



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

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

Baseline Report

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Cover picture: A group of stakeholders analyzing the performance of different varieties of several crops during an Innovation Platform workshop in Mumbwa District.

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# Introduction

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

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

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

As one of the countries highly affected by HIV/AIDS in Southern Africa and where agriculture holds the potential for addressing nutrition and health issues, Zambia is one of the target countries for the MIRACLE project. This report presents the results of the baseline survey of households and communities conducted in three target districts in Zambia in October and November 2011. The purpose of the baseline studies and situation analyses is to establish a strong knowledge base to contribute to an increased understanding of the production and market constraints; the role and constraints to the adoption of technologies; and the livelihood strategies and outcomes (food, nutrition, and health) of smallholder producers affected by HIV/AIDS. An important output is a description of the production and market constraints and opportunities, and analyses of the livelihood status and strategies of producers as well as the prospects of alternative investments and technological solutions. This guides

investments in agricultural research, institutional innovations, and complementary public goods for income gains, food and nutrition security, improved health outcomes, and poverty reduction. The results of the baseline studies form the basis for assessing progress and the primary or adopter-level impacts of the project.

The baseline report is organized in nine sections. The following section describes the link between agriculture, nutrition, and health in Zambia. 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 the resource endowments of the households. 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 the households' adoption practices of improved crop varieties. 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 the various coping strategies communities have adopted to mitigate the impact of HIV/AIDS on livelihoods. The last section provides a summary of the major results of the baseline survey.

# Agriculture, Nutrition, and Health In Zambia

## **Agriculture in Zambia**

Agriculture is the mainstay of the Zambian economy and most people live in rural areas. Zambia has experienced positive gross domestic product (GDP) growth over the last decade. However, stagnant to moderate growth in the agricultural sector has led to agriculture contributing a declining share to Zambia's GDP. Agriculture supports the livelihoods of over 70 percent of the population; 78 percent of women are engaged in agriculture, compared with 69 percent of men. Zambia's economy has grown steadily in real terms since 2001 while the percentage contribution of the agricultural sector to GDP has declined from 16 percent in 2001 to 13 percent in 2009 (Sitko et al. 2011). However, the livelihood prosperity is constrained by the labor drain from HIV/AIDS and this leads to loss of economic profits. Here we say loss of economic profits but the farmers consider everything, even the time spent caring for the sick. The dualism of Zambian agriculture has been influenced by historical factors, which are beyond the scope of this paper (Jansen 1977).

The overwhelming majority of Zambia's agricultural producers are smallholders, who use simple technologies (hand-hoes and oxen) and cultivation practices (minimal purchased inputs such as hybrid seeds or fertilizer). Productivity on smallholder farms tends to be relatively low. They mainly produce rain-fed maize, groundnut, roots, and tubers, primarily for their own consumption on five or fewer hectares. Most lack access to functioning input and output markets and support services. It is estimated that only 40 percent of smallholders are able to sell crops (World Bank 2003). At the other extreme are large-scale commercial farms using modern inputs with access to global input and output marketing chains. In some cases, large commercial farms are vertically integrated with agroprocessing (Francis et al. 1997; World Bank 2003). More commercially oriented, medium-sized ("emergent") farmers use animal traction, hybrid seeds, and fertilizer to grow rain-fed crops. Some attempts are being made to introduce micro-irrigation for emergent farmers and some smallholders. Zambian producers can also be differentiated by the types of crops they produce. Smallholders tend to produce low-value-to-weight food staples, including about 60 percent of the country's maize, 90 percent of sorghum, 85 percent of groundnut, and virtually all the cassava and other starchy staples. Smallholders produce some higher-value cash crops, such as cotton, tobacco, and paprika, and have small livestock, primarily poultry and pigs, for home consumption. The differentiation of crops and livestock by producer type is largely a function of the higher capital requirements for higher-value enterprises. Emergent and large-scale producers generally have better access to markets and infrastructure. Land tenure arrangements also differentiate producers and affect access to credit. Commercial farmers have title to lease State lands; smallholders produce on lands under customary tenure. Customary land is distributed by chiefs, which can lead to more or less land access and security, depending on factors such as types of marriage/social organizational systems and ties, length of residence, and the integrity of chiefs (Siegel 2005).

## **HIV/AIDS in Zambia**

Zambia has one of the world's most devastating epidemics of HIV and AIDS. More than one in every seven adults in the country is living with HIV (UNAIDS 2011) and life expectancy at birth has fallen to just 49 years (UNDP 2011). In 2009, nearly 76,000 adults were newly infected with HIV, which are about 200 new infections each day (UNAIDS 2010). Zambia's first reported AIDS diagnosis in 1984 was followed by a rapid rise in the number of people living with HIV. Although Zambia has several HIV programs to educate people about the epidemic, HIV prevalence is not dropping and has remained more or less stable since the 1990s at rates as high as 25 percent in some urban areas (WHO 2009). Unlike the situation in some countries, HIV in Zambia does not primarily affect the most underprivileged; infection rates are very high among wealthier people and the better educated. HIV is most prevalent in the two urban centers of Lusaka and the Central Province, rather than in poorer rural populations (AIDS Care 2008; Government of Zambia 2010). The collapse of copper prices in the 1970s weakened Zambia's economy and saw an increase in the number of men seeking work away from home. The movement of miners, seasonal agricultural workers, and young men between rural areas and urban centers has been shown to spread HIV to new areas.

## **Food security, nutrition, and HIV/AIDS in Zambia**

Agriculture plays a major role in the health of African people, not only by providing food for sufficient macronutrition, but also reducing micronutrient deficiencies and enhancing health. This is particularly important for vulnerable groups, such as PLWHA. Food and food fortification are seen as an important entry point for resolving malnutrition, as it is more cost-effective. Although too often neglected, food security and nutrition are critical for individuals, households, and communities affected by HIV and AIDS. Lack of food security and poor nutritional status hastens the progression to AIDS-related illnesses and undermine the response to antiretroviral drugs (Gillespie and Kadiyala 2005). HIV infection itself undermines food security and nutrition by reducing work capacity and jeopardizing livelihoods. HIV impairs nutritional status by undermining the immune system and nutrient intake, absorption, and use (Piwoz and Preble 2000).

Despite its rich agricultural resources, Zambia has continued to experience chronic problems of food and nutrition security. Stunting rates in Zambia stand at 45 percent, with 21 percent being severe. Stunting remains the most common nutritional disorder affecting under children under five years in Zambia, above the sub-Saharan African average of 42 percent (ZDHS 2007). Stunting is a proxy indicator for national development, inversely related to household wealth, high in all wealth quintiles (48 percent in the lowest and 33 percent in the highest). Stunting also decreases with increasing levels of the mother's education. Zambia District Health Surveys (ZDHS 2007) indicate that children born to mothers with no education are more likely to be stunted (45 percent) than children born to mothers with a secondary education (39 percent). Wasting, a short-term effect reflecting more recent or acute weight loss, can be a result of recent illness, sudden lack of appetite, or an inadequate food intake causing muscle and fat loss and is at 5 percent. Underweight (15 percent) is a composite index for stunting and wasting. A child can be underweight for age because of stunting, wasting, or both. Weight for age is a good general indicator of a population's nutritional health. The most nutritionally vulnerable population groups are pregnant and lactating women, whose bodies must cope with the additional nutritional stresses and demands of pregnancy and lactation, and infants and young children up to two years. Food insecurity is the major underlying cause of malnutrition in Zambia. Only 36 percent of households in Zambia have enough food to eat, while 19 percent of households seldom or never have enough to eat, and are thus categorized as chronically food insecure (Sitko et al. 2011). Food insecurity is exacerbated by seasonal fluctuations in access to sufficient food by the majority of the Zambian population.

The interaction between HIV/AIDS and nutrition can basically be seen from two perspectives: (1) the biological perspective, which is the association between nutritional status and risk of infection, as well as the relationship of nutritional status and the evolution of the disease; and (2) the socioeconomic perspective, which considers the consequences of the disease for the food and nutrition situation of affected households and communities through lack of food, insufficient care, and lack of time to ensure hygiene (Egal and Valstar 1999). It is the latter interaction that we are mainly concerned with in this study. HIV/AIDS has a detrimental impact on household food security and nutrition in endemic areas. Household food security is defined as the ability of the household to secure, either from its own production or through purchases, adequate food to meet the dietary needs of its members so that they can lead a healthy and active life

In HIV/AIDS-affected households, problems start as soon as an adult becomes sick because this leads to increased spending for health care, decreased ability to carry out work, and higher demands on time for care. Children are then forced to stop going to school so that they can help with household chores. The other reason why children discontinue school is that the household can no longer afford the school expenses (Topouzis and Hemrich 1996; Egal and Valstar 1999). When eventually the AIDS patient dies, additional expenditure is made for the funeral and the productive capacity of the household is permanently reduced. Sociocultural practices may further aggravate the problems of the household, for example, when the surviving spouse cannot maintain access to the property of the deceased, especially if it is a male spouse that dies first.

Secondly, problems increase and accumulate when the patient's partner becomes sick. Later, the household may find that their cash reserves are finished; often it becomes indebted and is forced to sell livestock and

other productive resources. Traditional solidarity systems may wear out, and the family may progressively slide into destitution. Eventually, the household is reduced to elderly people and children. Essential skills are lost to the family and the communities as active adults die. Households affected by AIDS are at risk nutritionally: access to food is difficult; demand for care soars, together with time constraints; and it becomes increasingly difficult to preserve health (Topouzis and Hemrich 1996). The impact of the epidemic on food and agriculture is clearly related to people's livelihoods and will vary according to the different ecological zones, farming systems, and the stage of the epidemic. It may result in a shift from cash crops to less labor-intensive food crops, to more basic and less varied food production, or to a reduction of productivity and cash income with corresponding adverse effects on household food security (FAO 1995).

# Methodology

## Sample design and data collection

The baseline survey was carried out over a period of 6 weeks between October and November 2011 in the three districts where the MIRACLE project is being implemented—Kazungula in Southern province, Mansa in Luapula province, and Mumbwa in the Central province. The selection of the districts for MIRACLE project intervention was based on the prevalence of HIV/AIDS and malnutrition, the availability of partners and initiatives where this project could leverage resources and information, and the representativeness of the project sites to larger extrapolation domains. For example, Kazungula is part of the seven border and transport towns in Zambia with the highest HIV prevalence. For the baseline survey, four camps each were sampled from Mansa and Mumbwa districts; three camps were selected in Kazungula district (Fig. 1).

The study was based on a survey of 600 households distributed across the three 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 camps during selection of project sites. The sample size was calculated as follows:

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

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

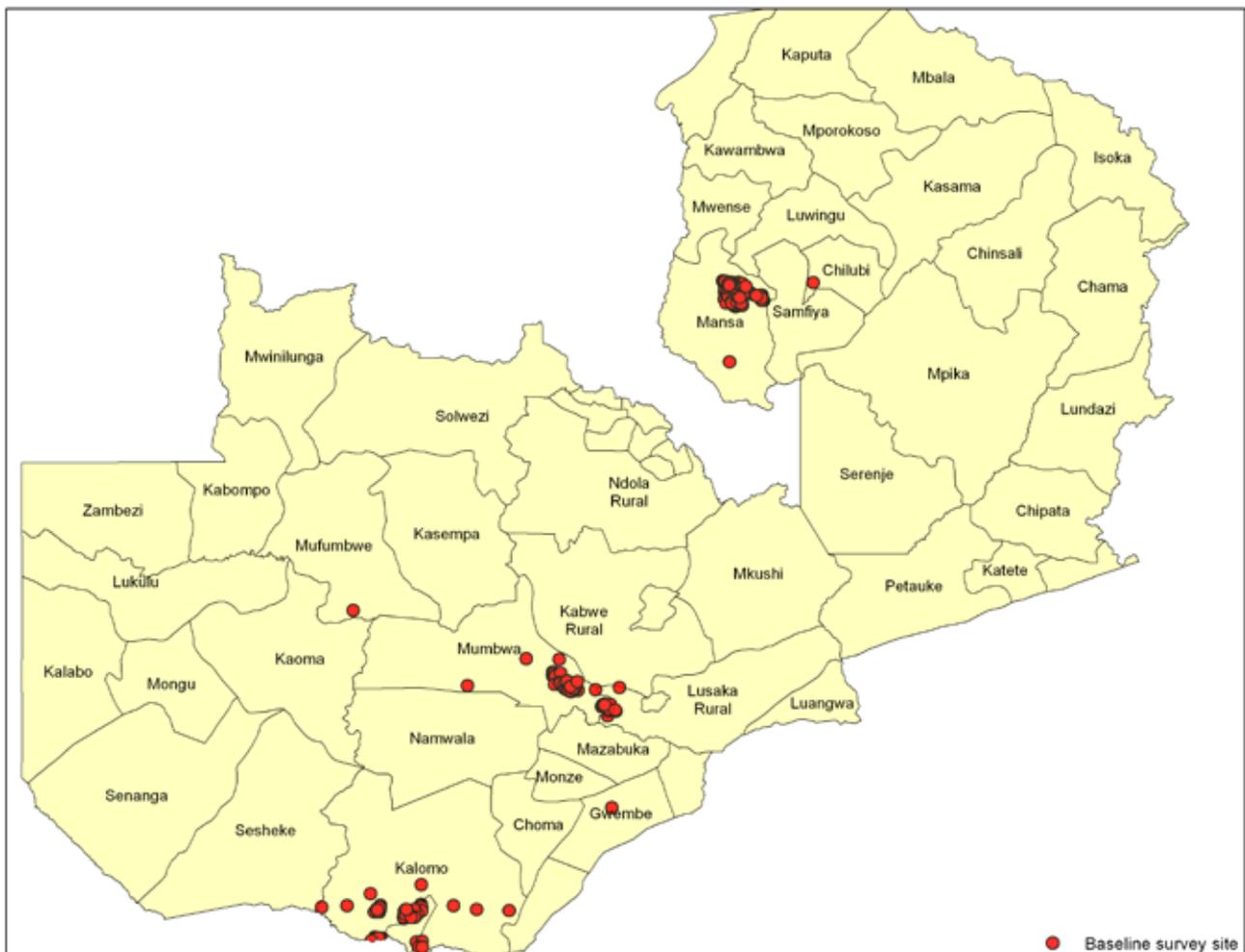


Figure 1. Baseline survey sites in Zambia.

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

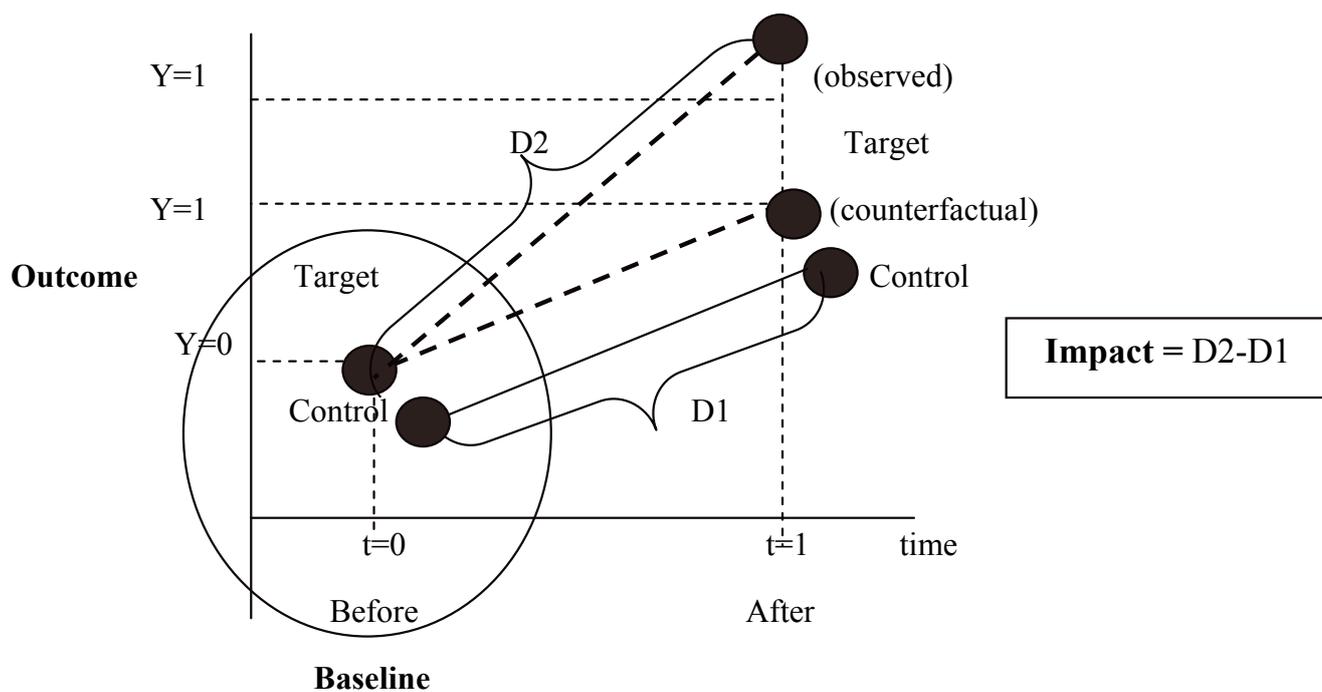
District	Camp	Number of households in camp (nHH)	Number of households as a proportion of all households (pHH= nHH/ $\Sigma$ nHH)	Sample households (N=pHH*nHH)
Mansa	Mibenge	750	0.04	26
	Mabumba	1800	0.10	63
	Kale	1300	0.08	45
	Resettlement	2000	0.12	70
Mumbwa	Chabota	486	0.03	17
	Martin Luther	1048	0.06	36
	Shikatende	1124	0.07	39
	Nampundwe	3986	0.23	139
Kazungula	Mandia	1285	0.07	45
	Mukuni	1615	0.09	56
	Musukotwane	1860	0.11	65
Total		17,254	1.00	600

In calculating the sample size, a response rate of 95 percent was assumed to account for a possible non-response rate of 5 percent and a design effect of 2 was used to account for multi-stage clustering in the selection of target areas of the project. This resulted in a sample of 600 households allocated proportionally across the study districts, with the sizes of the camps 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 camp through a census undertaken prior to the commencement of the actual survey. As not all communities and households in a target camp are likely to be reached through the MIRACLE project in just 3 years, each such camp is expected to have both target and non-target communities and households.

Detailed household level data collected between October and November 2011 using semi-structured questionnaires provided most of the information used to address the research questions. Community level analysis provided useful in-depth information on livelihoods and the infrastructural conditions of the communities in the study areas. The community-level surveys involved focus group discussions in the selected communities and interviews with key informants. The survey collected information on household demographics; farm and household assets; agricultural input use and crop production; marketing of crop and livestock products; sources of household income (both farm and non-farm income); extension services and technology adoption; farmers' groups and social capital; shocks and coping strategies; and household and livelihood dynamics.

### **Analytical framework**

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



**Figure 2. Difference-in-Difference impact evaluation method.**

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

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

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

## The logit model

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

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

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

where  $\beta$  is the vector of unknown parameters to be estimated and  $X_i$  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 ZMK1,454,850/capita/year (\$1.25/capita/day). It is related to the latent variable as follows:

$$Y = 1 \text{ if } Y^* > 0 \text{ (poor household)} \\ = 0 \text{ otherwise (non-poor household)} \dots\dots\dots (3)$$

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

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

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

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

where  $\Omega$  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

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

This ratio will give the odd 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 between both. The marginal effect of a given explanatory variable  $j$  on the probability of household  $i$  being poor is given by

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

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

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

- Gender of household head measured as 1 if head is male and 0 if female. Poverty is expected to be more pronounced among female-headed households. In Africa, more women than men are involved in rural economic activities, such as farming. However, at the same time, the majority of women in Africa have no rights to property, a factor that infringes on their access to either input or credit markets and this drags their households towards poverty (Apata et al. 2010).
- Age of household head is measured in years. We expect a positive relationship between age of household head and poverty status. Agricultural productivity is expected to decline with the age of the farm managers and consequently the household is expected to get poorer as the head of the household grows older (Mukherjee and Benson 2003).
- Education of household head was also included in the model, based on the hypothesis that human capital contributes positively to higher living standards and it was measured as years of schooling (Anderson et al. 2006). We therefore expect a negative relationship with poverty. In other words, access to education is hypothesized to reduce poverty, implying that the more educated the decision-maker the better skilled and productive he or she is and consequently experiences less poverty.
- Household size was measured by total number living in a household. We expect a positive relationship between household size and whether the household is poor or not (based on Mukherjee and Benson 2003).
- Presence of an orphan in a household (yes = 1, No = 0). We expect a positive relationship between the poverty level of the household and the presence of an orphan in that particular household (De Waal and Whiteside 2003). Along the same line, we also include the number of sick people in the household which was measured as whether a household had a sick person (1 = yes and 0 otherwise). We hypothesized that the presence of sick persons in a household increases its likelihood of being poor because the household expenditure increases and the productive time of the household members is reduced in taking care of the sick instead being invested (Salinas and Haacker 2009).
- The dependency ratio of a household was measured as a ratio of the number of children to the number of adults. Other things being equal, we expect households with a higher ratio of children to adults to have lower living standards, hence they would be poorer.

- The value of farm assets was also part of the explanatory variables and we expected it to have a negative relationship with poverty. In a study conducted to explore how farm productivity affects household poverty in Tanzania, Sarris et al. (2006) reported that poorer households not only possess fewer assets, but are also less productive.
- Livestock ownership was measured by the number of different animals, such as cattle, sheep, goats, pigs, and rabbits, and chickens, that the household owns, which are combined using a set of tropical livestock units (TLU).
- Land per capita was included as an explanatory variable with the hypothesis that, other things being equal, households with larger landholdings per capita are less likely to be poor. Literature on land ownership indicates that land enhances the chances of diversification into varieties of enterprises and thus improves the total farm profitability and reduces poverty levels (Jayne et al. 2008). Landholding size was not measured, but was estimated by the respondents.
- Off-farm income was included in the model as a share of the total household income. The expectation was that the higher the share, the lower the odds that the household is poor; hence a negative relationship was anticipated. Engagement in non-farm activities presents households with additional income for productive investment and/or consumption smoothing, which are expected to have a negative impact on poverty. In a study of resource-poor farmers in *Striga*-infested areas of western Kenya, Manyong et al. (2007) found that an increase in the share of off-farm income in total household income would reduce the household's probability of being poor.
- Access to credit (measured as a dummy that equals 1 if a household had access to credit facilities and 0 otherwise) is theoretically expected to reduce poverty through cash investment in productive activities and also in smoothing consumption. Policies and institutions that facilitate easier access by farmers to seasonal credit for intermediate inputs were cited as important in increasing agricultural productivity and reducing poverty in Tanzania (Sarris et al. 2006).
- Similarly, agricultural education, extension, and advisory services are 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 farmers to benefit from the agricultural knowledge and information system (Christopolos and Kidd 2000). Access to extension services was measured as 1 if a household had access to extension information and 0 otherwise. Farmers that readily have access to extension services are hypothesized to perform better in agricultural production, thus reducing poverty.
- To account for location differences in poverty among different communities, the logistic regression analysis used district-level fixed effects by incorporating district dummies in the model.

# Socioeconomic Characteristics of the Sample Households

## Household characteristics

Table 2 shows the socioeconomic characteristics of the sample households in the three MIRACLE project districts in Zambia. On average, about 60 percent of the sample households were female-headed (ranging from 51 percent in Mansa to 62 percent in Kazungula). However, it is important to note that the share of female-headed households in the total sample for this study is higher than the national level, which was about 23 percent in the 2010 population and housing census. Distinction of household heads by sex is important because it is often associated with aspects of household welfare. For instance, female-headed households in Zambia are typically poorer than male-headed households (ZCSO 1998; 2010). The average number of persons per household in the study area is 6.3. This is not consistent with national average of 5.2 persons per household, according to the 2010 population and housing census report. The mean age of the household heads is 53 years.

The latest value for the age dependency ratio (percentage of working-age population) in Zambia was 98 as of 2010. Over the past 50 years, the value for this indicator has fluctuated between 100 in 1979 and 90 in 1960. This statistic gives an indication of how much responsibility economically active persons have in providing for dependents younger than 15 years and older than 64 years. In the studied area, the average age dependency ratio is 97, implying that every 100 working persons are providing for about 97 persons. It is worth noting that this is slightly lower than the national average.

**Table 2. Socioeconomic characteristics of the sample households in Zambia.**

Characteristics	Kazungula (n = 165)	District Mansa (n = 204)	Mumbwa (n = 234)	All (n = 603)
Household demography				
Male-headed households (%)	38	49	40	43
Female-headed households (%)	62	51	60	57
Household size	6	6	7	7
Dependency ratio (all)	0.9	1	1	1
Age of the household head (years)	50	54	55	53
Widowed household heads (%)	44	38	55	46
Households with orphans (%)	67	71	65	68
Education of household head				
Years of schooling	6	6	5	6
Illiterate (%)	10	15	17	14
Asset ownership				
Total cultivated land (ha)	1.6	1.6	2.2	1.8
Livestock ownership (TLU)	3.1	1.2	4.7	3.1
Hoe (%)	100	100	100	100
Radio (%)	47	50	56	52
Bicycle (%)	29	53	58	48
Mobile phone (%)	60	50	59	56
TV (%)	17	11	18	15
Irrigation pump (%)	6	3	6	5
House with cemented floor (%)	10	17	16	15
House roofed with iron sheets (%)	21	16	30	23

Note: TLU = Tropical Livestock Unit

Another important issue to discuss is that of widow-headed households and its implications. The HIV/AIDS pandemic has substantially increased the number of widow-headed households in Africa. Using nationally representative rural survey data from Zambia: 9.4 percent of households were headed by widows in 2001 and 12 percent in 2004. Approximately 7 years later, the figures for the study area show that 46 percent of households were headed by widows.

This has serious implications when it comes to inequalities in property ownership. Various conceptual and qualitative studies highlight gender inequalities in property rights and that widows face difficulties in retaining access to land after the death of their husbands (Milimo 1990; Armstrong 1992; WLSA 1997; UNECA 2003; Mutangadura 2004; Shezongo-Macmillan 2005). In addition to the high rate of widow-headed households, most households (48 percent) had at least one orphan living within the household.

The majority of the household heads in the study area were literate, as shown by an average illiteracy rate of 14 percent. They had an average number of years of schooling of 6. This is good in terms of extension knowledge uptake or the adoption of innovative technologies in the area. The more literate people are, the higher the adoption of innovations.

## **Productive assets**

### **Land ownership**

Research has demonstrated that relatively egalitarian land distribution patterns have tended to generate higher rates of economic growth than those that are highly concentrated. The reason for this is that equitable land distribution is more likely to produce broad-based and inclusive agricultural growth. Broad-based agricultural growth tends to generate a greater demand for goods and services produced in rural areas and towns. In this way, rural and urban populations create a market for each other. These beneficial growth effects tend to be much weaker when the source of agricultural growth is concentrated in relatively few hands. Thus the rate of growth is likely to be affected by the distribution of assets in the agricultural sector, particularly land. Zambia has a total surface area of about 752,614 km<sup>2</sup> of which 47 percent (353,729 km<sup>2</sup> or 35,351,708 ha) is arable land, 30 percent National Parks and game management areas (225,784 km<sup>2</sup>), and hills and swamps take up 12 percent (90,313 km<sup>2</sup>). Forests cover 12 percent of the land while urban development takes up only 2 percent. Only about 14 percent of the arable land is presently cultivated (Chizyuka et al. 2006). However, much of the remaining 86 percent of arable land is remote, and could support only a subsistence-oriented agricultural production system unless accompanied by substantial public investment in roads and public services to support the development of communities and commercialized agriculture.

It might be considered unlikely that inadequate access to land would be one of the major causes of rural poverty in Zambia. However, economically viable arable land is not in great abundance in Zambia after the current situation is considered with respect to access to road infrastructure and access to services and markets. In fact, access to land is already a major problem for much of the rural population and this problem will become more acute with time. The bottom line is that Zambians would be well served to realize that good land is not an unlimited resource and that using State resources to cede millions of hectares for commercial development will come at a high cost to future generations who will need new land for their future livelihoods (Jayne et al. 2008). The mean landholding size for the study area is 1.8 ha per household. Households from Mumbwa have significantly larger land holdings (2.2 ha) than households from other two sites. Land is a vital asset to the population in the study area since their livelihood is dependent on agriculture.

## **Livestock ownership**

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

Livestock also provide a safety net in times of need in the form of liquid assets and a strategy of diversification for food production (Freeman et al. 2007). All these reviews and studies thus far have shown that livestock play multiple roles in the livelihoods of people in developing communities, especially the poor. Beyond the important role that livestock play in the provision of food and nutrition in people's diets, they also have important social functions. They raise the social status of owners and contribute to gender balance by affording women and children the opportunity to own livestock, especially small stock (Waters-Bayer and Letty 2010). The livestock prevalence in the study area is 3.1 Tropical Livestock Units (TLUs) with Mumbwa having the highest TLU of 4.7.

## **Household assets**

In this study, household assets refer to all the household's productive and non-productive assets, namely farm tools and implements, communication materials, as well as the housing condition. The number of hand tools varies according to the size and the wealth of the household in sub-Saharan Africa. Most households own an essential range of hand tools that differs slightly according to farming system and region. The universal tools are the hand-hoe (usually short-handled), axe, panga/machete, sickle, and cutlass. Even tractor-owning households maintain a full complement of hand tools because so few operations are mechanized. Ideally, households own a few axes, pangas/machetes or cutlasses, and a sufficient number of hoes and sickles for each member of the family who is able to work with them. In practice, poorer households do not have enough of the essential implements for all household members and some resort to borrowing from neighbors. Worn-out hoes and cutlasses are usually passed down from men to their wives and children for use for lighter tasks. It is therefore not surprising to see that all of the households in the study area owned at least one hoe. Only 5 percent of the sampled households had an irrigation pump. This shows either that irrigation is not commonly practiced in the study area or that people lack the capital to purchase an irrigation pump because it is expensive.

Ownership of radio, television set (TV), and mobile phone is an important factor when it comes to information dissemination. Almost all the latest innovations in Zambia are announced or advertised on different radio stations and on TV. Consequently, a household with either of these assets has a higher comparative advantage when it comes to technology acceptance and adoption. While it is good to see that slightly above half of the households in study area own radios, the ownership of TVs is still very low at 15 percent. This implies that most people in the area are still poor because ownership of TV is related to being wealthy in most rural areas of Africa. About 60 percent of households own a mobile phone which is important for communication. This means that in this area sharing of new ideas among different stakeholders and communities can be relatively easier.

One of the major barriers to improving the health of people living with HIV/AIDS, orphans and vulnerable children, and youth-headed households is their lack of access to health care. Access is particularly difficult in rural areas with poor transportation and communication. In rural Zambia, most individuals travel long distances

on foot to obtain services, help those in need, or collect water. Time spent walking on long journeys limits other potentially more fruitful activities such as farming, small business development, regular attendance at school, and caring for community members in need. Therefore, bicycle ownership improves their livelihoods. About 50 percent of the sampled households own a bicycle.

Although development efforts have created extensive road networks in much of sub-Saharan Africa (SSA) wheeled transport remains unavailable to most farmers. The inability to transport their crops to market prevents many farmers from entering the market economy (Wendroff 1993). Without access to efficient and affordable transport, farmers in eastern and southern Africa have little choice but to “carry farm inputs and produce on their heads and shoulders”, work that is “slow, difficult, and tedious” (Kumwenda 1998). If African farmers, restricted by the limitations of human muscle power, are ever to succeed in extending their cultivation beyond the subsistence level (Dibbits 1993; Kumwenda 1999), they will have to make use of wheeled devices to increase their work efficiency. Animal-drawn vehicles are far beyond the means of most African farmers. Smallholder farmers live on their farms and engage in a variety of agricultural and non-agricultural transport activities. It has been estimated that the typical household in SSA spends annually 200 to 450 hours on agricultural transport, and 600 to 1500 hours on domestic transport, mainly in providing itself with water and firewood. “About 75 percent of the transport activity involves short trips, less than 6 km, in and around the village, e.g., to and from the fields” (Dennis 1993). Water collection is a daily activity in most households, and firewood is gathered every few days. Both tasks are almost exclusively carried out by women using head loading (Barwell 1996). This burdensome domestic transport uses up time and energy that could otherwise be applied to productive agricultural activity. The increasing demands leave African women with that much less leisure time (Bishop 1995) and erode that much further their quality of life (Clarke 2000).

The use of bicycles is widespread in Zambia rural areas and is said to be one of the key factors in the recovery of its rural economy. They are used extensively by producers, suppliers, and marketers of the country’s staple food (green bananas) but also to export other commodities and cash crops in rural areas. Traffic counts on rural Ugandan roads of both pedestrians and vehicles found that bicycles were 22 percent of the traffic. Most of these bicycles are operated on bad roads and tracks (Riverson and Carapetis 1991). However, the cost of owning and operating a bicycle is very high for Africa’s rural population in comparison with their compatriots in other parts of the world. For example, Zambians would spend 40 percent of their annual income to buy a bicycle, while Malawians would need to spend their earnings from over 650 days of work at the rural minimum wage to do so. In comparison, Bangladeshis require only 80 days of rural minimum wages to own a bicycle. China has 270 bicycles per thousand people, but the estimate for Africa stands at only 35 per thousand. In Malawi, the price of bicycles rose sharply after the number of import licenses was restricted and competition was stifled until the restriction on licenses was lifted in the early 1990s and sales of bicycles rose again.

In relation to housing, all households own at least one house. Although there is universal ownership, the quality of those houses differs. Only 23 percent of households live in iron-roofed houses, while 15 percent dwell in houses with a cemented floor.

# Crop Production and Marketing

## Cropping patterns

Cropping patterns of the households in the study area for 2010/2011 cropping season are assessed in this section. Table 3 shows a portfolio of major crops in the study area including the proportion of households growing each crop by gender of household-head. Major crops grown by both male- and female-headed households are maize and cotton. This is not surprising because maize is the main staple food for Zambia while cotton is one of the major cash crops. However, the results further show that millet and groundnut are mainly grown by women. We can speculate that these are probably among the coping/crop diversification strategies for these vulnerable households.

Results in Figure 3 indicate the proportion of households producing selected major crops in the study area. The majority of households in all the three districts produced maize. Vegetables are equally produced by almost similar proportions of households in the study area. Otherwise we see some great variations in the proportions of households producing other crops, such as cassava, soybean, cowpea, and sweetpotato. This variation could be largely attributed to agroecological differences and market availability across the districts.

Consistent with the distribution of households growing each major crop in the study area, maize is allocated the largest share (52 percent) (Fig. 4) of the total cultivated land, followed by cassava (42 percent). Soybean and sweetpotato are allocated the smallest share (9 percent each) of the total cultivated land.

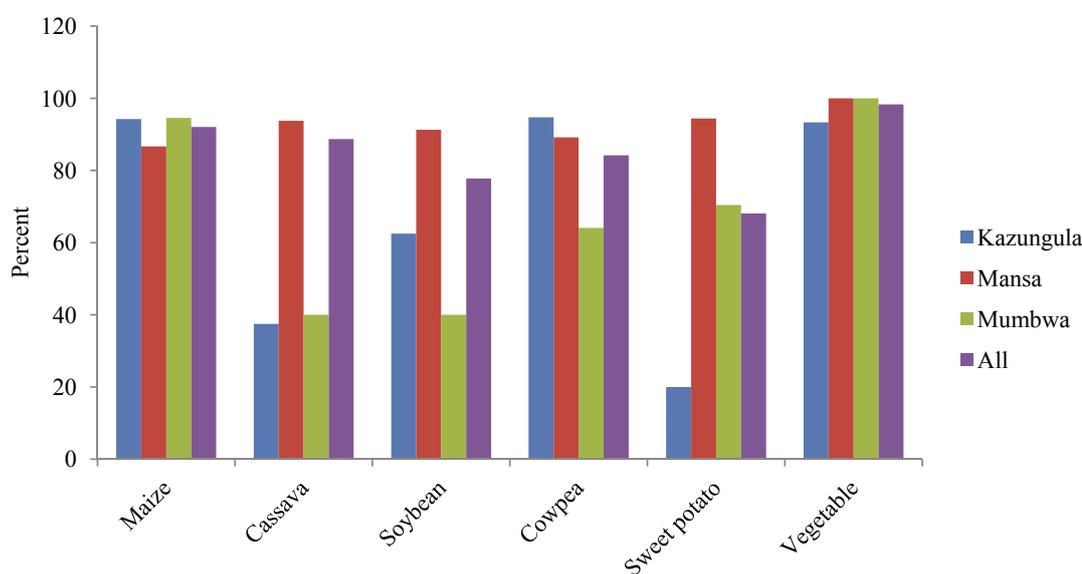
## Marketing participation

### Crop market participation

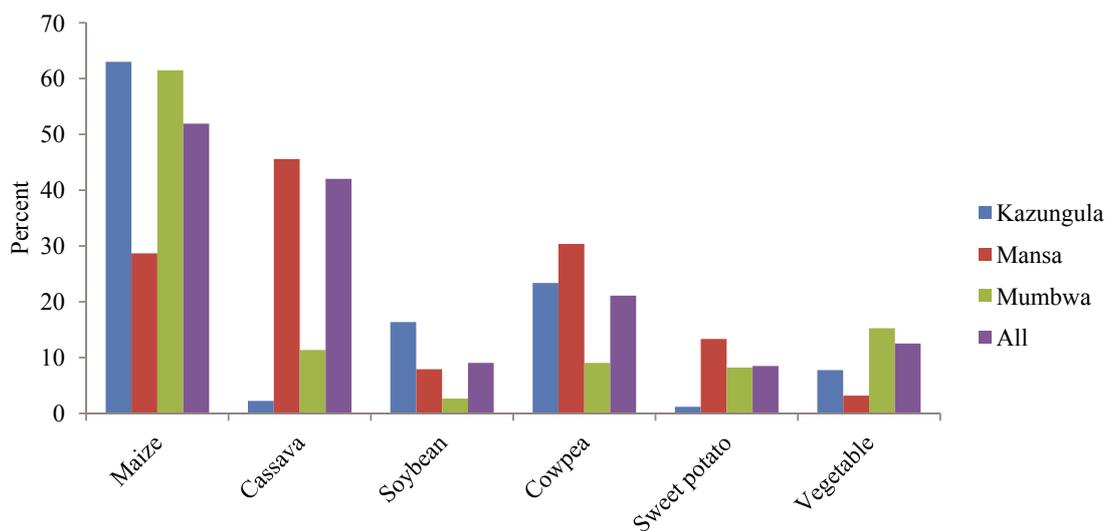
Smallholder farmers' access to markets and agricultural support services has been a major concern for policymakers in SSA. As with many other governments, the agricultural policies of the Zambian Government

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

Food crop	Male-headed	Female-headed	Cash crop	Male-headed	Female-headed
Maize	75	65	Cotton	71	62
Cassava	21	23	Vegetables	7	5
Millet	1	7	Groundnut	2	8



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



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

**Table 4. Proportion of producers of major crops who also sold in Zambia (%).**

Crop	District			
	Kazungula	Mansa	Mumbwa	All
Maize	12	47	29	30
Cassava	13	37	10	34
Soybean	13	13	20	14
Cowpea	2	16	0	5
Sweetpotato	6	41	12	21

particularly for maize, have fundamentally been conceived as a response to perceived market failure and weak access to markets for rural smallholder farmers. There is a widespread perception that private traders and input suppliers are not able to service rural farmers located in remote areas, and for these reasons the state must directly invest in the Marketing Board infrastructure to provide a market for smallholders' surplus production (Chapoto and Jayne 2011).

Access to regular buyers who pay fair and stable prices motivates marginalized rural households to diversify and invest more of their labor and available capital in market-oriented farming and processing activities, thus increasing their food security and total income. Many of Africa's most marginalized rural populations live in areas that are cut off from main roads or transport infrastructure, and are therefore potential consumers of their farming output. They lack access to the finance, the organizational, business, marketing and technical skills, as well as the information and technology that could help them to meet the quantity and quality requirements of buyers such as supermarkets, agricultural processing enterprises, wholesalers, or export firms. This problem is compounded by the very small sizes of their individual landholdings—the result of unequal land distribution—and their insecure land tenure arrangements. Therefore, too often, farmers who try to sell their surplus remain susceptible to the vagaries of farmgate traders who offer below-cost prices, or localized markets that can become saturated very quickly if too many local producers try to sell the same produce at the same time.

From Tables 4–6 we see a summary of how producers from the study area handled their produce in terms of marketing. In Table 4, it is revealed that only about one-third of the production of major crops was sold within Zambia. At the same time, Table 5 indicates higher proportions of producers who were buying major crops. We presume that this was mainly the buying of produce from the same locality. We can therefore speculate that the study area we are dealing with is not so much into commercial farming but rather subsistence farming and they sell only the surplus. Those producers who buy the produce could be those who are engaged in petty trading, that is why in Table 6, the proportions of households buying and selling crops is very low.

**Table 5. Proportion of households that bought crops (%).**

Crop	District			All
	Kazungula	Mansa	Mumbwa	
Maize	54	49	41	47
Cassava	63	33	40	35
Soybean	38	35	80	42
Cowpea	19	32	26	25
Sweetpotato	83	38	31	45

**Table 6. Proportion of households that bought and sold crops in Zambia (%).**

Crop	District			All
	Kazungula	Mansa	Mumbwa	
Maize	1	20	4	8
Cassava	0	11	0	10
Soybean	0	4	0	3
Cowpea	0	5	0	2
Sweetpotato	0	20	0	7

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

Buyer	District			All
	Kazungula	Mansa	Mumbwa	
Rural assembler/middlemen/traders	35	51	20	37
Consumers/other farmers	45	31	38	35
Government/parastatal	17	17	14	16
Processors	2	1	23	10
Private companies	0	0	6	2

### Major buyers of crops

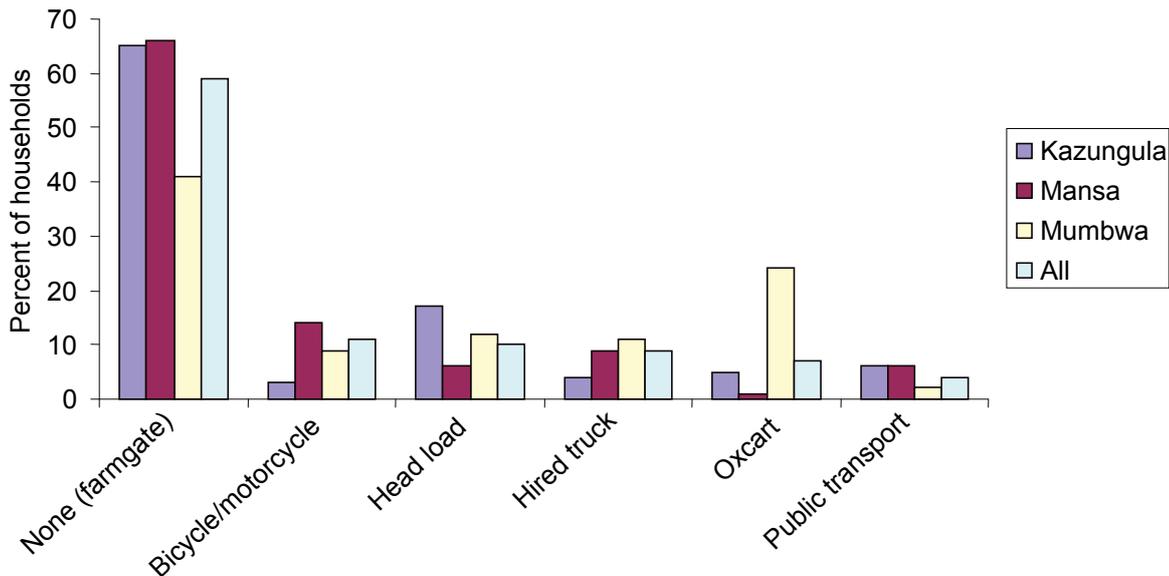
Most of the crops produced in the study area are sold to small-scale businessmen (rural assemblers/middlemen and traders) who mostly act as brokers for large-scale traders dwelling in big towns or cities. The other major buyers of the produce from farmers in the three districts are fellow farmers or rural households who buy to supplement what they produced in their own households (Table 7). There is little market participation in the study area from Government, parastatals, processing companies, and other private companies. This shows that farmers lack access to good quality markets which can offer reasonable prices for their produce. This might lead to the exploitation of farmers by brokers. This is surprising, however, because in Zambia, in general, it is the Government that buys crops, such as maize, at a very good price and resells it to processors/millers that make flour from it for sale to consumers.

When we assess the self-sufficiency status of the households in the study area in food production, we find that only about 30 percent are self-sufficient in maize. These are the households that produce enough maize to feed themselves throughout the year and they never sold any to traders. When it comes to root crops (cassava and sweetpotato), about 40 percent of the households are self-sufficient. The majority (66 percent) of cowpea producers never bought or sold any grain; 44 percent of soybean producers are self-sufficient.

### Mode of transport for marketing

Respondents who sold some of their produce were asked to provide information regarding the main mode of transportation that they used to go to the market. As shown (Fig. 5), the majority did not use any transport as they sold their products at the farmgate. This means most people sold to mobile middlemen. In Mansa district, most people used a bicycle or motor cycle to carry their produce to markets, while a head load (carrying on head and walking on foot) is the most prevalent method of the transportation of produce in Kazungula. The ox-cart is the major mode of transport to market in Mumbwa district. Other means of transport also used in the study area are public transport and hired trucks.

**Mode of transport used for marketing produce**



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

# Technology Preferences and Adoption

## Farmers' preferences

Farmers were asked to provide information on their preferences pertaining to different traits for the varieties of major crops grown in the study area. One of the reasons for the low adoption of improved varieties is argued to be the fact that most improved varieties lack the characteristics valued by farmers. This has been, in turn, due to the failure of crop improvement programs to involve farmers in the process of designing and developing improved varieties with a view to meeting their priorities and preferences. Figure 6 shows that farmers look for earliness in maturity as the most-preferred trait in any variety of the major crops grown. The second most preferred trait in a variety is high yield, especially for soybean, maize, and sweetpotato. Early maturity in food crops is preferred to high yield may be because of food security purposes. This would help shorten the hunger periods. But a high yield is more important for cash crops such as soybean. For cassava and sweetpotato, root size and color are also important traits that will enhance adoption for new varieties. The study found that farmers also prefer varieties with other traits such as resistance to pest and diseases, drought tolerance, taste, short cooking time, and high starch content.

## Sources of information on improved crop varieties

Variety knowledge is a necessary condition for variety adoption although it does not guarantee that the knowledge alone about a variety would cause it to be adopted. In this study, farmers provided the sources of information about the modern varieties that they knew. Although the highest proportion of farmers indicated extension agents as the major source of information about new varieties in the three districts, the proportions of other sources of information were variable in different districts (Fig. 7). For example, radio/TV was the second source of the information on modern varieties in Mumbwa and Mansa districts; in Kazungula, NGOs play a greater role in extending such information to farmers. In Kazungula, 32 percent of households indicated that they had heard information about modern varieties from NGOs which is the same as the rate for extension agents. Information on modern varieties was also relayed to farmers through neighbors, farmers' cooperatives, seed traders/agrodealers, and the research center. The results further indicate that the research center is helping a lot in bringing more information about existing technologies to farmers in Kazungula than in the other two districts.

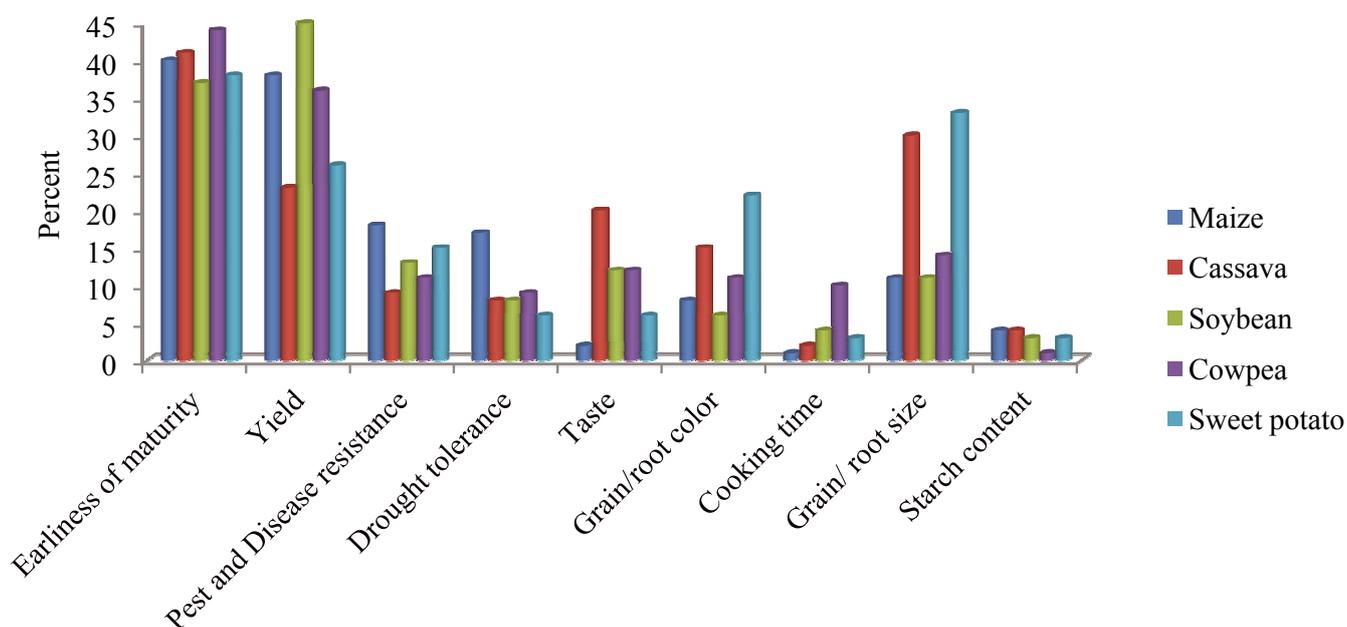


Figure 6. Most-preferred traits for major crops in Zambia (%).

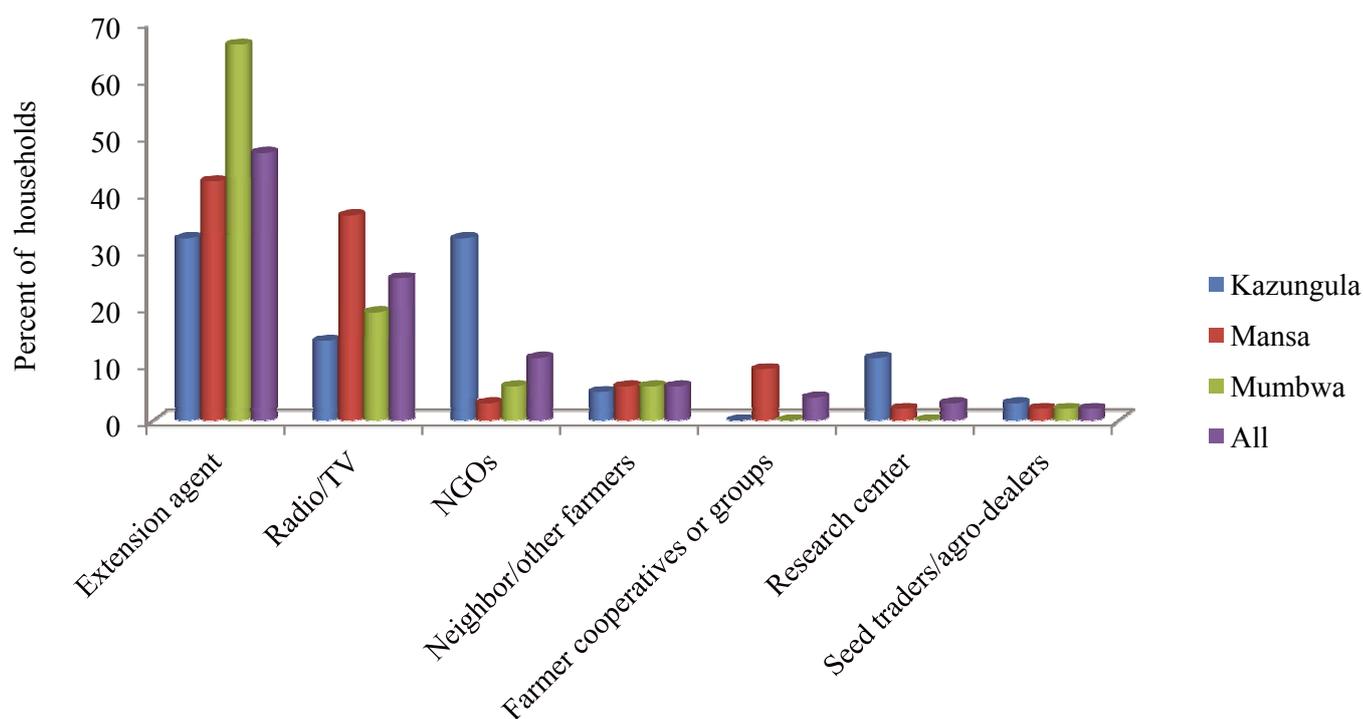


Figure 7. Source of information on modern varieties in Zambia (%).

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

Crop	District			All
	Kazungula	Mansa	Mumbwa	
Maize	35	22	33	30
Cassava	25	38	30	37
Soybean	38	57	0	44
Cowpea	77	51	64	66
Sweet potato	9	39	55	40

Table 9. Adoption of improved varieties of major crops in Zambia (% households).

	District			All
	Kazungula	Mansa	Mumbwa	
Maize	58	51	89	68
Cassava	3	31	2	12
Soybean	1	4	2	2
Cowpea	8	3	3	4
Sweet potato	4	16	3	8

## Adoption of improved crop varieties

Feder et al. (1985) conducted a comprehensive literature survey on the adoption of agricultural innovations. They list factors that have been frequently identified as being influential in determining the adoption of an agricultural innovation. These include farm size, risk exposure and capacity to bear risks, human capital, labor availability, credit constraint, tenure, and access to commodity markets. We note that farmers in the study area had also adopted improved varieties for some of the major crops grown. In all districts, the adoption of improved varieties of maize was high at 58 percent in Kazungula, 51 percent in Mansa, and 89 percent in Mumbwa (Table 9). Improved maize varieties had the highest average adoption rate (68 percent) followed by improved varieties of cassava (12 percent) and sweetpotato (8 percent). Very few farmers adopted improved

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

	District			All
	Kazungula	Mansa	Mumbwa	
<b>Maize</b>				
Lack of seeds	35	29	29	31
Lack of cash for seeds	63	68	69	67
Local varieties are better	2	2	0	1
<b>Cassava</b>				
Lack of seeds	81	69	85	80
Lack of cash for seeds	15	22	13	16
Local varieties are better	2	6	0	2
<b>Soybean</b>				
Lack of seeds	75	86	85	82
Lack of cash for seeds	21	14	13	16
Local varieties are better	2	0	0	1
<b>Cowpea</b>				
Lack of seeds	77	90	88	85
Lack of cash for seeds	19	10	10	12
Local varieties are better	2	0	1	2
<b>Sweetpotato</b>				
Lack of seeds	80	82	91	85
Lack of cash for seeds	16	6	6	9
Local varieties are better	2	10	1	5

varieties for soybean and cowpea. We can therefore speculate that, within the study area, there is more adoption of improved varieties for cereals, then for roots and tubers, and finally for legumes. This trend could be attributed to the fact that there are various multinational seed companies interested in the multiplication of hybrid maize that require farmers to buy seeds every year—it is a business for those seed companies. These companies show no or little interest in the multiplication of self-pollinating crops, such as legumes, that farmers can easily share with one another once the seeds have been made available to them without actually relying on the seed companies.

### Reasons for non-adoption

Since we found out that improved varieties were not universally adopted, we went further to find out the reasons for the non-adoption of improved varieties by some households within the study area. Based on results from the study presented in Table 10, we found that the major reason for non-adoption of improved varieties of maize was the lack of cash to purchase seeds. Farmers (80 percent) mentioned lack of seeds or limited availability of the improved planting material as the main constraint to adopting new varieties of cassava. We further find that the major contributing factor to the non-adoption of soybean, cowpea, and sweet potato is a lack of seeds, followed by lack of cash to purchase the improved varieties. This means that if seeds for improved varieties can be made available while credit facilities are also made available to farmers, the adoption of these improved varieties would improve for all crops.

# Poverty and Household Welfare

## Household income

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

## Crop income

Farming is the main occupation through which almost all households earn their living in all the three districts. The average annual per capita income for the study area is US\$955 (ranging from US\$716 for Kazungula to US\$1105 for Mumbwa) (Table 11). We can therefore comfortably speculate that, on average, all households are not very poor because the average daily income is way above the poverty line of US\$1.25/day used in Zambia. But a further analysis of poverty, taking each household separately, reveals that about 40 percent of the households live under the poverty line. Kazungula had the poorest population since over half of the households lived under the poverty line. This implies that we are dealing with a mostly poor population whose livelihood situation would be worsen if hit by the negative effects of the HIV/AIDS pandemic. From the figures we can also deduce that there is a big gap within the districts between the well-to-do households and the poorest, which is why we end up with an average indication of the households not being poor when we put them together. The average gross value of production is US\$686 and the average net returns/ha is US\$671 (Table 11).

## Off-farm activities

Although farming is the main occupation in the study area, 80 percent of the households also engage themselves in off-farm employment. On average, about 90 percent in Kazungula seek off-farm employment; 76 percent in Mansa, and 75 percent in Mumbwa have off-farm employment (Table 11). So apart from earning a living from farming activities, households complement their livelihood strategies with other non-farm activities,

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

Strategies/Outcomes	District			All
	Kazungula	Mansa	Mumbwa	
Farming as primary occupation (%)	92	97	96	95
Household income (US\$/capita/year)	716	982	1105	955
Gross value of production (\$/ha)	345	850	796	686
Net returns (\$/ha)	335	818	772	671
Crop income share in household income (%)	54	75	70	62
Livestock income share in household income (%)	7	4	11	10
Off-farm income share in household income (%)	39	21	19	28
Off-farm employment (%)	89	76	75	79
Artisan work/handicraft	14	3	5	8
Unskilled wage labor (e.g., daily laborer)	24	20	23	21
Skilled wage labor (e.g., carpentry)	6	8	9	9
Petty trade (e.g., retail shop, vending)	32	32	24	33
Drought Relief	1	2	4	3
Food for Work	5	10	7	7
Remittances	18	25	28	19

such as artisan work/handicraft, unskilled and skilled wage labor, petty trading, Food for Work and also, most importantly, they get remittances from other members of the household or relatives who live away from the communities.

### Income shares

Crop income represents the highest share of household income indicating that the main source of income in the study area is crop production. The second highest share of household income comes from off-farm income which takes about a 30 percent share of household income (Table 11). Livestock represent only about 10 percent of household income.

### Poverty profile

Poverty is widespread in the rural areas where the people are in a state of human deprivation with regard to incomes, clothing, housing, food, health care, education, sanitary facilities, and human rights (Simler et al. 2004; Fox et al. 2005). Food security is when people have year-round access to the amount and variety of safe foods required by all household members in order to lead active and healthy lives, without the undue risk of losing such access. The opposite of food security is food insecurity. The study investigated how food secure the people are in the study area. This is the self-reported perception of food insecurity based on the judgment of the head of a household. Figure 8 profiles the poverty in the study area based on income and compares it with levels of food insecurity. The results indicate that 37 percent of people in the study area live below the poverty line. This is below the national figure of about 60 percent as reported by the World Bank (2010). Kazungula has the highest rate (52 percent) of households living under the poverty line compared with the other two districts that were studied. In terms of food insecurity, Kazungula again has the highest rate of 66 percent of households which cannot provide enough food for their members to last the whole year. Even though in Mumbwa only 28 percent of households are poor, over twice this figure are food insecure (62 percent).

### Determinants and correlates of poverty

Poverty is a multi-aceted 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, to prepare strategies for more efficient intervention schemes aimed at poverty reduction. The

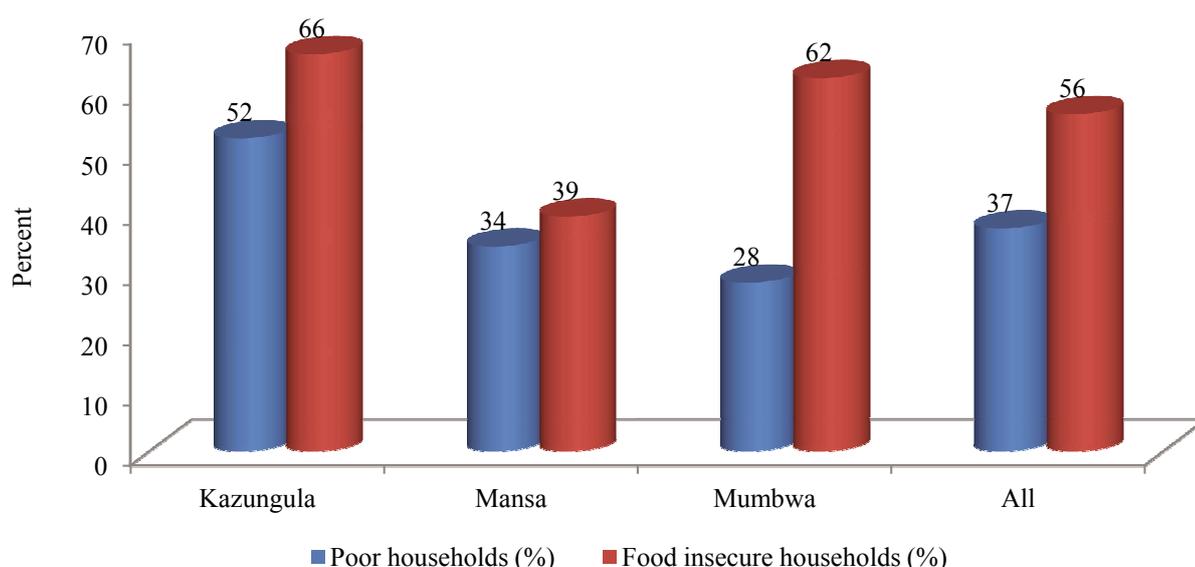


Figure 8. Household poverty and food security in Zambia.

\* Poverty line = ZK1, 454,850/capita/year (equivalent to US\$1.25/capita/day at purchasing power parity).

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

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

Variables	Estimate	T-ratio	Marginal effect	% change in probability of being poor
Constant	6.648****	4.60		
Gender of household head (male=1)	-0.154	-0.62		
Age of household head (years)	-0.004	-0.56		
Education of household head (years)	-0.63	-1.61		
Household size	-0.165**	-2.25	-0.027	-2.7
Orphan in the household (yes=1)	-0.302	-1.27		
Dependency ratio (child/adult)	-0.009	-0.09		
Log of value of farm assets (ZMK)	-0.325**	-2.52	-0.052	-5.2
Livestock ownership per capita (TLU)	-0.163	-0.84		
Land per capita (ha)	-2.256**	-2.42	-0.362	-36.2
Off-farm income share in total income	-1.381***	-2.97	-0.222	-22.2
Access to credit (yes=1)	-0.122	-0.52		
Access to extension services (yes=1)	-.102	-0.44		
Sick person in the household (yes=1)	0.130	0.57		
<b>Location</b>				
Mansa	-1.358****	-4.28	-0.230	-23
Mumbwa	-1.054****	-3.70	-0.186	-18.6
<b>Goodness of fit tests:</b>				
Hosmer-Lemeshow chi-squared (538)	680****			
Likelihood Ratio chi-squared (15)	75.24****			
Pseudo R-squared	0.18			
Correct prediction	77%			

Note:\*\*\*\* $P < 0.001$ , \*\*\* $P < 0.01$ , \*\* $P < 0.05$ , \* $P < 0.1$ .

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. 2001).

### Empirical results

The logit maximum likelihood estimates and marginal effects are presented in Table 12. Marginal effects from the logit model provide a good approximation of the amount of change in the dependent variable produced by a unit change in each explanatory variable while holding all other factors constant. The marginal effects were computed only for the significant variables in the model and converted into percentages. Goodness-of-fit tests were carried out to determine the strength of the model. Both Hosmer-Lemeshow 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 (77 percent).

The logit analysis results in Table 12 show that households with higher household sizes are less poor. This is contrary to our expectation, as discussed under the methodology section. This could be attributed to the fact that even though larger households, on average, have less income, they do not associate household size with poverty, but rather, derive a sense of belonging, support, and care that feeds positively into their perception of well-being (World Bank 1995; Devereux et al. 2006). This finding is also in contradiction to other studies which found that poor households are generally larger than non-poor households. The larger household size reflects the higher number of dependents in poorer households, which is largely driven by the higher number of children in the

household (World Bank and Malawi Government 2006). It is noteworthy that this finding is not uncommon as studies elsewhere have also found that the poverty level seemed to decrease with a higher household size (Kamuzora and Gwalema 1998; Kamuzora and Mkanta 2000).

One of the most significant results is the relationship between poverty and access to land. Land is fundamental to the lives of poor rural people. It is a source of food, shelter, income, and social identity. Secure access to land reduces vulnerability to hunger and poverty (IFAD 2009). We find that an additional hectare of land per capita reduces a household's probability of being poor by 36 percent. This result is consistent with the expectation that rural household poverty is associated with poor access to land (Cotula et al. 2006; Jayne et al. 2008.) Studies in Malawi found that an additional hectare of rain-fed land corresponded to an increase in per capita consumption by 4 percent on average (World Bank and Malawi Government 2006; World Bank 1995). A separate study also showed that access to land via agricultural production is one of the important factors that can translate growth into poverty reduction (Chirwa 2004).

Assets can empower the rural poor by increasing their income, reserves against shocks, and choices to escape from harsh or exploitative conditions. Assets most help rural poverty reduction when they are employment-intensive, divisible into small low-cost units, and low-risk (Lipton 2001). Other farm assets, including farm tools and equipment, constitute important capital in farming. The results indicate that households owning more farm assets have lower odds of being poor. This corroborates the findings of a study in Uganda that ownership of farm equipment reduces the likelihood that a household is chronically poor (Ssewanyana 2010).

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

Finally, regional location remains an important determinant of poverty. The regional location factor effectively reflects differences in opportunities and characteristics which have not been already captured by other variables in our model. With regard to location effects on poverty, households in Mansa and Mumbwa districts have a lower probability of being poor than those in Kazungula. The econometric results thus lend strong support to the descriptive result showing that Kazungula (52 percent) has the highest poverty level. This is consistent with other reports showing that the southern province (where Kazungula is situated) is poorer than the Luapala and Central provinces of Zambia (IFAD 2010).

### **Household shocks and coping strategies**

We assessed self-reported trends of economic well-being in the study area by asking the households how they perceived the change in their economic well-being for the past year and what they expected in the coming year. In general, 44 percent reported that their well-being had worsened from a year ago, while 30 percent reported that their economic well-being had improved. The rest had seen no change in their economic status. However, it is a little different when we analyze this across the districts. According to Table 13, Kazungula and Mumbwa had more households whose economic status had deteriorated while for Mansa, the proportions for those who felt it had changed for the better are almost equal to those who felt their well-being had worsened. It is worth noting that when it comes to expectations in the year to come, the majority (52 percent) expect that their economic status would improve and 34 percent perceive that their economic status would not change. This is a good indication that there will be a general improvement of livelihoods in the study area.

**Table 13. Important sources of welfare shock and trends in economic well-being (%).**

	District			All
	Kazungula	Mansa	Mumbwa	
<b>Changes in economic well-being from a year ago</b>				
Better off	31	36	25	30
Worse off	44	35	51	44
Same	25	29	24	26
<b>Expected economic well-being a year from now</b>				
Better off	52	57	48	52
Worse off	14	7	20	14
Same	34	36	32	34
<b>Source of shock</b>				
Sickness/death of household head/member	27	50	43	41
Poor harvest due to drought	48	6	23	24
Rising input prices	5	19	17	14
Rising food prices	4	13	7	8
Falling crop prices	1	3	1	2
<b>Coping strategy</b>				
Selling livestock	14	12	31	20
Reducing quantity of meals	20	18	8	15
Engaged in small-scale businesses	13	10	14	13
Borrowing food in kind	18	8	9	11
Borrowing cash	8	9	11	10
Piecework	13	9	5	9

Most of the welfare shocks for the households in the study area result from the loss of a member or the head of the household. This was the major source of shock in Mansa and Mumbwa. The effects of the death on farm production could be sensitive to the gender and position in the household of the deceased. According to Chapoto and Jayne (2005), the decline in cultivated land can be 13 percent following the death of a male and 5 percent after the death of a female while the death of a male household head results in a 21 percent reduction in the area of land cultivated. This can be attributed to the loss of land, capital, and livestock assets to other relatives after the death of the husband. It was also found that relatively wealthy widow-headed households are particularly vulnerable, as they have more land and assets that can be claimed by relatives than afflicted households that are poor to begin with. The mortality of younger adults resulted in statistically insignificant declines in land cultivation.

A poor harvest due to drought ranks number two in general as a source of shock in the study area but it is the main source of shock for Kazungula district. Poor harvests have a direct impact on food security so that farm families are not able to be food self-sufficient. Apart from these two events bringing shock to the households, there are other several events that are also sources of shocks to household welfare in the study area. These are rising input and food prices and falling crop prices. Rising input prices indirectly affect what a household can to produce. Low input use can limit the maximization of other input productivity, such as land and labor. On the other hand, an increase in food prices affects what farming households can purchase to supplement their own production. The higher the prices, the less they are able to purchase with their income, so this directly affects their consumption patterns. Falling crop prices directly affect the household's income. As discussed earlier, the majority of households in the study area depend on farming and crop sales for their livelihood.

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

	District			All
	Kazungula	Mansa	Mumbwa	
<b>Cultivated land</b>				
Increased	36	52	35	41
Decreased	41	21	32	31
No change	23	27	33	28
<b>Household size</b>				
Increased	47	47	54	50
Decreased	32	37	33	34
No change	21	16	13	16
<b>Sick people</b>				
Increased	42	39	31	37
Decreased	22	16	26	22
No change	36	45	43	41
<b>Non-farm activities</b>				
Increased	39	26	27	30
Decreased	33	28	41	35
No change	28	46	32	35

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

### Household livelihood dynamics

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

In this section we examine the livelihood changes of the study area over the past 10 years. We use self-reported changes in different parameters of livelihood to assess the livelihood dynamics of households over a period of ten years. The results (Table 14) show that the cultivated land increased in 41 percent of households over the ten-year period while 31 percent indicated a decrease in the area they were cultivating and 28 percent of households

said there was no change in the cultivated land. With regard to household size, about half of the households in the study area increased in size. We see a two-way scenario when it comes to the number of sick people. There is not much difference in the proportion of households whose number of sick people had not changed and those who reported that the number had increased.

Only about 30 percent of the households in the study area had increased their engagement in off-farm activities. The proportion of households who reduced their non-farm activities was the same as that of those who reported no change (35 percent). From these results we can see some interesting trends in the proportion of the above parameters in relation to sick people. The proportion of households with an increase in the number of sick people is 37 percent which is not so different from the proportion of households which reported a decrease in cultivated land, a decrease in household size, and a decrease in participation in off-farm activities. However, our analysis does not go into enough detail to show if these were same households or not.

# Community Analysis

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

## Public support services

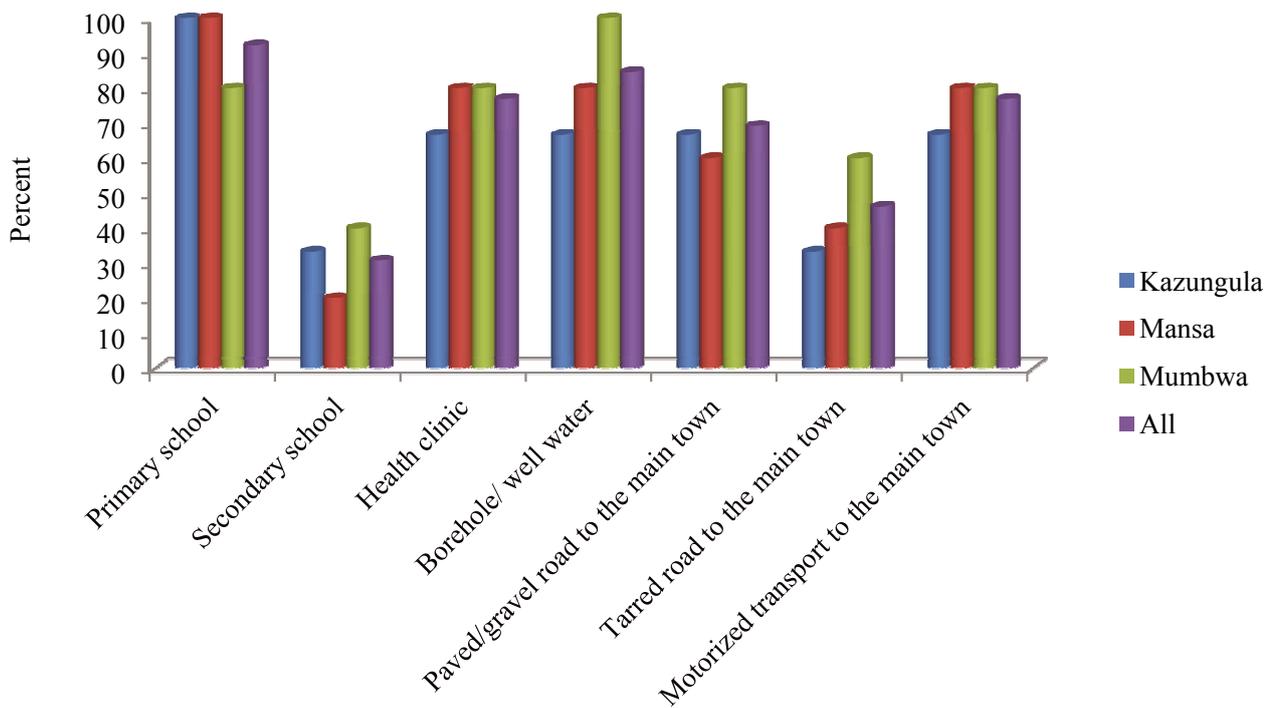
Improving smallholder farmers’ access to agricultural services in SSA is a central challenge facing Governments in the region. Structural adjustment and a commitment to market-based agricultural development have reduced the direct role of the State in providing services. In most countries, publicly financed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

## Community infrastructure and services

### Infrastructure

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

As depicted (Fig. 9), considerable numbers of primary schools were available in various communities in all the districts under study. The average distance to the nearest primary school in the study area is 5 km. Proximity to school has an effect on children’s academic participation and performance and has tremendous potential for reducing existing gender disparities in rural areas. Shorter distances encourage school participation, resulting in increased literacy rates in the areas. There are also secondary schools available in all the representative communities that were studied, with Mumbwa district having a higher percentage of secondary schools. In terms of health clinics, we observe that they are readily available within the three districts while some communities have to go as far as 24 km to reach one. With regard to water supply, we found that there is 100 percent availability of a water source in Mumbwa. Water is also available in the other two districts at an average walking distance of 1 km to a water source. The study area has a very good road network, especially those which are mostly paved/graveled or tarred roads leading to main towns. All three districts have access to motorized transport to the nearest main town. This is an advantage when it comes to obtaining health and market services from the town. Mumbwa is a well-to-do district compared to Mansa and Kazungula with respect to infrastructure availability.



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

### Services

Since the advent of technology, the ability of man to work has been enhanced by the discovery of various forms of energy and the efficient management of these resources. Thus, all over the world, the GNP of a nation depends on the energy consumption per capita and the growth in the macroeconomics of the locality. Energy is closely linked to poverty reduction because it is central to practically all aspects of the core conditions of poverty, such as poor health and lack of access to water, sanitation and education. The electrification of rural communities can bring about development through changes in the following areas among others: effective sociopolitical awareness; economic growth; industrial revolution (i.e., offspring of small-scale industries and agro-allied industries, for example, cassava processing); mechanized farming and irrigation schemes; reduced rural–urban drift; information technology on people’s doorstep; enhancement in health sector control and management, thus population growth; improved infrastructural development schemes; and reductions in forestation problems. Table 17 presents different types of services found in the study area. The average nearest point where farmers can have access to electricity is about 10 km away. Electricity is available in approximately two-thirds of the different camps of the three districts that were studied.

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

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

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

Infrastructure and services	Availability (%)			All
	Kazungula	Mansa	Mumbwa	
Electricity	67	60	60	62
Mobile phone reception	100	100	100	100
Extension services	67	80	100	85
Credit facilities—formal (e.g., banks)	0	0	0	0
Credit facilities—informal (e.g., money lenders)	67	60	20	46
Credit facilities—informal (e.g., NGOs)	0	40	20	23
Output market (e.g., for fresh cassava)	33	20	40	31
Fertilizer market (agrodealer shops)	0	0	20	8
Seeds/planting materials market	0	0	20	8

**Table 16. Access to credit in Zambia (%).**

Credit use	District			All
	Kazungula	Mansa	Mumbwa	
Credit access in terms of actual borrowing (%)	43	28	42	38
Credit use (%)				
Family health	14	9	11	11
Seeds/planting materials	9	3	14	9
Fertilizer	3	3	9	5
Business	4	3	5	4

### Access to credit

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

Evidence shows that access to credit facilities may assist smallholder farmers to tap financial resources beyond their own means and to take advantage of potentially profitable small business opportunities. Access to credit can also help landless smallholder farmers to establish or expand their existing family enterprises (Zeller and Sharma 1998). Hence, credit contributes to the productivity and incomes of rural households, thereby contributing to poverty alleviation.

About 40 percent of the households in the study area were able to have access to credit (Table 16). In Mansa district, only 28 percent of household could have access to credit facilities. The credit was mainly used for family health and the acquisition of seeds/planting materials for different crops. Other uses that were highlighted are the purchase of inputs such as fertilizer and the establishment of a small business.

## Farmers' groups and social capital

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

Table 17 presents statistics of households' group membership in the study area and the type of activities in such groups. The results reveal that, on average, 52 percent of the sampled households belonged to a certain group. The main activity in these groups in the study area is organizing for marketing purposes. Farmers come together so that they can purchase inputs as a group. In doing so they are able to buy in bulk and at wholesale prices. This can also help to curb the transaction and transportation costs. Collective action is equally important for the marketing of crop and livestock products. Other activities that are done in groups are the production of crops and livestock, access to counseling and nutrition lessons, access to safety net alternatives, and for the exchange of labor to carry out farming activities.

## Access to extension service

In this study we establish that farmers had access to extension services during the 2011/2012 season. Table 18 highlights what type of extension services were offered. Nearly three-quarters of the sampled households had contact with extension agents. The services that were offered were mostly to do with information regarding modern varieties of different crops, how to control pests and diseases, and also on soil and water conservation. This is an advantage because it means that if an innovation was to be disseminated in the study area, extension agents would play a greater role with the dissemination of the new technology.

**Table 17. Group membership and activities in Zambia.**

	District			All
	Kazungula	Mansa	Mumbwa	
Group membership (%)	41	54	57	52
Activity				
Input-output marketing	50	61	48	53
Crop and livestock production	9	25	23	21
Counseling/Nutrition	31	3	5	10
Safety nets	9	5	15	10
Labor exchange	0	5	5	4

**Table 18. Access to extension services in Zambia (% of communities).**

Service	District			All
	Kazungula	Mansa	Mumbwa	
Extension contact (% households)	75	66	73	71
Modern varieties	66	26	18	34
Pests and diseases	62	26	18	29
Soil and water conservation	64	20	34	38

## Production and marketing constraints

### Crop production constraints

In this section, we will discuss the major crop production constraints faced by producers in the study area and the practices that farmers adopted to address them. The use of low yielding varieties is the most important constraint for maize production only in Mumbwa and farmers address this by mainly using improved varieties. Across all districts, the major production constraint was drought, as reported by the majority, as it was ranked number one by 80 percent of the communities (Table 19). Maize was the crop most affected by drought and farmers address drought by using improved and early-maturing maize varieties. Pest and diseases were mostly controlled by spraying chemicals. Two other problems experienced in maize production are the prevalence of weeds and low soil fertility. Weeding by hand, hoe, or herbicides gets rid of the weeds. The application of compost manure was practiced to improve the fertility of the soil in farmers' maize gardens.

### Major institutional, infrastructural, and marketing constraints

Through focus group discussions, community members in different districts were asked to give insights on the constraints faced pertaining to various items. With regard to access to improved seeds, 100 percent of all communities in the Mansa and Mumbwa districts indicated that they are constrained by their unavailability. Fifty percent of communities in Mumbwa and Mansa also mentioned the high price of seeds as a hindrance for them in acquiring improved seeds. This implies that if the adoption of improved seeds is to take off or increase, mechanisms need to be put in place to ensure that the improved seeds for different crops are available within the proximity of the study area's communities. According to Table 20, unavailability and high price are also a major constraint that limits the farmers' use of fertilizer in the study area to boost their crop production. Lack of fertilizer in areas with soil fertility problems can lead to low yields where no other alternatives are used to mitigate the problems. Lack of access to credit is one of the institutional constraints that farmers in Zambia face. The unavailability of extension services was a problem only for Kazungula and Mansa districts. In terms of marketing constraints, Kazungula district faces a lack of physical access to markets, Mansa has a lack of market information, and Mumbwa faces low output prices.

**Table 19. Crop production constraints (% of communities).**

Production constraints	District				Most affected crop	Varieties/Practices
	Kazungula	Mansa	Mumbwa	All		
Pests and diseases	50	75	0	44	Maize	Apply chemicals
Drought	67	100	100	80	Maize	Use early maturing varieties
Weeds	–	75	25	50	Maize	Weeding
Low soil fertility	50	0	25	22	Maize	Apply compost manure
Low yielding varieties	0	0	100	40	Maize	Use improved varieties

**Table 20. Institutional, infrastructural, and market constraints (% of communities).**

Constraints	Kazungula	District		
		Mansa	Mumbwa	All
Unavailability of improved seeds	–	100	100	100
High price of seeds	0	50	50	43
Unavailability of fertilizer	100	100	–	100
High price of fertilizer	50	50	25	40
Lack of access to credit	50	25	80	55
Unavailability of extension services	100	100	0	67
Lack of market information	–	50	–	50
Low output prices	–	–	100	100
Lack of physical access to markets	100	–	–	100

**Table 21. Preferences for improved agricultural technologies in Zambia (% of communities).**

Improved technology	District			All
	Kazungula	Mansa	Mumbwa	
High yielding varieties	67	33	80	64
Pest and disease resistant varieties	100	33	–	50
Drought-tolerant varieties	33	50	0	22
Nutrient-dense varieties	–	100	100	100
Soil fertility enhancing technologies	50	–	100	75
Weed management technologies	–	50	33	40
Postharvest storage technologies	–	100	–	100
Postharvest processing technologies	–	100	–	100
Harvest and pre-harvest mechanization	–	50	–	50

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

Crop	Preference (% of communities)
Quality protein maize	100
Yellow maize (e.g., pro-vitamin A)	25
Yellow cassava	50
Orange-fleshed sweet-potato	56
<i>Amaranthus</i>	–
Pumpkin	–
Cleome	–
<i>Moringa tree</i>	–
Cowpea	100
Soybean	20

### Improved agricultural technologies to be introduced

During the community survey, members were asked to indicate which types of improved technologies they would like to have introduced, based on their potential impact on farmers' livelihoods. Table 21 gives a description of the outcome. The majority in all the three districts indicated that high-yielding varieties should be introduced and the expectation is that this would have the most impact on their livelihoods. The second highly preferred technology which was mentioned by all communities in Mansa and Mumbwa district was nutrient-dense varieties of crops. Soil fertility enhancing technologies were among the preferred technologies for improved land productivity. Farmers would also like the pest- and disease-resistant varieties to be introduced in their areas to prevent yield losses caused by pest and disease attack. Other improved technologies that were listed were drought-tolerant varieties, weed management technologies, and also postharvest handling technologies. From this we can speculate that farmers would easily adopt new technologies that are meant to improve their production, productivity, and nutrient consumption.

The study also captured the nutritious crops grown in the study area that farmers would like to be introduced or expanded. Table 22 shows that almost all communities indicated that they grew quality protein maize and cowpea and they would like to have an expansion of these crops. About 50 percent of the communities also grew orange-fleshed sweetpotato and yellow cassava; some were growing yellow maize and soybean. No observations were made with regard to the growing of other crops, such as cleome, *amaranthus*, pumpkin, and *moringa*. However, farmers would like these crops to be introduced in their areas.

## **HIV/AIDS vulnerability and coping strategies**

HIV/AIDS has become increasingly understood as a development issue and, moreover, to have a “bi-directional” relationship with the processes related to development. HIV/AIDS has an impact on the socioeconomic dynamics of households and communities; socioeconomic change itself may have a negative or positive effect on the spread of HIV/AIDS. General research findings suggest that HIV/AIDS is creating new problems and challenges for rural development, including the dramatic increase of vulnerable groups such as households headed by grandparents, widows, and young people. HIV/AIDS can be characterized as a “shock”. Most individuals who live in rural areas in SSA do not know whether or not they are HIV-positive. Hence, although the literal impact for a rural household occurs when an individual becomes infected with the HIV virus, the “shock”, in terms of both the physical and psychological impacts, is manifested when the individual develops AIDS. Furthermore, HIV/AIDS has long-term effects at both micro and macro levels. As Barnett and Blaikie describe, it is a “long-wave disaster” (Barnett and Blaikie 1992).

The impact of HIV/AIDS and the coping strategies pursued by households are inextricably linked. Household resource allocation is adapted as soon as a household becomes AIDS-afflicted or AIDS-affected, and each of these adaptations has a “down-stream effect”. Mutangadura et al. (1999) provide a comprehensive review of the research that has been undertaken concerning household and community responses to HIV/AIDS in rural areas, and the policy implications of the findings of this research. While the review reveals how scanty the available baseline data are, it provides a useful summary of some of the strategies pursued by households to overcome the impact of HIV/AIDS. The strategies are grouped in three categories according to the aim, as follows: (1) strategies aimed at improving food security; (2) strategies aimed at raising and supplementing income to maintain household expenditure levels; and (3) strategies aimed at alleviating the loss of labor.

In this section we present the different coping strategies adopted by households in the study area when afflicted by HIV/AIDS. When an adult member of a household is ill for a long time or dies from HIV/AIDS, households in the community raise cash by doing piecework, begging, selling crops or livestock, and getting assistance from fellow-villagers. Generally, households cope with labor shortages by hiring labor in exchange for food; withdrawing children from school and involving them in farming activities; being assisted by well-wishers; and using labor-sharing arrangements. Sometimes the wife has to continue alone with what the husband was doing when alive. When a man dies, household assets (including the access to land) are mostly given to the wife and children, as shown by 92 percent of respondents in the study area. However, about 20 percent of the communities in Mansa indicated that the assets are taken by the man’s relatives. A slightly similar scenario exists when both parents are dead; 85 percent of the communities revealed that the property goes to the children (Table A2).

The study further shows that the surviving household members after the death of a key adult remain in the household taking care of the children. But if the surviving members are only children, then they go and live with relatives. Coping strategies employed by surviving members to manage food shortages in the study area are doing piecework in other people’s farms for food or for cash payments that they can use to buy food. Alternatively, the surviving members engage in non-farm activities, selling livestock, and also borrowing. Finally, the study investigated whether there are any activities taking place in the community to help households cope with the impacts of HIV/AIDS during sickness and after death. It was found that generally no interventions are in place. However, in some instances, the households can receive assistance from family and friends but only during the funeral. There are also some communities which have community-based organizations that help people with HIV/AIDS together with other NGOs.

## **Social safety nets**

Safety net programs are designed to reduce the impact of disasters on vulnerable populations and to prevent them from falling into poverty. Like the Supplemental Nutrition Assistance Program (formerly Food Stamps) in the United States, these programs help vulnerable people in developing countries to meet their basic

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

Safety net program	Kazungula	Mansa	Mumbwa	All
Free seeds/fertilizer	20	11	28	20
Food/Input for Work	16	13	18	16
Free food	4	3	2	3
Direct cash transfers	10	1	2	4

needs during difficult times. For example, consider a poor family that just purchased its first cow after months of saving. In the wake of a famine, a safety net program helps to ensure that the family is able to keep its cow, rather than having to slaughter or sell it. By helping vulnerable people to maintain a basic level of self-sufficiency and food security, these programs reduce the need for more costly emergency interventions and help to provide a foundation for future development efforts.

Table 23 shows that several safety nets programs were conducted in the study area. One-fifth of the households participated in the free seeds/fertilizer safety net program. The idea is to provide with poor farmers the essential inputs when it comes to the production of maize and other crops. There was also a Food/Input for Work program whereby people work on a project and are paid in kind by being given food items or different types of inputs. In addition to the above programs, some households benefited from free food donations and direct cash transfers for them to cope with various economic shocks to their household welfare.

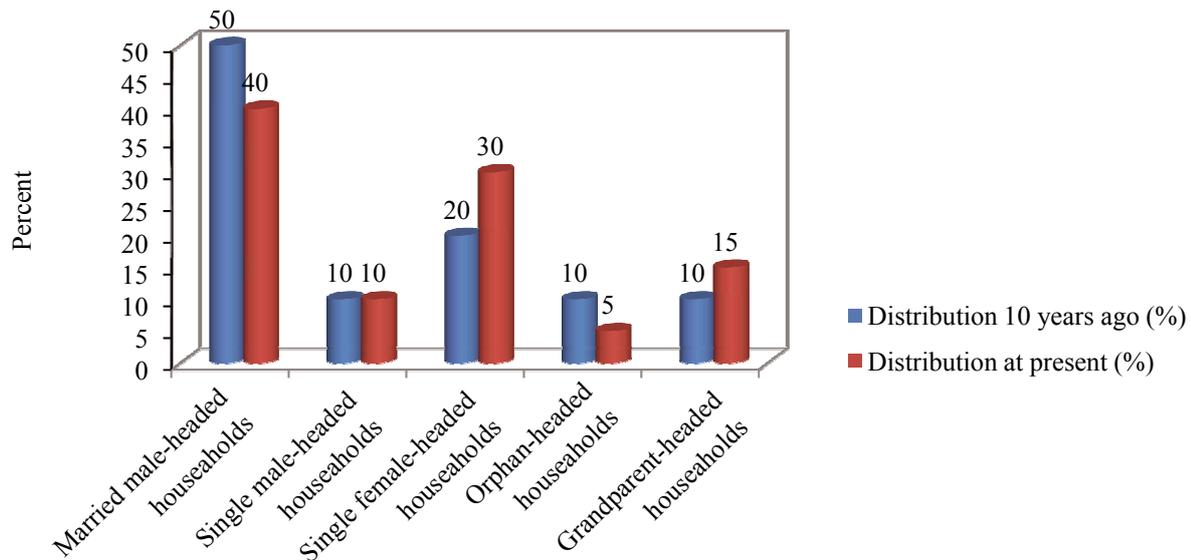
## Community dynamics

### Household composition dynamics over past 10 years

The composition of households frequently changes due to births, deaths, divorces, marriages, the departure of children from home, and other compositional changes. A typical household usually consists of several individuals with different characteristics, including economic capacity, which ultimately determine the economic capacity of the household as a unit. Consequently, a change in a household's composition will affect its economic capacity and condition. The degree to which these are changed after a change in the household's composition depends very much on the nature of the change. The death of a small child may have little effect, but the death of a breadwinner can have a profound effect on the economic capacity and condition of the household (Widyanti et al. 2009).

It is most likely that a change in household composition will simultaneously produce both positive and negative effects on a household's economic capacity and condition. The net effect, therefore, will be determined by the difference between these offsetting effects. For example, the addition of a working adult will most likely have a positive effect on a household's economic capacity and condition. When a working adult joins a household, he or she brings additional earning capacity. At the same time, he or she adds to the consumption needs of the household. As long as the gain in earning capacity exceeds the increase in consumption needs, the household benefits from the addition to its members.

Figure 10 shows the dynamics of household composition over the period of ten years in terms of who was heading the household. The results show that there was a reduction in married male-headed households by 10 percent; single male-headed remained static. Orphan-headed households were also reduced by 5 percent over the period of ten years. We further found out that single female-headed households increased by 10 percent and grandparent-headed households by 5 percent. We can deduce that, over time, the headship of the household has shifted from more married males heading households to single females and grandparents being the heads. This can be attributed to several factors: either there have been more deaths of men and/or married couples due to HIV/AIDS or the divorce rate has increased. It is also possible that men could have migrated to other areas for greener pastures. Another explanation is that the orphans have been incorporated in the households of their grandparents.



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

### **Community dynamics over past 10 years**

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

In this section we discuss the community dynamics in terms of different processes that have occurred over the period of ten years. In general, in terms of crop and livestock production, we see that cultivated land has increased over time whereas livestock production has decreased. Human population has increased so also has the number of sick people in the communities, especially due to the high rise of HIV/AIDS infection. Even though a rise in population is expected to improve savings, we note from the results that community savings have been reduced over time. The results further show that community expenditure on medical care has increased with the increasing number of sick people. The inclusion of vegetables and roots and tubers in people’s diets in the study area has increased over the past ten years. This is a good change, because it means people are now diversifying their diets and would be able to get more nutrients from different types of food. With regard to labor-sharing, the results show that use of this social safety net in the community in times of hardship has been reduced in many communities (53 percent). The use of labor-saving technologies has also decreased in all communities. Off-farm activities have increased in general, implying that farmers in Zambia are diversifying their livelihood strategies. However, in Kazungula district, results show a reduction in off-farm activities in two-thirds of the communities (Table A3).

## Summary

The sample was dominated by female-headed households and about 46 percent of households were headed by widows. The average age of the household head was quite high at 53 years while the average number of years of schooling for household head was quite low (about 6 years). The average dependency ratio was one, implying that every 10 working persons are providing for 10 other persons. There was not much difference across districts in terms of landholding sizes with Mumbwa respondents having the relatively largest landholdings. Livestock ownership was about three TLUs per household. Almost all households owned a hoe and about half of the households had a radio and a bicycle. Ownership of other assets such as TV, irrigation pump, and houses with cemented floors and iron roofs was very low.

Major food crops grown by both male- and female-headed households were maize, cassava, and millet; the major cash crops were cotton, vegetables, and groundnut. Male-headed households dominated the production of maize, cotton, and vegetables; female-headed households dominated the production of cassava, millet, and groundnut. With regard to crop yields, Mumbwa respondents had higher yields of maize, soybean, and sweetpotato than others. In terms of the gender of the household head, we found that male-headed households had higher crop yields except for maize. Most of the crops produced were sold to small-scale businessmen (rural assemblers/middlemen and traders) who mostly act as brokers for large-scale traders. There was little market participation from Government, parastatals, processing companies, and other private companies. The main mode of transporting produce to markets was by the head load. Farmers also used bicycles, ox-carts, and public transport as means of transport.

Farmers preferred improved varieties with good traits such as high yield and early maturity. Other traits mentioned as preferred in improved crop varieties were taste, color, size, resistance to pests and diseases, drought tolerance, short cooking time, and high starch content. Extension agents played a premier role in disseminating information about existing and improved varieties and their availability. In relation to the adoption of new technology, we found that respondents in Mumbwa had a higher adoption rate of maize improved varieties; those in Mansa were highest in the adoption of cassava and sweetpotato. Improved varieties of soybean, maize, cowpea, cassava, and sweetpotato were adopted across the districts in the study area. Those that did not adopt the new varieties indicated the non-availability of the seeds and lack of cash to purchase the seeds as major reasons for their non-adoption. This means that if seeds for improved varieties can be made available to farmers as well as credit facilities the adoption rate for these improved varieties would improve for all crops.

The main income strategy used by farmers was selling their farm production, such as crops and livestock. They also raised income through other non-farm activities, such as artisan work/handicraft, unskilled and skilled wage labor, petty trading, Food for Work and remittances from other members of the household or relatives who live away from the communities. The main source of income was from crop sales, as shown by the highest share of crop income in total household income. Off-farm income has the second highest share of total household income; income from livestock has the lowest share. Slightly above one-third of the households live below the poverty line while slightly above half are food insecure. Kazungula respondents were the most hit by both poverty and food insecurity; Mumbwa households are the least hit by poverty, and Mansa rates low in food insecurity. The main correlates of poverty are household size, value of farm assets, land ownership, and the off-farm income share in the total household income.

The most common household shocks include rising input prices, poor harvest, and the sickness or death of a member or the head of a household. Coping strategies were adopted by households to mitigate the shocks, such as reducing the number and quantity of meals, selling livestock, borrowing, doing piecework, and participating in small-scale businesses. We used self-reported changes in different parameters of livelihood to assess the livelihood dynamics of households over a period of ten years. It was found that the cultivated

land and household size had increased in over half of the households. In terms of the number of sick people, there was not much difference in the proportion of households whose number had not changed and those who reported that the number had increased. In terms of community dynamics, we found that cultivated land had increased whereas livestock production had decreased. The human population had, in general, increased; so had the number of sick people in the communities. Community savings had decreased with the increase in community expenditure on medical care. There was an increase in diet diversification over the past ten years; labor sharing had been reduced. The use of labor-saving technologies had been reduced; school attendance had increased. There had also been an increase in off-farm activities in slightly above half of the communities in the study area.

Most of the communities had access to public services and infrastructure such as schools, health facilities, water facilities, road networks, electricity, mobile phone reception, extension services, and output markets. However, the issues of credit facilities and input markets were still lagging. Regarding social capital, very few households belonged to a farmers' group. Major crop production constraints were pests and diseases, drought, weeds, low soil fertility, and low crop yield. With regard to institutional constraints, farmers mentioned unavailability of improved seeds, high price of seeds, unavailability of fertilizer, high prices for fertilizer, and lack of access to credit and extension services as major constraints. Lack of access to physical markets, lack of market information, and low output prices were the market constraints that farmers experienced.

The study investigated the coping strategies adopted by households when afflicted by HIV/AIDS. When an adult member of a household was ill for a long time or died from HIV/AIDS, households in the community raised cash, food, and labor by doing piecework, assisted by fellow-villagers, and by borrowing or begging, hiring labor, involving children, labor-sharing, reducing cultivated land, and selling livestock. Household assets are given to the wife and children at the death of a man. When both parents are dead, the property goes to the children. The study further found that surviving household members after the death of a key adult mainly remain in the household taking care of the children. We noted that in most cases there were no interventions taking place to help households cope with the impacts of HIV/AIDS during sickness and after death. However, in some instances, the households can receive assistance from family and friends during the funeral only. Sometimes there are community-based organizations which help people with HIV/AIDS together with other NGOs.

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## Annex

**Table A1. Producer and consumer prices in the community.**

Crop	Producer price at peak selling time (ZMK/kg)	Consumer price at peak buying time (ZMK/kg)
Maize	1008.608	1806.39
Cassava	701	2749
Soybean	1786	1820.67
Cowpea	5451.82	5470.31
Sweet otato	1133.64	1221.73
Moringa	–	5000
Cleome	1750	1760
Pumpkin	3422.22	4110
Tomato	13023	15,730.77
Paprika	2400	10700
Potato	1750	4169
Beans	2574.3	5556.15
Pigeon pea	866.67	67,466.67
Sorghum	2766.67	3100
Millet	2145.5	1802.33
Rice	5157.5	6923.46
Groundnut	5193.69	5910.62
Tobacco	4200	3300
Cotton	3840	4400

**Table A2. HIV/AIDS vulnerability and coping strategies.**

HIV/AIDS vulnerability and coping strategies	District			All
	Kazungula	Mansa	Mumbwa	
<b>Raising cash if an adult member of a household is ill for a long time or dies</b>				
Sell crops and/or livestock	0	20	20	15
Begging	0	20	20	15
Get assistance from villagers	33	20	20	23
Piecework	67	40	40	46
<b>Coping with labor shortage</b>				
Hire labor in exchange for food	33	20	0	15
Involve children	0	20	20	15
Assisted by well-wishers	0	40	0	15
Wife continues what the husband was doing	0	40	0	15
Use of labor-sharing	67	20	20	31
Nothing is done	0	0	20	7
<b>Household assets when a man dies</b>				
Given to wife and children	100	80	100	92
Taken away by man's relatives	0	20	0	8
<b>Household assets when both parents die</b>				
Left with children	100	80	80	85
Property grabbed from children	0	20	20	15
<b>Surviving household members after death of a key adult</b>				
They remain at the house looking after the children	100	60	80	77
Children live with relatives	0	40	20	23
<b>Coping with food shortages</b>				
Piecework in other people's fields	33	60	20	38
Non-farm activities	67	0	40	31
Selling livestock	0	20	20	15
Borrowing	0	20	0	8
Nothing	0	0	20	7
<b>Coping with impacts of HIV/AIDS in the community</b>				
No interventions	0	20	60	31
Church interventions	33	40	0	23
Support from NGOs	0	20	20	15
Community-based organizations	67	0	20	23
Nothing	0	20	0	8
<b>Coping after HIV death</b>				
Assistance from family during the funeral only	0	0	20	8
Support from community-based organizations	0	40	20	23
Support from NGOs	0	20	20	15
Nothing	100	40	40	54

**Table A3. Community dynamics over the past 10 years.**

	District			All
	Kazungula	Mansa	Mumbwa	
<b>Cultivated land</b>				
Increased	33	80	60	62
Decreased	67	20	40	38
No change	0	0	0	0
<b>Livestock population</b>				
Increased	33	20	20	23
Decreased	67	80	80	77
No change	0	0	0	0
<b>Human population</b>				
Increased	67	100	80	84
Decreased	33	0	0	8
No change	0	0	20	8
<b>Community savings</b>				
Increased	0	60	40	38
Decreased	100	40	60	62
No change	0	0	0	0
<b>Expenditure on medical care</b>				
Increased	67	40	80	62
Decreased	33	60	20	38
No change	0	0	0	0
<b>Vegetables in the diet</b>				
Increased	100	100	80	92
Decreased	0	0	20	8
No change	0	0	0	0
<b>Roots/ Tubers in the diet</b>				
Increased	33	80	40	54
Decreased	67	20	60	46
No change	0	0	0	0
<b>School attendance</b>				
Increased	67	100	80	85
Decreased	33	0	20	15
No change	0	0	0	0
<b>Use of labor-sharing</b>				
Increased	0	80	40	46
Decreased	100	20	60	53
No change	0	0	0	0
<b>Use of labor-saving technologies</b>				
Increased	0	20	40	23
Decreased	100	40	60	62
No change	0	40	0	15
<b>Non-farm activities</b>				
Increased	33	80	60	62
Decreased	67	20	40	38
No change	0	0	0	0
<b>Number of sick people</b>				
Increased	0	80	60	54
Decreased	100	20	40	46
No change	0	0	0	0



