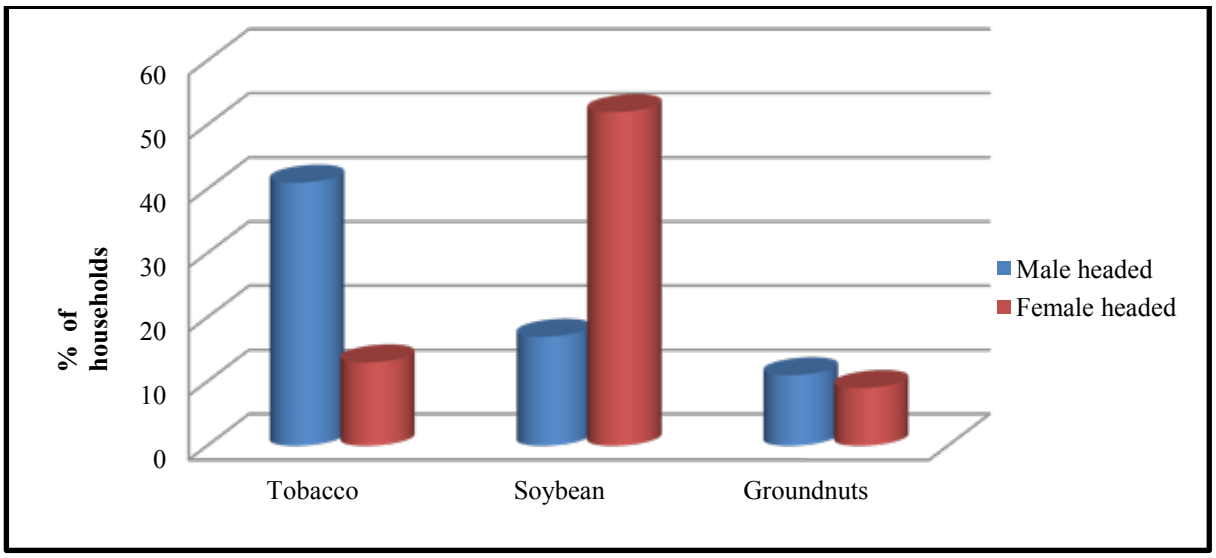

Figure 5. Major cash crops grown by the sample households in Malawi.

Table 4 presents the proportion of land allocated to major crops grown by the sampled households and may be used to assess the relative importance of the various crops for them. Consistent with the distribution of households growing each major crop in the study area, maize is allocated the largest share (52 percent) of the total cultivated land, followed by cowpea (32 percent). Despite being grown by 73% of the sampled households, sweetpotato is allocated the smallest share (9 percent) of the total cultivated land. Soybean is allocated 22 percent and beans 25 percent of the total cultivated land.

Table 4. Share (%) of major crops in total cultivated land in Malawi.

	District						
Crop	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Maize	76	55	51	44	59	29	52
Tobacco	13	24	19	23	16	11	20
Soybean	14	29	21	17	26	7	22
Beans	1	45	36	19	40	2	25
Cassava	35	0	3	10	2	40	16
Cowpea	52	35	9	18	27	11	32
Sweet potato	11	11	11	10	5	9	9
Groundnut	27	33	16	16	25	7	21

Results reveal that female-headed households allocated larger shares of the total cultivated land to maize, soybean, cassava, and cowpea (Table 5). It is further established that male-headed households allocated more land to tobacco and sweetpotatoes (Table 5). Maize was allocated the largest share of cultivated land (56 percent) followed by cowpea (38 percent) in female-headed households. Male-headed households, however, allocated about 51 percent of their total cultivated land to maize, followed by 29 percent to cowpea.

Table 5. Share (%) of major crops in total cultivated land by gender in Malawi.

Crops	Male- headed	Female- headed	All
Maize	51	56	52
Tobacco	21	18	20
Soybean	21	26	22
Beans	25	25	25
Cassava	14	24	16
Cowpea	29	38	32
Sweetpotato	10	7	9
Groundnut	21	21	21

Market participation

Some of the challenges facing governments in developing countries are in improving smallholder productivity and access to markets. Since 1981, Malawi has implemented several economic policy reforms under the Structural Adjustment Programs (SAPs) championed by the World Bank, mostly targeting the agricultural sector. These included the deregulation of agricultural marketing activities, removal of fertilizer subsidies, currency devaluation, liberalization of agricultural prices, and liberalization of special crop production. The liberalization of agricultural marketing was expected to provide incentives for the participation of the private sector, with consequences of competitive marketing benefiting smallholder farmers through better marketing arrangements and higher prices. However, according to Chirwa et al. (2005), the evidence from rural Malawi does suggest that smallholder farmers, particularly the poor, have been the main losers through unfair trading practices and the monopsony power of private traders, and a lack of reliable markets for agricultural produce

and inputs. Markets are not working for the poor and consequently most farmers are not benefiting from selling produce in the value chain.

Crop market participation

Smallholder farmers in Malawi depend on agricultural production for their livelihoods. Produce is therefore either consumed or sold for income. As indicated in Table 6, the majority of households that grew cash crops sold their produce. Tobacco and soybean were sold by 80 percent of the households; groundnut was sold by 52 percent. This indicates that tobacco, soybean, and groundnut are the most important cash crops grown by farmers in the study area.

Being the commercial capital, Blantyre has the highest proportion of households that sell tobacco. Despite being the most important cash crop in Malawi, there is limited scope to raise farm incomes through minimum prices as Malawi is a price-taker on the international tobacco market. In addition, farmers are penalized through an overvalued exchange rate that effectively reduces farm-gate prices (WTO 2010).

Table 6. Proportion of producers of major crops who also sold in Malawi (%).

	District						
Crops	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Tobacco	100	86	83	78	73	100	80
Soybean	0	80	91	86	78	14	80
Groundnut	57	58	46	58	62	13	52
Maize	23	17	55	50	38	43	39
Sweetpotato	13	21	33	46	13	35	29
Cassava	25	4	8	43	7	49	28
Cowpea	17	11	17	27	14	0	16
Rice	3	0	0	28	2	42	16

Groundnut and soybean were the crops least often sold by households in the northern district of Nkhata-bay. Since maize is mostly grown for subsistence, the percentage of households that sold it is lower (39 percent) than that of those selling the main cash crops. Rice as a crop is the least grown by the sampled households, and ultimately it is the crop bought by the majority of the households (82 percent) (Table 7). Cassava was bought by 47 percent of the households and sweetpotato by 29 percent. Maize is the staple food in Malawi and it was grown by almost all the households in the study area. MoAFS (2008) reported that 10 percent of Malawian maize producers are net sellers of maize, while 60 percent are net buyers. However, only 20 percent of the sampled households bought some maize. Net buyers of soybean comprise 8 percent of the sampled households and groundnut 9 percent. Two percent of the sampled households are net buyers of tobacco. Kasungu and Lilongwe are the only districts where the households bought some tobacco.

Table 7. Proportion of households that bought crops in Malawi (%).

	District						
Crops	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Rice	79	97	77	95	98	48	82
Cassava	42	89	60	33	89	4	47
Sweetpotato	62	38	20	4	56	15	29
Maize	39	31	14	14	16	15	20
Cowpea	22	21	13	0	29	0	20
Soybean	38	7	4	7	7	29	8
Groundnut	7	8	3	4	7	33	9
Tobacco	0	0	0	2	7	0	2

Some of the producers of the major crops in the study area bought and also sold their crops. This may be attributed partly to the seasonality of some crops, which thereby determines their availability and scarcity. For instance, maize is abundant during the harvesting months from April to June. For want of immediate cash, farmers may then sell their crop despite low prices on the market. During the agricultural lean period, there may be food scarcity in the households that sold their produce and so they have to buy maize for their consumption. Very few of the sampled households that grew the major crops bought and also sold their produce (5 percent for maize, 5 percent for cassava, 3 percent for soybean, and 2 percent for groundnut) (Table 8). The trend is similar across the districts, with little variation in the proportion of households buying and selling their produce.

Table 8. Proportion (%) of households that bought and sold crops in Malawi.

	District						
Crops	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Maize	3	3	5	7	6	1	5
Cassava	3	0	0	16	1	0	5
Soybean	0	5	1	4	1	0	3
Cowpea	0	0	0	0	0	0	0
Sweet otato	2	2	2	2	0	2	2
Rice	0	0	0	26	2	3	7
Groundnut	0	3	0	2	4	0	2
Tobacco	0	0	0	2	0	0	1

Self-sufficiency in maize is one of the central elements of food security in Malawi. National food security is mainly defined by the Government in terms of the people's access to maize, the main staple food. Thus, even if the total food production is above the minimum food requirement while maize supply is below the minimum food requirement, the nation is deemed to be food insecure (Chirwa and Zakeyo 2003). The nation, therefore, faces a food crisis if the production and supply of maize falls below the minimum required levels. According to WTO (2010), Malawi has been self-sufficient in maize since 2005–2006 and it even exported some of the maize produced. However, localized production shortages have been brought about by factors such as drought, acute food shortages, and high food prices occur. This translates into food and nutritional insecurity at the household level. Table 9 shows that 45 percent of the households in the study area are self-sufficient producers of maize and did not buy or sell any of the maize they produced. There is very little variation in terms of self-sufficiency in maize across the districts. Thirty-nine percent of the households did not buy or sell groundnut; 26 percent were self-sufficient in cassava.

Table 9. Self-sufficient producers of major crops in Malawi (% of households).

	District						
Crops	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Maize	41	55	36	43	53	43	45
Cassava	36	0	15	38	3	45	26
Soybean	50	18	4	12	15	43	14
Cowpea	59	47	17	55	49	67	47
Sweetpotato	24	42	47	53	29	50	42
Groundnut	35	35	46	38	34	52	39

Major buyers of crops

Smallholder farmers in Malawi face obstacles on both the production and market sides of their businesses. Yields are depressed by a lack of quality inputs, depleted soils, and outdated practices and farmers often have difficulty in finding stable markets that will offer fair prices for their crops. To create a conducive environment

and improve access to productive resources for all groups of smallholder farmers, the Government of Malawi has, since 1981, implemented reforms aiming at removing market distortions and improving productivity. A significant element of all SAP loans to which Malawi had access from 1981 to the early 1990s was to reduce the direct role of the State in providing services and ensuring an appropriate price policy to provide adequate incentives to producers and expand the role of the private sector in the marketing of smallholder crops (Bhalla et al. 2000).

Markets in Malawi favor established farmers and traders who are able to fulfill large orders. As smallholder farmers are unable to get access to regional markets directly, they often resort to selling their product at reduced prices to middlemen. More than half (68 percent) of the households in the study area reported that their crop produce is bought by rural assemblers, middlemen, or traders (see Table 10).

Table 10. Major buyers of crops in Malawi (% of households).

	District						
Buyers	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Rural assemblers/middlemen/traders	58	68	81	68	68	53	68
Consumers/other farmers	36	27	11	23	27	45	26
Government/parastatal (ADMARC)	2	3	4	5	3	1	3
Farmers' union/cooperative	2	1	1	2	1	0	1
Processors	2	1	3	1	1	1	1
NGOs	0	0	0	1	1	1	1

Only 26 percent sold to other farmers or directly to consumers. A small proportion of the sampled households (3 percent) sold their produce to the Government through the Agricultural Development and Marketing Cooperation of Malawi (ADMARC), 1 percent sold to farmers' unions and cooperatives, 1 percent sold to processors, and 1 percent sold to NGOs. These trends are consistent across all the districts in the study area.

Mode of transport for marketing

About 44 percent of the households reported that they did not use any transport for marketing as their produce was sold at the farm gate, (Table 11). This was highest in Nkhata-bay where 71 percent of the farmers indicated that they sold at the farm gate. Agricultural production is severely constrained by the lack of wheeled transport. Most farmers must carry all their farm inputs and outputs on their heads. This is not conducive to efficient farming as farmers frequently cannot carry their crops to markets in this way. In the study area, 30 percent of the farmers carry their farm produce as head loads to the market. Other modes of transport used by the farmers for marketing include carrying the produce by bicycle or motorcycle (17 percent) and using public transport (4 percent). Only 3 percent used an ox-cart; an equal proportion hired a truck to transport their produce to the market.

Table 11. Mode of transport used for marketing in Malawi (% of households).

	District						
Transport	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
None (farmgate)	49	33	44	39	41	71	44
Head load	24	30	35	29	36	22	30
Bicycle/motorcycle	23	32	11	14	19	5	17
Public transport	4	1	2	10	1	1	4
Ox-cart	1	2	3	6	0	1	3
Hired truck	0	2	6	3	2	2	3

Technology Preferences and Adoption

Farmers' preferences

Farmers' preferences and circumstances play a large role in influencing their decisions to adopt or increase the use of modern varieties. Low adoption has sometimes been attributed to the modern varieties lacking the characteristics valued by farmers and other end users. Researchers, therefore, need to understand the traits that farmers prefer in varieties in order to develop appropriate technologies and for policymakers to design and execute the most effective policies for promoting improved varieties and technologies.

The variety traits most preferred for the major crops grown in the study area are earliness of maturity, high yield, and taste (Table 12). As maize is the staple and most important crop in Malawi, it is not surprising that about half (46 percent) of the households indicated that the most preferred trait for maize is earliness, followed by high grain yield (32 percent). The most preferred traits for soybean are also high grain yield (34 percent) and earliness (27 percent). The sampled households' most preferred variety trait for cassava is taste (38 percent) and also for sweetpotato (37 percent).

Table 12. Most preferred traits for major crops in Malawi (% of households).

Trait	Crops				
	Maize	Cassava	Soybean	Cowpea	Sweet potato
Earliness of maturity	46	19	27	30	22
Yield	32	17	34	21	15
Pest and disease resistance	9	10	3	6	12
Drought tolerance	4	6	8	6	10
Taste	3	38	7	29	37
Grain/root color	2	7	19	3	4

Sources of information on improved crop varieties

For farmers to adopt new and improved crop varieties, knowledge of the varieties is a prerequisite. However, this on its own is not sufficient to ensure adoption. Table 13 shows that the majority of households in the study area (53 percent) receive information on modern varieties from extension agents. This indicates the crucial role extension services play in agricultural enhancement in Malawi.

As about half of the households in the study area owned radios, it is unsurprising that a substantial proportion (25 percent) obtained information on modern varieties through the radio or television. Other sources of such information include neighbors or other farmers (11 percent), NGOs (8 percent), farmers' cooperatives or groups (2 percent), research centers (1 percent), and seed traders or agro-dealers (1 percent). NGOs provided the information to more households in Blantyre than to any of the other study districts.

Table 13. Sources of information on modern varieties in Malawi (% of households).

	District						
Source	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Extension agents	38	50	55	64	54	55	53
Radio/TV	24	32	20	17	28	31	25
Neighbors/other farmers	7	16	18	9	12	2	11
NGOs	28	0	2	5	4	8	8
Farmers' cooperatives or groups	0	2	0	5	2	2	2
Research center	4	0	4	0	0	0	1
Seed traders/agro-dealers	0	0	2	1	0	2	1

Adoption of improved crop varieties

One of the reasons put forward as resulting in low productivity and yield is the low level of adoption of improved varieties. Crop yields in developing countries are often many times lower than those that could be achieved using readily available technologies and farming techniques, and food security can be a serious problem. Agricultural incomes and food security can depend on the farmers' adoption of these tools and techniques. However, despite bringing about significant increases in agricultural productivity and growth, there has been some variation in the extent to which households have benefited from improved varieties. Production risk is a major source of income fluctuations for rural households involved in agricultural activities, especially in developing countries. Because high yielding varieties are more profitable but also more risky, households that are unwilling to bear consumption fluctuations may decide not to adopt (Gine and Yang 2007).

In the study area, 78 percent of the households adopted improved varieties of maize (Table 14). The highest adoption rates for improved maize varieties are in Nkhata-bay (93 percent) and Blantyre (91 percent). Improved groundnut varieties are grown by 30 percent of the households. This is consistent with results found by Simtowe et al. (2011) that only 26 percent of the sampled farmers grew at least one of the improved groundnut varieties. There is a lot of variation in the adoption rates of groundnut across the districts. In Dedza, the adoption rate is 90 percent and in Dowa, none of the households adopted the improved varieties. Adoption rate for soybean is 23 percent and that of cassava is 20 percent.

Table 14. Adoption of improved varieties of major crops in Malawi (% of households).

	District						
Crops	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Maize	91	74	63	70	83	93	78
Cassava	25	4	5	27	2	55	20
Soybean	4	37	30	29	25	4	23
Cowpea	12	4	0	1	0	2	3
Sweetpotato	49	31	17	57	21	64	40
Groundnut	33	90	0	40	25	10	30

Reasons for non-adoption of improved crop varieties

New crop varieties have often been promoted in developing countries based upon superior yield vis-a-vis locally available varieties (Dalton 2003). However, farmers tend to be risk averse and therefore try to derive utility from both improved and local varieties instead of focusing only on new varieties. In addition, farmers' preferences change over time and so a newly released variety may not necessarily be superior to the varieties already existing on the ground. This may contribute to the low adoption of new and improved varieties. As indicated in Table 15, lack of seeds is the main reason for the non-adoption of improved varieties of cassava and soybean in the study area. Of the sampled households, 77 percent indicated that the lack of seeds was the reason for not growing improved varieties of cassava while 85 percent of those that did not adopt improved varieties of soybean made the same report. Similarly, households in the study area gave lack of seeds as the reason for non-adoption of modern varieties of cowpea (86 percent) and sweetpotato (83 percent). This pattern is consistent across the sampled districts.

Table 15. Reasons for non-adoption of improved varieties of major crops (% of households).

	District						
Reasons	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Maize							
Lack of seeds	33	27	37	16	39	40	29
Lack of cash for seeds	25	46	53	37	38	40	42
Lack of land	25	21	3	42	4	10	19
Local varieties are better	17	6	8	5	19	10	9
Cassava							
Lack of seeds	79	71	84	85	69	69	77
Lack of cash for seeds	4	4	4	9	4	22	6
Lack of land	4	3	0	1	1	6	2
Local varieties are better	16	22	11	4	26	3	15
Soybean							
Lack of seeds	85	76	87	90	86	83	85
Lack of cash for seeds	5	16	12	10	5	14	10
Lack of land	3	2	0	0	0	0	1
Local varieties are better	7	6	2	0	7	3	4
Cowpea							
Lack of seeds	81	84	84	92	89	87	86
Lack of cash for seeds	3	10	9	6	6	12	8
Lack of land	7	3	1	1	1	0	2
Local varieties are better	9	4	4	1	4	1	3
Sweetpotato							
Lack of seeds	70	78	84	91	86	79	83
Lack of cash for seeds	9	12	11	9	8	14	10
Lack of land	6	2	0	0	1	4	1
Local varieties are better	15	8	6	0	5	4	6

Non-adoption of maize varieties was attributed to lack of cash to buy the seeds by 42 percent of the sampled households while 29 percent indicated that they did not grow improved maize varieties because of lack of seeds. This is in line with the results from a study by Lunduka et al. (2011) who found that access to seeds influenced the adoption of modern varieties of maize. Adoption of modern varieties was high among farmers that received Government vouchers for maize seeds and/or fertilizer. Other reasons for the non-adoption of maize, cassava, and soybean among the sampled households are the lack of land and a preference for local varieties.

Poverty and Household Welfare

Household income

Household income is the aggregation of income both in cash and/or in kind that accrues from economic activities performed by household members on a regular basis. The distribution of income by source may act as an important targeting tool by policymakers. The average annual household income in the study area is US$708 per capita. This is highest in Nkhata-bay (US$1019 per capita) and lowest in Dedza (US$344 per capita).

Crop income

In Malawi, household agricultural activities are a major source of livelihood. This is especially true in rural areas where 81 percent of the active population aged 15 years and above is classified as *Mlimi* or subsistence farmer (NSO 2005). Across the sampled districts, 95 percent of the households engage in farming as the primary occupation.

In this study, the gross value of production measures the total value of output from agriculture per unit of land. It was compiled by multiplying gross production in physical terms by output prices at prevailing market prices and dividing it by the amount of land used for agricultural activities. Thus, the value of production measures production in monetary terms at the market price level/ha. The gross value of agricultural production is essentially an ex-farm value of production estimate and, as such, does not include any multiplier effects associated with agriculture—including downstream processing and manufacturing. Results indicate that households in Nkhata-bay had the highest gross value of production of US$1075/ha. There is substantial variation across the districts, with Dedza having the lowest gross value of production of US$335/ha. This could be attributed to differences in productivity as well as to differences in input and output prices. The average gross value of production for all the sampled districts is US$637/ha.

To determine the net returns from production accruing to the farmers, costs (both fixed and variable) have to be incorporated. These include the monetary values of all inputs of production used, such as seeds, fertilizer, manure, purchased chemicals, and both hired and family labor. As compared to the gross value of production, there is slightly less variation in the net returns across the districts. Although Nkhata-bay still has the highest net returns/ha, the difference from the gross value of production is substantial in contrast to the differences in the other districts. This means the cost of production is high in Nkhata-bay. The average net returns for the sampled districts is US$411/ha.

Off-farm activities and income

Diversification of household activities is a key factor for household food security. Farm households diversify their income sources by working off the farm. This is a risk management strategy that is used by farm households in both developed and developing countries. Income diversification via off-farm work is associated with higher incomes and food consumption (Chang and Mishra 2008). Diversified households are said to be more likely to enjoy higher flexibility and resilience capacity than households that are completely dependent on agriculture. Furthermore, the perceived advantages of livelihoods diversification are increasingly becoming important in the light of reiterated environmental, economic, and political shocks affecting the rural areas of developing countries (Simtowe 2009). Although there is a widespread traditional image that farm households in developing countries focus on farming and undertake very little rural non-farm activities, rural non-farm income is also an important resource for farm and other rural households, including the landless poor and rural town residents (FAO 1998).

Table 16. Income strategies and outcomes in Malawi.

	District						
Strategies/Outcomes	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Farming as primary occupation (%)	92	95	95	93	91	90	95
Annual household income (US$/capita)	401	344	1000	853	586	1019	708
Gross value of production (US$/ha)	366	335	819	727	534	1075	637
Net returns (US$/ha)	257	266	470	352	465	706	411
Crop income share in total income (%)	61	66	74	66	62	65	66
Livestock income share in total income (%)	5	3	4	7	2	6	4
Off-farm income share in total income (%)	34	31	22	27	36	29	30
Off-farm employment (%)	86	78	81	82	77	79	81
Artisan/handcraft	11	12	6	14	5	5	11
Unskilled wage labor (e.g., daily laborer)	45	22	43	21	30	18	25
Skilled wage labor (e.g., carpentry)	9	14	9	13	18	14	14
Petty trade (e.g., retail shop, vending)	25	40	35	41	36	45	36
Drought relief	2	0	2	2	0	1	1
Food for work	4	0	0	2	0	4	2
Remittances	4	12	5	7	11	13	11

Rural non-farm income refers to the earned and unearned income received by rural people from non-agricultural activities. The most common sources of this income include remittances and non-farm activities based in rural areas. In a study to examine the options for improving household food security in southern Malawi, Anderson (2002) found that households with more access to income generating activities or access to higher paying work are more food secure than households who do not have these benefits. This is so since in Malawi, farms are not large enough for households to be food secure from subsistence farming alone.

Employment is one of the main sources of income for most people and therefore the statistics on employment and its related statistics are major factors in the formulation and evaluation of policies that affect the income generation, poverty reduction, and income situation of the working population. According to NSO/ICF (2011), national employment rates are 56 percent for women and 82 percent for men. Table 16 summarizes the sample households' engagement in off-farm employment and various income-generating activities. In the study area, most of the households (81 percent) are employed off-farm. This implies that the majority of the sampled households complement their income from farming with income from off-farm employment. Being the commercial capital, Blantyre has the highest proportion of households that have off-farm employment (86 percent). Other sources of non-farm income include petty trade (e.g., retail shop and vending) undertaken by 36 percent of the households, unskilled wage labor (*ganyu*) involving 25 percent of the households, skilled wage labor, artisan/handcraft, remittances, and public works programs, such as Food for Work and Drought Relief.

Income shares

Farming is the most important source of income for the households in the study area. Crop income accounts for 66 percent of the total household income (Fig. 6). Livestock, on the other hand, provide the smallest share to the total household income. Crop income, therefore, plays a very important role in the livelihoods of the sampled households and this is evident across all the districts.

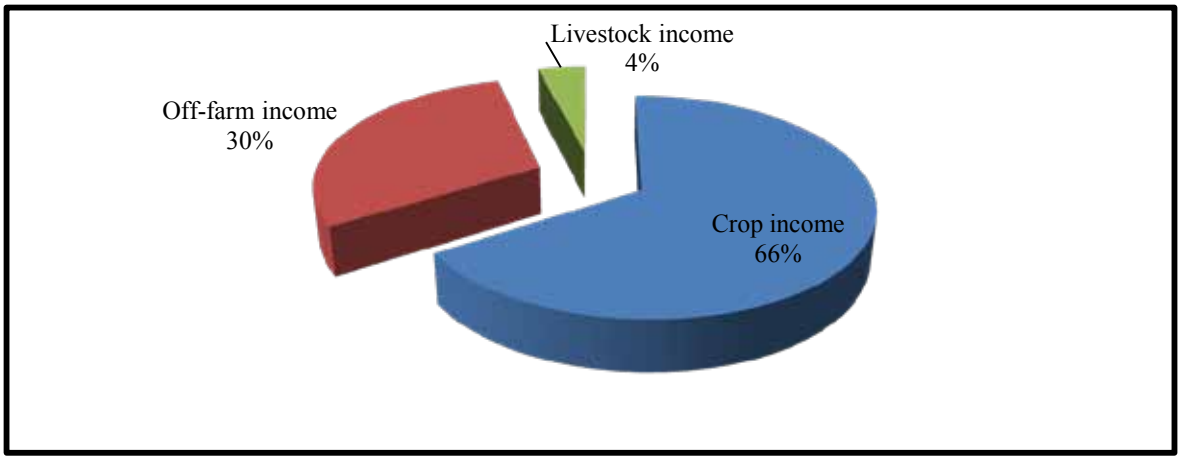

Figure 6. Household income shares in Malawi.

Poverty profile

Poverty is a multidimensional concept encompassing numerous aspects of well-being. The World Bank defines poverty as “the inability to retain a minimal standard of living, measured in terms of basic consumption needs or some income required for satisfying them”. The dominant Western definition since World War II is of poverty in monetary terms, using levels of income or consumption (Grusky and Kanbur 2006) and defining the poor by a headcount of those falling below a given income/consumption level or “poverty line” (Lipton and Ravallion 1993). In practice, no one indicator can capture all its dimensions. Nevertheless, measures of poverty are routinely constructed to help policymakers and researchers to understand the poor. One such indicator is the poverty line, defined as the threshold level of welfare that distinguishes poor households from those that are non-poor.

In this study, the poverty line was calculated to be MK18 615/capita/year which is an equivalent of US$1.25/ capita/day at the purchasing power parity exchange rate. About two-thirds of the households (66 percent) live below the poverty line and are classified as poor (Fig. 7). The incidence of poverty is highest in the southern region district of Blantyre with 85 percent of the households living below the poverty line.

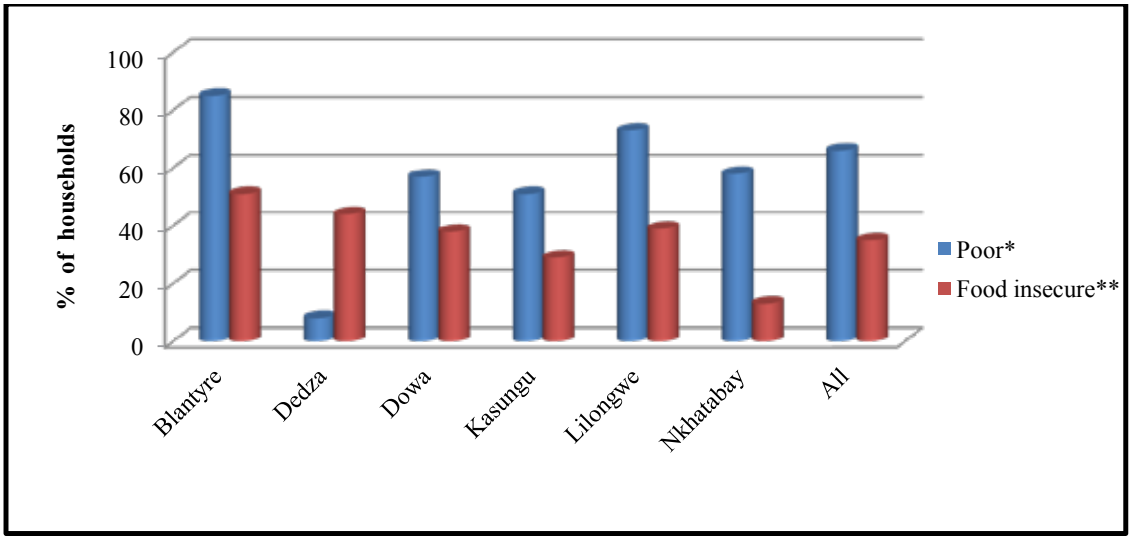

Figure 7. Household poverty and food security in Malawi.

**Poverty line = MK18 615/capita/year (equivalent to US$1.25/capita/day at purchasing power parity exchange rate).*

***Subjective self-assessment of own food security as perceived by the heads of households.*

The sample average is higher than the national average of 52 percent, as indicated in the Malawi Poverty and Vulnerability Assessment report. This also found that the poverty rate is highest in the southern region at 64 percent (GoM 2006), which is consistent with the results of this study. One determining factor for this trend is the high population density in the southern region. The study went further to analyze the self-assessment of their own food security as perceived by the heads of households. This provides a subjective assessment of household well-being. Altogether, 35 percent of the sampled households reported being food insecure. This is lower than the national figure (56 percent) of food insecure households, as reported in the Integrated Household Survey, with 58 percent reporting food inadequacy in rural areas compared to 48 percent in urban areas (NSO 2005).

Determinants and correlates of poverty

Poverty is a multifaceted phenomenon which affects not only the ability to purchase goods, but also vulnerability towards 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 17. 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 the strength of the model. Both the Hosmer-Lemeshow chi-squared and Likelihood Ratio chi-squared values are highly significant, indicating that the model is a good fit of the data. In addition, the percentage of correct predictions is also high (80 percent). All significant coefficient estimates of the explanatory variables have the expected signs.

The probability of being poor is reduced by 1.4 percent with each additional year of schooling for the household head. This implies that households headed by individuals with 10 more years of formal education than the education level of an average household head are 14 percent less likely to live below the national poverty line. This is consistent with Mukherjee and Benson (1998) who found that the attainment of higher levels of education will provide higher levels of welfare for the household. The size of the household is highly correlated with the poverty status of the household. As the household gets larger, household members share the same amount of resources, thereby reducing their per capita expenditure (NSO 2005). Results from the logit model indicate that holding all other factors constant, an additional household member increases by 2.8 percent, the

probability of the household being poor.

Table 17. Logit model estimates of the determinants and correlates of poverty in Malawi.

Variable	Coefficient estimate	*t*-ratios	Marginal effects	% change in probability of being poor
Gender of household head (1=Male; 0=Female)	–0.509	–1.61		
Age of household head (years)	0.013	1.54		
Education of household head (years)	–0.091***	–2.88	–0.014	1.4
Household size	0.187**	2.57	0.028	2.8
Orphans (1=Yes; 0=No)	0.195	0.63		
Sick people (1=Yes; 0=No)	0.110	0.48		
Dependency ratio	–0.083	–0.64		
Log value of farm assets (MK)	–0.097	–0.75		
Livestock ownership per capita (TLU)	–1.052**	–2.10	–0.158	16
Cultivated land per capita (ha)	–3.611****	–4.03	–0.542	54
Off-farm income share in total household income	–2.022****	–4.45	–0.304	30
Access to credit (1=Yes; 0=No)	–0.328	–1.30		
Access to extension information (1=Yes; 0=No)	–0.733	–1.46		
Location				
Dedza	–0.687	–1.42		
Dowa	–1.572****	–3.44	–0.220	
Kasungu	–1.494****	–3.41	–0.207	
Lilongwe	–0.928**	–2.00	–0.117	
Nkhata-bay	–2.197****	–4.39	–0.331	
Goodness of fit tests				
Hosmer-Lemeshow chi-squared (538)	620.93****			
Likelihood Ratio chi-squared(18)	94.04****			
Pseudo R-squared	0.28			
Correct prediction	81%			

**** P < *0.001,* *** P < *0.01,* ** P < *0.05,* * P < *0.1*

Agriculture has the potential to reduce poverty in low-income countries such as Malawi since a large proportion of the population engages in agriculture for both subsistence needs and income generation. Ownership of productive assets, among other factors, has been found to lower the likelihood of being poor in Malawi (Mussa and Pauw 2011). In the study area, an additional hectare of cultivated land reduces by 54 percent the probability of being poor. This is consistent with the results from a study by Chirwa (2005) whereby it was found that after controlling for initial conditions, access to land is an important determinant of poverty in Malawi and an increase in land would reduce the likelihood of the household being poor. Access to agricultural land, through agricultural production, is therefore one of the important factors that can translate growth into poverty. Similarly, households with a livestock unit more than the average household are 16 percent less likely to be poor than the average household.

Off-farm income contributes to one-third of the total household income in the study area. This implies that households do not depend solely on farming for their livelihoods. Households that diversify their income sources by engaging in off-farm activities are less likely to be poor compared to those that depend largely on farm income for their livelihoods. A percentage increase in the share of off-farm income in total household income reduces the probability of being poor by 30 percent. Similar findings were reported by Manyong et al. (2007) who found that a 10 percent increase in the share of off-farm income in total income reduces a

household's probability of being poor by about 34 percent. This indicates that enhancing households' access to income-earning opportunities beyond the farm is a plausible entry point for interventions aimed at poverty reduction in Malawi.

Location effects indicate that households in all the study districts are less likely to be poorer than households in Blantyre. The results also indicate that this probability is significant in all the districts except Dedza. This is consistent with results from the descriptive poverty analysis which showed that Blantyre has the highest prevalence of poverty among the study districts, followed by Dedza.

Household livelihood dynamics

Livelihood dynamics of the sampled households over the past 10 years are summarized in Table 18. Almost half of the households (42 percent) indicated that the amount of cultivated land has not changed over the past decade. Only 23 percent of the households reported a decrease. The Ministry of Economic Planning and Development (2012) reported that landholdings have become smaller and smaller to accommodate the increasing population pressures. Smaller farms combined with soil erosion have degraded agricultural land and decreased Malawi's area of arable land.

Household size, on the other hand, has increased over the past 10 years in the study area, as reported by 67 percent of the sampled households. This has negative impacts on households' welfare as it increases the dependency ratio, thereby putting a strain on households' resources if the new additions are economically inactive. The major reason for this increase is the high birth rate due to early marriages. On the other hand, 46 percent of the households indicated that the number of sick people in the household has increased over the past 10 years while 31 percent reported a decrease. One reason for the increase has been the HIV/AIDS pandemic, as 930,000 people in Malawi were living with HIV/AIDS by the end of 2007.

Table 18. Household livelihood dynamics over the past 10 years in Malawi (% of households).

	District						
	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Cultivated land							
Increased	41	30	36	35	33	37	35
Decreased	23	33	28	15	31	11	23
No change	36	37	36	50	36	52	42
Household size							
Increased	58	63	76	72	69	65	67
Decreased	26	25	19	21	23	27	23
No change	16	12	5	7	8	8	9
Sick people							
Increased	29	34	45	48	53	51	46
Decreased	57	42	19	36	23	35	31
No change	14	24	36	16	24	14	23
Non-farm activities							
Increased	29	55	46	37	40	45	41
Decreased	57	29	39	44	54	46	45
No change	14	16	15	19	6	9	14

Non-farm, income-generating activities are an important complementary source of households' income since crop income is prone to risks and fluctuations. Most smallholders are vulnerable to economic and climatic shocks and spread their risk by diversifying their sources of livelihood, often including significant off-farm, income-generating activities. While 45 percent of the households in the study area reported that their engagement in non-farm activities had reduced over the past 10 years due, among other reasons, to lack of capital and time, 41 percent stated that non-farm activities had increased.

Household shocks and coping strategies

Household welfare can be affected by adverse shocks such as drought, the death of a household member, and poor harvests due to pests and diseases. These can lead to income effects, loss of assets, or both. Pervasive risks and high vulnerability to shocks are among the main causes of persistent poverty in Malawi. The most common shocks facing households relate to a drop in crop yields and an increase in the price of food, reflecting Malawi's great dependence on rain-fed agriculture, and its high level of exposure to drought or floods (GoM 2006).

In this regard, households were asked their perception of their economic well-being. The majority (61 percent) reported that, from a year prior to the interview, their economic well-being had become worse-off while 30 percent reported an improvement in their economic well-being. This pattern is consistent across the study districts. The households, however, have a positive outlook on their future. This is evidenced by more than half of the households (58 percent) reporting that they expect their economic well-being to be better-off in a year from the date of the interview. Some of the reasons for this included the anticipation of a better crop harvest and also better access to credit for the purchase of farm inputs, such as fertilizer, during the 2011–2012 growing season. Twenty-one percent of the households indicated that they expect their well-being to be worse-off, a year from the interview date, while an equal percentage reported that they expect no change in their well-being, a year from the interview date.

As reported by 37 percent of the households, sickness or death of a household head or member is the most important shock to household welfare (Table 19). This is in line with findings from the Malawi Poverty and Vulnerability Assessment report (GoM, 2006) stating that illness or injury to a household member is a very common source of shock to households, affecting over one-third of the households, as is the high prevalence of shocks associated with death of family members, reflecting, in part, the impact of the HIV/AIDS epidemic. Following this, a poor harvest from drought is an important shock reported by 22 percent of the households. This is more prominent in Blantyre where 70 percent reported it as the most important shock to household welfare. Other important shocks are falling crop prices (16 percent), rising input prices (10 percent), rising food prices (7 percent), and poor harvest because of pests and diseases (4 percent).

Table 19. Sources of welfare shocks and trends of economic well-being (% households).

	District						
	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Changes in economic well-being from a year ago							
Better off	26	20	30	25	40	37	30
Worse off	62	67	60	67	52	57	61
Same	12	13	10	8	8	6	9
Expected economic well-being a year from now							
Better off	59	58	56	49	69	59	58
Worse off	24	19	19	22	19	21	21
Same	17	23	25	29	12	20	21
Source of shock							
Sickness/death of hh head/member	12	15	50	38	49	50	37
Poor harvest due to drought	70	19	9	16	10	18	22
Falling crop prices	2	12	16	26	13	22	16
Rising input prices	5	39	1	7	13	0	10
Rising food prices	10	1	8	4	10	7	7
Poor harvest due to pests and disease	1	4	8	7	1	0	4
Coping strategy							
Engaged in small-scale businesses	9	10	52	23	20	42	26
Selling livestock	29	10	14	29	25	16	22
Borrowing cash	11	25	16	21	18	22	19
Piecework	31	25	0	9	12	0	12
Reducing quantity of meals	11	6	1	2	12	4	6
Borrowing food in kind	5	13	1	4	4	1	4
Other	4	13	16	13	9	15	12

Households adopt *ex post* strategies to cope with shocks to their welfare. These are used to smooth consumption and welfare. Malawians have too few instruments to support *ex ante* risk management, such as insurance against shocks. As a result, many of the poor households affected by various shocks resort to low-risk, low-return livelihood strategies which further perpetuate poverty. Most important coping strategies after the shock include engaging in small-scale businesses (26 percent)—selling livestock (22 percent), borrowing cash (19 percent), and piecework (12 percent). Other coping mechanisms, such as reducing the quantity of meals consumed (6 percent) and borrowing food in kind (4 percent), were adopted by smaller proportions of the sampled households.

Community Analysis

Public support services

The study collected information on the infrastructure and public services available in communities in the study area. This includes public services and the various coping strategies communities have adopted to mitigate the impact of HIV/AIDS on livelihoods.

Community infrastructure and services

Improving rural infrastructure is an essential requirement for the commercialization, modernization, and growth of agriculture in Malawi (GoM 2002). Implementing the multisectoral approach to poverty reduction in Malawi is faced by a number of challenges, one of which is the poor state of infrastructure and facilities. Hence, there is a need to provide good rural roads (including bridges), water and sanitation, energy, education, and telecommunications. Table 20 summarizes the major infrastructure and services available in communities in the study area.

Education is known to be a major determinant of living standards. It is positively related to agricultural productivity, higher incomes, lower fertility rates, and improved nutrition and health. Primary and secondary schools are found in the majority of the communities in the study area. This entails better access to basic education in the communities. The average distance to the nearest school located outside the communities is 1.3 km for primary schools and 5.1 km for secondary schools. Distance to the nearest health facility is, however, longer (8.1 km). Communities in Kasungu reported having no nearby clinics and secondary schools. This is an indication that interventions are required that are aimed at improving the health situation in the study area, especially in the face of the rampant HIV/AIDS pandemic.

One interesting finding is the complete absence of formal credit facilities, such as banks in the communities. On average, the nearest bank is at a distance of about 14 km. Similarly, NGOs that offer credit services are about 21 km away. This illustrates why informal credit facilities, such as money lenders, are predominant among smallholder farmers. Agro-dealer shops (fertilizers and seeds/planting materials markets) are found in 27 percent of the communities while 47 percent have output markets. Increasing farmers' proximity to marketing points through good road networks is one effective way of improving their access to markets.

Table 20. Availability of community infrastructure and services in Malawi.

	Availability (% of communities)					
Infrastructure and services	Blantyre	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Primary school	100	100	100	50	100	87
Secondary school	100	33	0	50	100	60
Health clinic	67	33	0	75	67	53
Borehole/ well water	67	33	50	100	100	73
Electricity	0	33	0	25	33	20
Mobile phone reception	100	33	100	100	100	87
Extension services	100	67	100	100	100	93
Credit facilities—formal (e.g. banks)	0	0	0	0	0	0
Credit facilities—nformal (e.g., money lenders)	67	33	100	100	100	80
Credit facilities—NGOs	33	33	50	0	0	20
Output market (e.g., for fresh cassava, etc.)	100	0	50	50	33	47
Fertilizer market (agro-dealer shops)	33	33	0	50	0	27
Seeds/planting materials market (agro-dealer shops)	33	33	0	25	33	27
Paved/gravel road to the main town	100	67	100	50	67	73
Tarred road to the main town	100	0	100	50	100	64
Motorized transport to the main town	100	0	100	75	67	67

Access to credit

Lack of access to productive capital has been widely accepted as one of the major causes of poverty in developing countries. This is due to the fact that formal financial institutions mostly exclude the poor in their lending activities. Many developing countries have, therefore, adopted the strategy of promoting access to credit facilities by establishing Government-owned Agricultural Banks and promoting NGOs that offer credit to the poor (Chirwa 2002). Despite their need for credit access, the provision of financial services remains limited for rural households. Inherent risks associated with the agricultural sector, high transaction costs, operational inefficiencies, and the absence of effective Government policies have hindered the growth of microfinance in many African countries (Dooner 2007).

In Malawi, microfinance[3] supply is a mixture of agricultural credit and business finance carried out in rural and urban areas by a variety of public and private sector firms. Agriculture-related credit is dominant and frequently takes the form of in-kind inputs of fertilizer and seeds. The sector is controlled by a few major players and the Government's presence is pervasive in all aspects of the sector: financial service delivery, governance, legal, regulatory, supervisory, and donor. Malawi Rural Finance Company (MRFC) and Malawi Savings Bank (MSB) are the two largest micro-savings providers. These are parastatals that hold more than 80 percent of the market. On the microcredit side, close to 50 percent of the demand is satisfied by MRFC; a bilateral agriculture credit project (APIP) accounts for another 18 percent of outstanding loans (Microfinance Chemonics Consortium 2004). A very common category of financial services providers in rural areas is the informal financial sector which mainly targets low-income clients. This comprises of Rotating Savings and Credit Associations (ROSCAs), money lenders (*Katapila*), and social networks of family and friends.

According to Zeller et al. (1997), access to credit affects household welfare outcomes through three pathways: providing capital for financing inputs, labor, and equipment for income generation, increasing a household's risk-bearing ability and altering its risk-coping strategy, and by efficiently stabilizing the consumption of food and other essential goods. However, despite this, a study to analyze the determinants of access to credit in Malawi and its impact on farm and non-farm income and household food security found that the contribution of rural microfinance institutions to the income of smallholders can be limited or outright negative if their design and services do not take into account the constraints on and demands of their clients (Diagne and Zeller 2001).

Diagne (1998) distinguishes access to credit from participation in credit programs as saying a household has access to a particular source of credit if it is able to borrow from that source though it may choose not to borrow, whereas a household participates if it borrows from a source of credit. Of the sampled households, 35 percent had access to, and participated in the credit market by borrowing (Fig. 8). The pattern is consistent across the study districts, with very little variation. This is higher than results by IFAD (2011) who found that only 12 percent of the households in Malawi have access to credit. Households in the study area borrowed money for various reasons. Those that borrowed mainly used the money for purchase of fertilizer (9 percent), investment in a business or trade (8 percent), purchase of seeds and other planting materials (6 percent), and for family health by paying medical costs (6 percent).

[3]Microfinance is the provision of a broad range of financial services, such as deposits, loans, payment services, money transfers, and insurance to the poor and low-income households and their micro-enterprises.

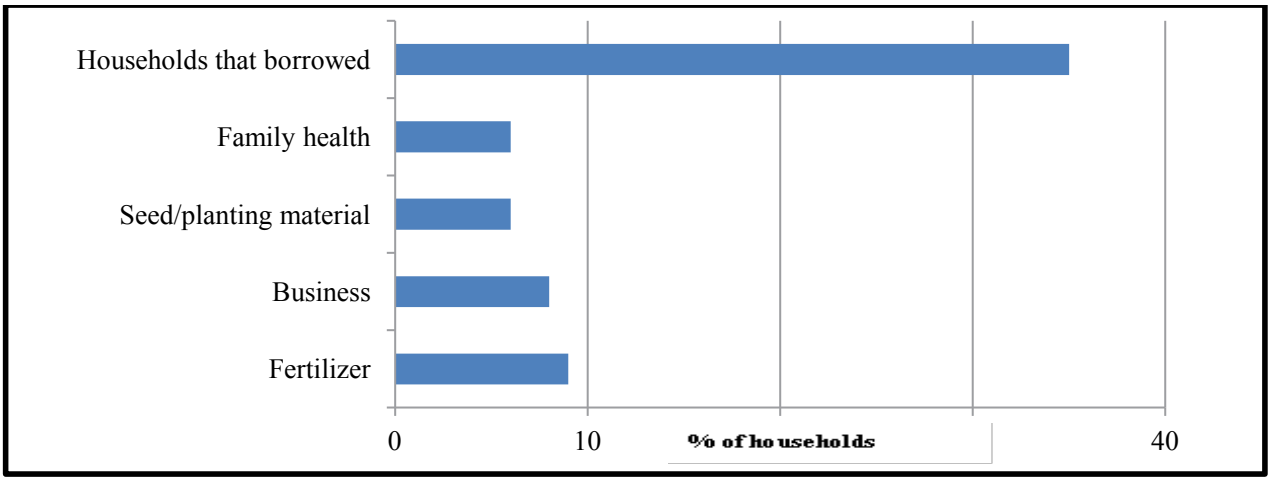

Figure 8. Access to credit in Malawi.

Farmers' groups and social capital

The concept of social capital has become popular in many disciplines, including rural development. Due to its increasing popularity, several definitions have been generated. According to Fukuyama (1997), social capital can be defined as "... the existence of a certain set of informal values or norms shared among members of a group that permits cooperation among them". The World Bank defines social capital as the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions. Roles of social networks include conflict resolution, coordination and timing of activities, and the provision of information, for instance, about new technologies and markets. In the context of this study, social capital is captured by membership in farmers' groups including support groups, clubs, associations, or cooperatives. As indicated in Table 21, 44 percent of the households are members of a farmers' group. Membership is highest in Nkhata-bay (87 percent of the households) while Dedza has the lowest with only 21 percent of the households reporting membership in some farmers' group. With respect to the services provided, membership was highest in farmers' groups that offered services in crop and livestock production (45 percent of the households).

Table 21. Group membership and activities in Malawi (% of households).

	District						
	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Group membership	36	21	26	50	44	87	44
Crop–livestock production	55	81	57	57	33	24	45
Input-output marketing	27	13	10	11	7	0	10
Safety nets	3	6	0	2	5	0	2
Counseling/nutrition	3	0	23	8	22	53	23
Credit and saving	10	0	7	22	33	23	20

A substantially high percentage of the sampled households from Dedza belong to a farmers' group that provides such services (81 percent). Other farmers' groups to which the households belong are those that provide counseling and nutrition services, reported by 23 percent, and credit and saving services reported by 20 percent. Smaller proportions belong to farmers' groups providing safety nets and input-output marketing information.

Access to extension services

In Malawi, the Government is the main provider of extension services to about 2.7 million smallholder farmers. The Malawi Poverty and Vulnerability Assessment report (GoM 2006) states that increased productivity

and diversification into high-value crops in turn requires effective extension services, among other factors. Extension services are important in promoting best practices or technologies that can enhance agricultural productivity. Matita and Chirwa (2011) found that, in Malawi, farmers that received agricultural extension advice experienced higher agricultural growth relative to non-recipients. In a study to assess the adoption of improved agricultural technologies for Irish potatoes among farmers in Tanzania, Namwata et al. (2010) found that access to extension services was positively and significantly associated with adoption.

The Malawi Integrated Household Survey 2004–2005 indicated that 13 percent of agricultural households received extension advice from an agricultural advisor (NSO 2005). However, results in Table 22 show that, in the study area, almost half of the households (48 percent) had access to extension services. Households in Kasungu had the most contact with agricultural extension advisors; households in Dedza had the least extension contact. Information received was on modern varieties of crops (36 percent), pest and disease control (34 percent), and methods of soil and water conservation (32 percent). There is little variation across the study districts on the type of information obtained by the households.

Table 22. Access to extension services in Malawi (% of households).

	District						
Service	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Extension contact	47	42	39	60	43	53	48
Modern varieties	28	31	33	41	37	38	36
Pest and diseases	21	27	32	45	33	38	34
Soil and water conservation	25	23	27	44	27	39	32

Production and market constraints

Crop production constraints

Low productivity is a reflection of marginalized access to resources, the use of traditional technologies (usually low input), and poor policies being pursued by the various governments in sub-Saharan Africa (SSA). Transforming agriculture and expanding its productive capacity are therefore, prerequisites for improving the living standards in SSA. The policy action in Malawi, both agriculturally and economy-wide, is largely based on influencing the dynamism of the agricultural sector (Nakhumwa et al. 1999). This involves identifying constraints to production in order to determine sound interventions aimed at boosting productivity. Pests and diseases are the major crop production constraint in the study communities, followed by low soil fertility and low yielding varieties (Table 23).

Table 23. Production constraints in Malawi.

	% of communities						Most affected	
Production constraints	Blantyre	Dowa	Kasungu	Lilongwe	Nkhata-bay	All	crop	Practices
Pests and diseases	33	50	0	67	67	46	Maize/cassava	Crop rotation
Drought	0	50	0	0	0	7	Maize	Irrigation
Weeds	0	0	0	0	33	7	Maize	Weeding
Low soil fertility	33	0	50	33	33	39	Maize	Compost manure
Low yielding varieties	33	0	50	67	33	39	Maize	Adoption of improved varieties

It is unsurprising that maize is the crop most affected by these constraints as it is the most widely grown crop in Malawi. Practices adopted by the communities in combating crop pests and diseases include crop rotation and the application of chemical pesticides.

Major institutional, infrastructural, and market constraints

According to the Malawi Poverty Reduction Strategy Paper, the key factors that will contribute to an environment conducive for pro-poor growth are macroeconomic stability, access to credit, and improved rural infrastructure. Constraints such as a lack of access to credit and poor infrastructure in the form of poor access to markets and market information have led to farmers being unable to buy inputs such as seeds, fertilizers, and other chemicals, leading to lower yields and their inability to help themselves.

High prices of fertilizer (47 percent) and seeds (20 percent) are the major institutional constraints affecting the majority of communities in the study area (Table 24). Fertilizer and seeds may be available in the markets but high prices make them unaffordable for the farmers. Communities in Blantyre and Nkhata-bay are most affected by high fertilizer prices; those in Kasungu are most affected by high prices for seeds. The livelihoods of the farmers in the study area are also constrained by a lack of market information and low output prices that render the production of cash crops unprofitable for them.

Virtually all African farmers depend on trading for some household needs. However, in Malawi, most stakeholders, especially smallholders and small-scale traders, have very limited access to information on local and international markets, leading to lack of knowledge of the quality, quantity, and type of products to be produced and targeted to specific markets. Therefore, enhancing the ability of smallholder, resource-poor farmers to have access to market opportunities and diversify their links with markets is one of the most pressing development challenges facing both governments and NGOs.

Table 24. Institutional, infrastructural, and market constraints in Malawi (% of communities).

	District					
Constraints	Blantyre	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Unavailability of improved seeds	0	33	0	0	0	7
High price of seeds	33	0	50	25	0	20
Unavailability of fertilizer	0	0	0	25	0	7
High price of fertilizer	67	33	50	25	67	47
Lack of access to credit	0	33	0	0	33	13
Lack of extension services	0	33	0	0	0	7
Lack of market information	0	67	0	0	33	20
Low output prices	33	0	50	25	0	20
Lack of physical access to markets	0	0	0	50	0	13

Improved agricultural technologies

Agriculture should provide safe, adequate, and nutritious food that reduces micronutrient deficiencies and enhances the health of vulnerable groups in populations, such as hPLWHA. Communities in the study area indicated that agricultural technologies, such as high yielding (54 percent) and drought-tolerant crop varieties (29 percent) need to be introduced because these have a potential impact on their livelihoods. About one in five communities reported their preference for nutrient-dense varieties (Fig.9).

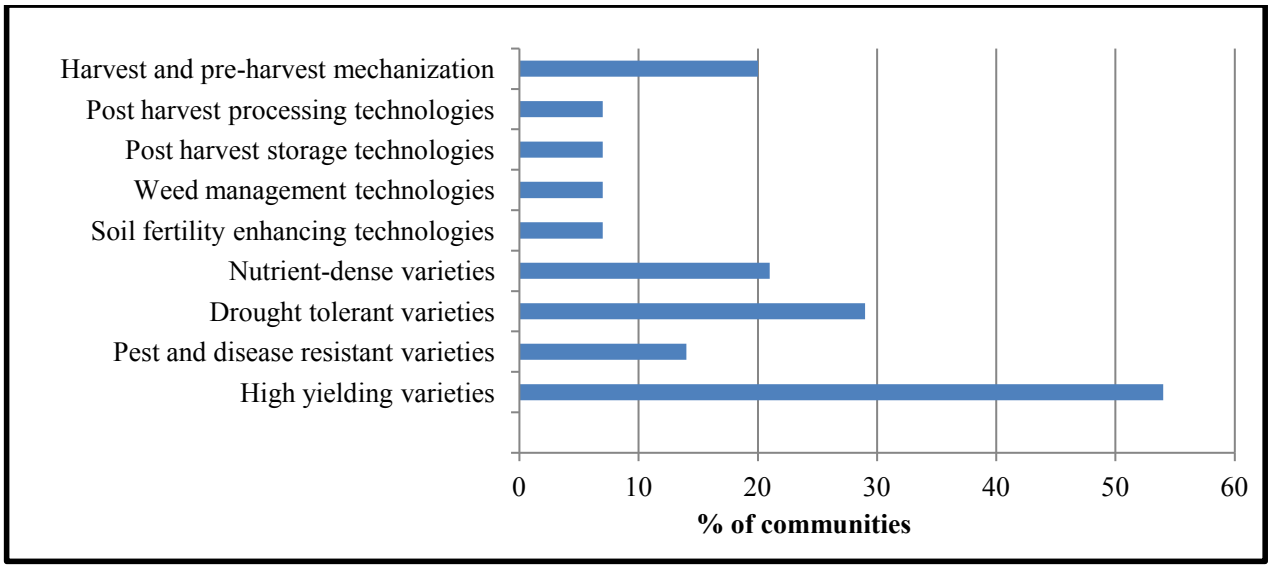

Figure 9. Preferences for improved agricultural technologies in Malawi (% of communities).

IITA and its partners have developed technologies to improve diets, health, and productivity through research on micronutrient content, food toxins, and nutrient patterns. Current research and development interventions emphasize the diversification of crop systems, development and bio-fortification of food crops (maize, cassava, cowpea, banana, and plantain) with increased levels of micronutrients, reduction in toxic substances, stable productivity, higher yields, and better postharvest characteristics. Nutrient-dense crop varieties, such as quality protein maize, yellow maize (pro-vitamin A), yellow cassava, and orange-fleshed sweet potato are some of the nutritious crops grown in the communities. Despite being grown by very few households, quality protein maize is ranked as the most preferred nutritious crop that the study communities would like to have introduced or expanded in the area, as reported by more than half of the communities (Fig.10).

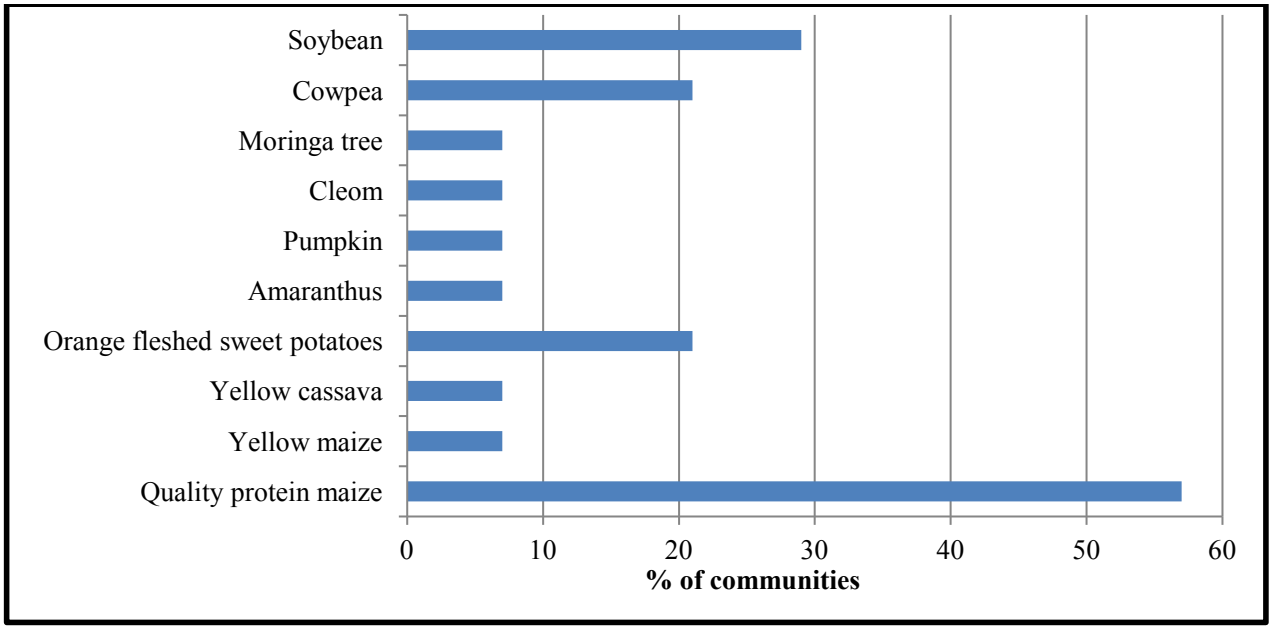

Figure 10. Preferences for nutritious crops in Malawi (% of communities).

Sweetpotato is also considered an excellent food security crop in sub-Saharan Africa because it often survives when other crops, such as maize, fail. About one in every five communities indicated their preference for orange-fleshed sweetpotato. This is a particularly promising food for improving vitamin A intake in the region as it is widely grown and has high levels of pro-vitamin A carotenoids (Low et al. 2007). Other nutritious foods preferred in the communities are soybean and cowpea.

HIV/AIDS vulnerability and coping strategies

In the light of the increasing occurrences of sickness or death, households and communities undertake activities to cope with such impacts of HIV/AIDS. Table 25 summarizes the various coping strategies that communities in the study area adopt. When an adult member of the household is chronically ill or dies from AIDS-related illnesses, the majority of communities resort to doing piecework and selling crops and/or livestock to raise cash for livelihood sustainability. These are also undertaken so as to tackle food shortages in the household. Households hire labor in exchange for food to deal with labor shortages from HIV/AIDS deaths.

Property grabbing is a serious issue in Malawi and elsewhere in Africa. Due to the increasing number of deaths related to HIV/AIDS, many Malawian women are left widowed and vulnerable to property grabbing. This is escalated by the fact that one-third of Malawian women are illiterate (NSO/ICF 2011) and so they are unaware of the equal right to property between men and women. In the study area, more than half of the communities indicated that property grabbing takes place when either the man or both parents die. However, after the death of a key adult, relatives usually look after the children.

Community-based organizations are the main intervention offering support to HIV/AIDS-affected households in the study communities. The aim of such organizations is to improve the quality of life for people living with or affected by HIV/IDS in Malawi. Services provided include home-based care, voluntary counseling, orphan care, and support groups. Church organizations and NGOs also offer some support to households affected by HIV/AIDS in the communities.

Social safety nets

Safety-net programs also provide protection against the livelihood shocks faced by households and communities in Malawi. Devereux (1999) argues that that policymakers concerned with providing assistance to Malawi's poor should consider "productivity-enhancing safety nets", such as Inputs-for-Work so as to boost agricultural production, rather than Food-for-Work to compensate for production deficits. In addition, safety net programs should include livelihood promotion objectives that facilitate, at least for some, the graduation out of poverty, thereby ultimately reducing the need for social welfare support (GoM 2006). Safety net programs from which households in the study area have benefited include free food or maize distribution (36 percent), Food/Input for Work programs (29 percent), and the distribution of free seeds/fertilizer (23 percent) as shown in Table 25. Direct cash transfers from Government reach out to a minimal proportion of the households (2 percent) with none of the households from Nkhata-bay benefiting from them.

Table 25. Social safety nets in Malawi (% of households).

Safety net program	District						All
	Blantyre	Dedza	Dowa	Kasungu	Lilongwe	Nkhata-bay	
Free food	32	39	6	82	17	18	36
Food/Input for Work	22	32	31	33	36	9	29
Free seeds/fertilizer	39	22	29	18	23	4	23
Direct cash transfers	5	1	1	1	1	0	2

Community and household dynamics

Household composition dynamics

The HIV/AIDS pandemic has had adverse economic and psychological consequences that eventually led to changes in the family structure in most African countries (Ankrah 1993). Household management has been affected by the high numbers of orphans and widows. Elderly members of the community are also forced to take care of their sick children and orphaned grandchildren. This has increased responsibilities and the burden of caring activities on affected households and communities, particularly on women as they are the main care-givers.

In Malawi, the situation is no different. As indicated (Fig. 11), the percentage of married male-headed households has dramatically decreased while the numbers of single, male-headed and female-headed households have increased over the past 10 years. Similarly, there is an increase in orphan-headed and grandparent-headed households. This emphasizes the high mortality rates due to HIV/AIDS, among other factors.

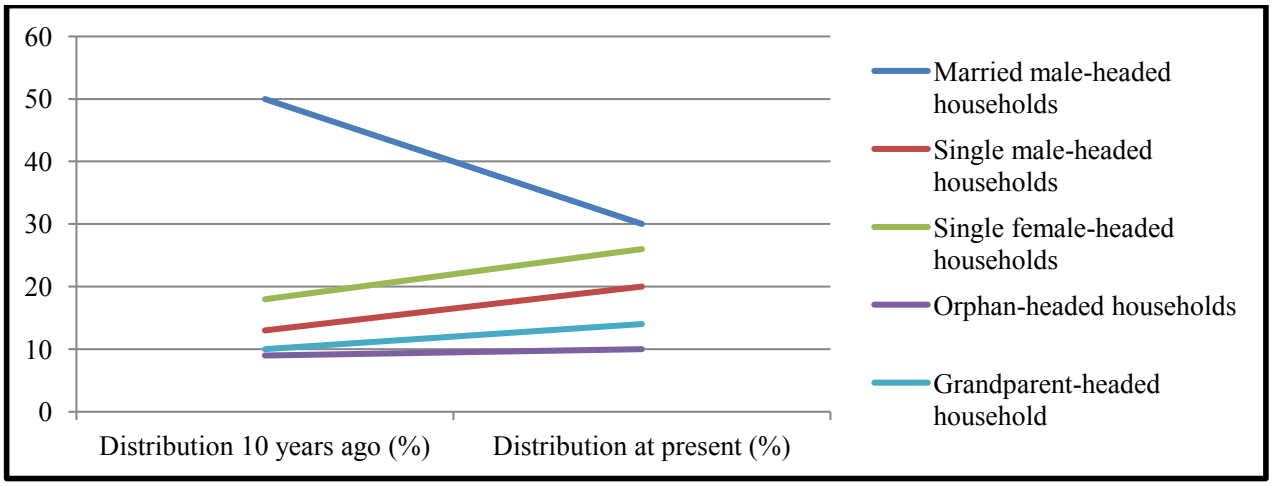

Figure 11. Household dynamics in Malawi.

Community dynamics

Community dynamics over the past 10 years are presented in Table 26. At the community level, cultivated land has decreased over the past 10 years. The major reason for this is the high birth rates, leading to an increase in population which, in turn, results in a high demand for land. The livestock population on the contrary has decreased. The majority of communities reported that theft and attacks of pests and disease are the main causes of this decrease.

As reported at household level, the number of sick people at the community level has risen in the past 10 years due to high incidences of AIDS-related illnesses. Consistently, expenditure on medical care has also been on the rise. In addition to having enough food, a diversified diet is also an essential component of food security, particularly for vulnerable households such as those affected by HIV/AIDS. In general, the consumption of vegetables and roots/tubers is high as compared with the situation 10 years ago because they are cheap, readily available, and commonly grown on household farms.

Infrastructure availability plays an important role in improving livelihoods. The majority of communities in the study area indicated the presence of primary and secondary schools in their area. It is therefore not surprising that school attendance has increased. On top of this, the free education policy is also an incentive for poor households since they can send their children to school at no cost. Community savings have increased in more than half of the communities, due to active NGOs providing such services in the area. Those that reported a reduction in savings attributed it to the high prices of commodities, thereby leaving little opportunity to save. In general, in spite of the adverse impacts of HIV/AIDS and the growing population, other aspects of rural livelihood such as education, savings, and the use of labor-saving technologies have improved in the past 10 years.

Summary

This baseline study was conducted to inform and enhance technology delivery activities and contribute to the development of more appropriate technologies, institutional arrangements, and partnerships for enhancing the delivery of technologies for enhancing the livelihoods of people affected by HIV and AIDS under the MIRACLE project.

Results indicate that the average land holding size is 1.5 ha/ household. Livestock ownership is generally considered to be very low in Malawi compared with other countries in southern Africa. However, households in the study area were found to have an average of 1.0 Tropical Livestock Units (TLU)/household. Maize is the staple crop. It was therefore allocated the largest share of the total cultivated land (52 percent) and grown by almost all the households during the 2010–2011 cropping season. Tobacco was allocated 20 percent and soybean 22 percent of the total cultivated land. Female-headed households allocated more cultivated land to maize, soybean, cowpea, and cassava while male-headed households allocated more land to tobacco and sweetpotato.

Tobacco and soybean are the second most frequently grown crops (95 percent) followed by groundnut, sweetpotato (73 percent), and cowpea (69 percent). Rice is the crop least grown in the study area, as indicated by only 16 percent of the households. By gender, more male-headed households produced food crops, such as maize and cassava, than female-headed households. Being the major cash crop, tobacco was grown by more male-headed households than female-headed households. Soybean, on the other hand, is grown by more female-headed households (52 percent) than male-headed households (11 percent). Major crop production constraints are pests and diseases, low soil fertility, and low yielding crop varieties.

Tobacco, soybean, and groundnut are the most prominent cash crops grown by farmers in the study area, as indicated by the proportion of households that sold their produce (80 percent for both tobacco and soybean and 52 percent for soybean). About 82 percent of the households bought rice. This is consistent with the fact that it is the crop least grown in the area and so households need to purchase it from other sources. Because of lack of access to regional markets, the majority of the households sell their produce, mainly at the farm gate, to rural assemblers, middlemen, or traders although at reduced prices. Self-sufficiency in maize was achieved by 45 percent of the households that never bought or sold their produce.

Adoption rates have sometimes depended on whether the modern varieties possess the characteristics valued by farmers. Preferred traits for major crops in the study area include earliness of maturity, high yield, and good taste. Information on modern varieties was mainly obtained through extension agents and radio or television broadcasts. Adoption rates are as high as 78 percent for maize. For groundnut (30 percent) and soybean (23 percent), adoption rates are slightly lower. The main reasons for non-adoption include a lack of cash to purchase seeds and a lack of the seeds themselves. Of the nutrient-dense crop varieties grown, quality protein maize is ranked as the most preferred nutritious crop that the communities would like to be expanded in the area.

Households in the study area complement crop income with income from off-farm work and livestock. The average annual income for households in the study area is US$708 per capita. Crop income contributes to about two-thirds (66 percent) of the total household income. Measuring the total value of output from agriculture per unit of land, the average gross value of production in the study area was found to be US$637/ha. Due to variations in factors such as input and output prices, the average gross value of production varied substantially across the districts. Households in Nkhata-bay have the highest gross value of production of US$1075/ha while those in Dedza have the lowest gross value of production of US$335/ha. The average net returns for the sampled households is US$411/ha. Off-farm income accounts for 30 percent of the total household income but

livestock income is almost negligible, accounting for only 4 percent of the total household income. About 81 percent of the households are employed off-farm.

The majority of the households reported that their economic well-being had been worse-off from a year prior to the interview. However, they have a positive outlook on their future well-being. The analysis of household livelihood dynamics shows that household sizes, the number of sick people, and the human population have increased over the past 10 years. This has in part been due to the HIV/AIDS pandemic and the high birth rates caused by early marriages. Using a poverty line constructed based on the purchasing power parity exchange rate, 66 percent of the households live below the poverty line and therefore they are classified as poor. In the analysis of household heads' perception of their own food security, 35 percent reported being food insecure. Results from the logit model show that the poverty status of a household is significantly related to the education of the household head, household size, livestock ownership, off-farm work, and location.

Improving rural infrastructure is an essential requirement for the commercialization, modernization, and growth of agriculture in Malawi. This involves improvement in road networks, communication services, and access to services such as credit and extension. About one-third of the households had access to, and participated in the credit market by borrowing. There is little variation in the proportion of households that got credit across the sampled districts. To capture the concept of social capital, membership in farmers' groups was used. Results indicated that 44 percent of the households are members of some farmers' group. About half of the households had access to extension services. Information received was on modern crop varieties, pests and diseases, and methods for the conservation of soil and water. High prices of fertilizer and seeds are the major institutional constraints affecting the majority of households in the study communities. Fertilizer and seeds may be available in the markets but high prices make them unaffordable. In addition, agro-dealer shops (fertilizer and seeds/ planting material markets) are found in only 27 percent of the communities; 47 percent of the communities have output markets. Therefore, increasing farmers' proximity to marketing points is one effective way of improving their access to markets.

Household welfare in Malawi is affected by shocks, the most important being sickness or death of a household head/member, followed by a poor harvest due to drought. Coping strategies include engaging in small-scale businesses and selling livestock. Community-based organizations play the major part in improving the quality of lives and supporting those affected by HIV/AIDS in the communities. Safety nets, such as free food or maize distribution and public works programs, also provide some protection against livelihood shocks. It is therefore expected that the MIRACLE project will result in an improved environment, facilitating the access and use of knowledge for innovation, improved nutrition, and health, particularly of people affected by HIV and AIDS in Malawi.

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Annex

Table A-1. Producer and consumer prices in the community.

Crop	Producer price at peak selling time (MK/kg)	Consumer price at peak buying time (MK/kg)
Maize	15	57
Cassava	28	177
Soybean	53	163
Cowpea	41	123
Sweetpotato	20	55
Aramanthus	123	112
Pumpkin	23	54
Tomato	27	92
Paprika	176	264
Potato	29	57
Beans	42	220
Pigeon pea	63	160
Sorghum	30	85
Millet	50	254
Rice	47	153
Groundnut	69	160
Sesame	41	98
Tobacco	34	80
Cotton	54	170

Table A-2. HIV/AIDS vulnerability and coping strategies (% of communities).

	District					
	Blantyre	Dowa	Lilongwe	Kasungu	Nkhata-bay	All
Raising cash if an adult member of a household is ill for a long time or dies						
Borrow cash	0	0	0	25	0	7
Sell crops and/or livestock	67	0	0	25	0	21
Get assistance from villagers	0	0	0	25	0	7
Piecework	33	100	100	25	100	65
Coping with labor shortage						
Hire labor in exchange for food	0	67	50	25	67	40
Involve children	67	0	0	50	0	27
Rent out land	33	33	50	25	33	33
Household assets when a man dies						
Given to wife and children	33	67	50	0	67	40
Taken away by man's relatives	67	33	50	100	33	60
Household assets when both parents die						
Left with children	33	67	0	75	33	47
Property grabbed from children	67	33	100	25	67	53
Surviving household members after death of a key adult						
They remain at the house looking after the children	33	67	0	75	33	47
Children live with relatives	67	33	100	25	67	53
Coping with food shortages						
Piecework in other people's fields	33	33	50	50	33	40
Non-farm activities	33	0	0	25	0	13
Selling livestock	33	67	50	25	67	47
Coping with impacts of HIV/AIDS in the community						
No interventions	0	33	0	0	0	7
Church interventions	33	0	0	50	33	27
Support from NGOs	33	0	50	50	0	27
Community-based organizations	33	67	50	0	67	40
Coping after death						
Assistance from family during the funeral only	33	33	50	50	0	33
Support from community-based organizations	33	67	50	50	100	60
Support from NGOs	33	0	0	0	0	7

Table A-3. Community dynamics (% of communities)

	District					
	Blantyre	Dowa	Kasungu	Lilongwe	Nkhata-bay	All
Cultivated land						
Increased	0	0	0	0	67	13
Decreased	67	100	100	100	33	80
No change	33	0	0	0	0	7
Livestock population						
Increased	33	0	0	25	33	20
Decreased	67	100	100	75	67	80
No change	0	0	0	0	0	0
Human population						
Increased	100	100	100	100	100	100
Decreased	0	0	0	0	0	0
No change	0	0	0	0	0	0
Community savings						
Increased	100	0	50	75	33	53
Decreased	0	100	50	25	67	47
No change	0	0	0	0	0	0
Expenditure on medical care						
Increased	100	100	100	100	100	100
Decreased	0	0	0	0	0	0
No change	0	0	0	0	0	0
Vegetables in the diets						
Increased	67	67	100	100	100	87
Decreased	0	0	0	0	0	0
No change	33	33	0	0	0	13
Roots/Tubers in the diets						
Increased	33	0	50	50	67	40
Decreased	33	100	50	50	33	53
No change	33	0	0	0	0	7
School attendance						
Increased	100	33	50	100	100	80
Decreased	0	67	50	0	0	20
No change	0	0	0	0	0	0
Use of labor-sharing						
Increased	0	0	0	0	33	7
Decreased	67	67	100	100	33	73
No change	33	33	0	0	33	20
Use of labor-saving technologies						
Increased	33	33	100	75	67	60
Decreased	0	33	0	0	0	7
No change	67	33	0	0	33	33
Non-farm activities						
Increased	33	0	50	75	67	47
Decreased	67	100	50	0	33	47
No change	0	0	0	25	0	6
Number of sick people						
Increased	67	100	100	100	67	87
Decreased	33	0	0	0	33	13
No change	0	0	0	0	0	0

(Footnotes)

[1]*TLU = Tropical Livestock Unit*