

Baseline Study of Smallholder Farmers in *Striga* Infested Maize Growing Areas of Central Malawi

AFRICAN AGRICULTURAL TECHNOLOGY FOUNDATION
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- Agricultural Extension Development Officers (AEDOs) who conducted the interviews
- Farmers who responded to the interviews

Acronymns and abbreviations

AATF	African Agricultural Technology Foundation
ADDs	Agricultural Development Divisions
AEDCs	Agricultural Extension Development Coordinators
AEDOs	Agricultural Extension Development Officers
BMI	Body Mass Index
CLR	Composite Liquidity Resources
DADOs	District Agricultural Development Officers
DfID	Department for International Development
EPAs	Extension Planning Areas
GPS	Global Positioning System
HIV/AIDS	Human Immuno-deficiency Virus/Acquired Immune Deficiency Syndrome
ICRISAT	International Crops Research Institute for the Semi–Arid Tropics
ICT	Information and Communication Technology
IDRC	International Development Research Centre
IHI	Ill Health Index
IITA	International Institute of Tropical Agriculture
IR	Imazapyr Resistant
ISC	Integrated *Striga* Control
ITDG	Information Technology, Transnational Democracy and Gender
MDGs	Millennium Development Goals
MLE	Maximum Likelihood Estimation
NGOs	Non-Governmental Organisations
OPV	Open Pollinated Variety
PTI	Productive Tools Index
PCA	Principal Component Analysis
SLF	Sustainable Livelihood Framework
SSA	Sub-Saharan Africa
UNICEF	United Nations Children's Fund
ZHFA	Z-score Height For Age
ZWFA	Z-score Weight For Age
ZWFH	Z-score Weight For Height

Summary

This report presents the results from a livelihood study of smallholder farmers carried out in *Striga* stricken maize growing areas in four districts of central Malawi namely Dedza, Kasungu, Mchinji and Lilongwe. Maize is the major staple in Malawi and the Central Region as the major maize growing area. Given its pivotal position in the national food basket, maize is marketed in both rural and urban centres. Therefore, maize is also a major source of income for many households. The maize sub-sector has been constrained by many factors of which *Striga* is among the more significant production constraints.

A selective sampling strategy was used to select the four districts from which 40 villages mostly hit by *Striga* were randomly selected. Seventy-five (75) households in each district were randomly selected for interviews. The study applied a Sustainable Livelihood Framework (SLF) to conceptualising the study and analysing the data. The SLF entails five livelihood capitals: natural, physical, financial, human and social. These capitals form the basis of the livelihood status of households given contexts and policies within which they strive to make a living.

Data was collected using a structured questionnaire that was administered with the help of field extension workers in their respective districts between July and August 2007. Data entry was done in CSpro (**C**ensus and **S**urvey **Pro**cessing system) v2.4 software which minimises errors during data entry. The data was then exported from CSpro into SPSS v11.5 for subsequent quality checks. STATA v9.0, LIMDEP v8.0, SPSS v11.5 and EPiInfo v3.3.2 were the software used in data analysis. Analyses were done at three levels entailing generation of secondary variables, descriptive and explorative analyses.

The households were characterised by male headship, large household sizes, high dependency ratios and few years of formal education for household heads. Crop production was the most prominent livelihood activity serving the majority of households in all four districts. Most farmers and much of land was owned in the context of customary right of use only (usufruct right). The cropping system across districts was predominantly annual crops based. Annual cropping requires farm planning every year to ensure that inputs are delivered on time.

Households across districts differed in terms of the stock of tools used in the production process. Kasungu District had the highest while Dedza had the least average index measuring productive tools in terms of their adequacy and working status. An interesting causal relationship between productive tools and wealth is that Kasungu District registered the largest wealth index and Dedza the least.

No apparent gender discrimination in access to education was expressed in terms of the ratios of formally educated male and female adult members to all adults in the house-

holds were noted in the districts. In terms of access to agricultural extension, farmers in Kasungu and Lilongwe districts were favoured compared to other districts.

The majority of households kept much of their cash savings at home with only a few managing to have bank savings accounts. At least some households in Kasungu and Lilongwe kept their cash savings in a bank. Cash remittances as social transfers were popular in Kasungu and important in magnitude in Lilongwe District. In the areas of central Malawi surveyed, the livestock sector seems to be under-developed as most of the households owned no animals. On average, households in all districts kept less than one animal.

Networking through religious groups was the most common across districts. Therefore, church based organisations can serve as avenues to launch development changes.

The total land allocated to various crops did not exceed two acres with the exception of about three acres allocated to maize in Lilongwe District. Local maize:legume intercropping was widely practised among farming households in all the districts, especially in Dedza and Lilongwe. Hybrid and local maize under sole cropping were popular in Kasungu and Mchinji. Traditionally, non tradable crops that were to some extent grown across districts were soyabean, sweet potato and cassava mainly in Kasungu District. Irrespective of the variety, maize got the greatest share of land compared to other crops.

Apparently, most farmers in all districts tended to procure improved and local maize seeds from the market and home saved grain stocks, respectively. The yield and returns to land from improved maize varieties were much higher than those of local maize even under severe *Striga* infestation.

The likelihood of allocating more land to improved maize increased significantly with the availability of farm productive tools, number of extension visits and ratio of formally educated male adults. The age of the household head was the only variable which correlated negatively with the acreage based extent of adoption of improved maize varieties.

Lack of inputs, mainly fertiliser, and *Striga* infestation were the major crop productivity constraints that faced most households. Where most households face liquidity problems it is difficult for them to invest in productivity enhancing inputs during a particular season.

Over three quarters of the sampled households in the study districts reported *Striga* infestation in their maize plots ranging from mild to severe infestation. The encroachment rate of *Striga* into arable land over a period of ten years has been much higher to the tune of about 50% in three out of the four study districts. The majority of farmers use technologies used to manage normal weeds such as uprooting which are less effective in controlling a noxious weed like *Striga*.

Livelihood diversification is almost non existent as over 85% of household heads were involved in crop production only. Food deficit was the major shock experienced by most of the households in the study area. However, households applied strategic measures following their exposure to livelihood shocks. Casual labour exchange for either cash or food was the most widely used *ex-post* strategy to cope with negative externalities of shocks. *Striga* infestation shock prompted *ex-ante* adoption of some measures to control *Striga*. Furthermore, most respondents felt that the livelihood situation of their households has worsened over the past five years preceding the survey.

The human diseases which afflicted most households were malaria, dysentery or diarrhoea and those related to the respiratory system. About three quarters of mothers in the study area were either underweight or obese. The rate of severe child stunting was alarming in all districts.

Wealth based poverty varied in the four districts but was more apparent in Dedza. In addition, wealth inequality was very plain in all four districts. Households in the poor category were also deprived of assets that would serve different developmental purposes like transport and communication. Wealth based poverty can be reduced by increasing farmers access to better farming tools, improving education of both men and women, and building up the stock of animals.

Chapter 1

Introduction

Background information

Maize ranks first among the major cereal grains in many countries of eastern and southern Africa as a very important staple food and a source of income. In Malawi, maize is currently grown on 1.2 million hectares with an average yield of 1.61 metric tonnes/ha (Kabambe et al, 2002). It is taken as a source of food to the entire nation and is produced by almost every farmer in Malawi. It is a source of income to other farmers. The constraints to maize production in Malawi are *Striga*, decline in soil fertility, limited access to fertiliser and lack of high yielding cultivars. Damage due to *Striga* is enormous in maize in Malawi and, in some cases, farmers abandon their fields (Kabambe et al, 2003; Kabambe, 1991). The extent of yield loss is related to the incidence and severity of attack, host susceptibility to *Striga* environmental factors (edaphic and climatic), and the management level at which the crop is produced (Ransom, 2000).

AATF (2006), estimated 268,000ha of maize fields in Malawi to be affected by *Striga*, accounting for about 11% of land infected in Africa (second to Nigeria with 822,000ha infested, followed by Kenya with 210,000ha and Tanzania with 179,000ha. There are three main *Striga* species that affect maize production in Africa. These are *S asiatica*, *S hermonthica* and *S gesnerioides*. *Striga asiatica* is the prevalent species throughout Malawi, parasitising maize, upland rice, sorghum, millet and sugarcane (Banda and Kabambe, 1996). Yield losses associated with *Striga* damage are often significant, ranging from 40–100% (Bebawi and Farah, 1981; Lagoke et al, 1991; Ejeta et al, 1992). Significant yield reductions result in little or no food at all for many subsistence farmers and, consequently, aggravate hunger and poverty (Kabambe et al, 2003; Frambach et al, 2002). As an immediate response to these instant economic effects, farmers take actions that are severe to the environment and the future well being by migrating from severe to less infested land, abandonment of fields and changing the cropping pattern involving switching within the crop enterprise mix. These actions lead to deforestation and further accelerated spreading of *Striga*.

Given the devastating effect of *Striga* on the livelihood of smallholder farmers, novel *Striga* control technologies have been developed and disseminated to farmers over time. One recent promising technology is Imazapyr Resistant (IR) maize[1] which is at the farm level experimentation stage in the east and southern Africa sub-region involving Uganda, Kenya, Tanzania and Malawi. As novel technologies to combat *Striga* are developed and transferred, there is a lack of knowledge on the *ex-ante* livelihood status entailing micro–level benchmark indicators for measuring *ex-post* changes brought

1. *Imazapyr Resistant maize technology involves dressing the maize seed with a systemic herbicide which kills attaching Striga but not the maize*

about by the technology. This study was designed and implemented to address this information gap in the *Striga* infested maize growing areas of central Malawi.

Conceptual framework

The Sustainable Livelihood Framework (DFID, 2000), has been adopted to help understand and analyse the livelihoods of smallholder farmers in the study area (Figure 1). The livelihood journey to intended outcomes involves transformation of capital through a range of household initiatives characterised by vulnerability contexts, policies, institutions and processes. The five livelihood capital forms (**N**atural, **P**hysical, **H**uman, **F**inancial and **S**ocial), craft what can be termed as the livelihood pentagon. The details of the strands of these forms of capital are found in the literature on livelihood such as DFID (2000), and Scoones (1998). *Striga* infestation fits into the vulnerability context and impacts on the level of capital, especially natural capital. It may influence policies such as crop protection, livelihood strategies mainly crop production and, ultimately livelihood outcomes such as food security and farm income. Indicators of different aspects along the context–outcome livelihood continuum were analysed as shown by the various analyses in this report.

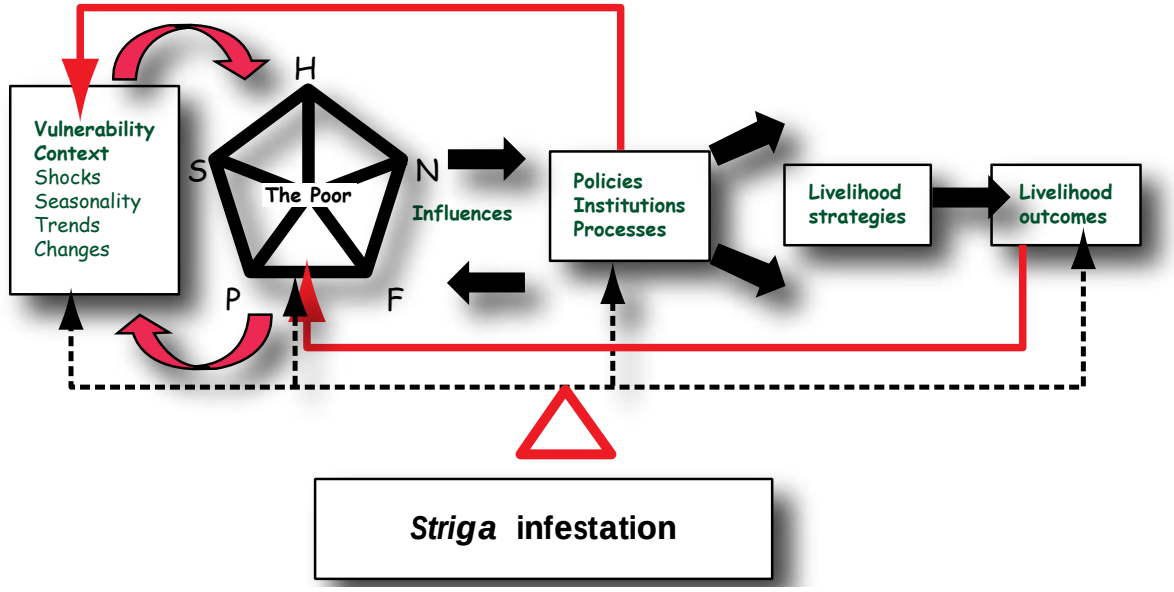

Figure 1: Schematic diagram of the conceptual framework

Methodology

Study area

The study was conducted in the Central Region of Malawi involving Dedza, Kasungu, Mchinji and Lilongwe districts. The importance of maize and emergence of *Striga* as a major productivity constraint in these districts was the major reason for their choice. Dedza District has 162,202 households and a total population of 796,675 people according to the food requirement study of the District Agricultural Office during the 2006/2007 season. The district covers a total estimated area of about 220,000ha of which

20% is hilly and *dambo*[2], with an average land holding size of 0.61ha. According to the crop estimates and extension report for the 2006/2007 season, maize was planted on a total area of about 99,639ha and estimated to produce a total yield of 156,171.2 metric tonnes.

Kasungu is one of major maize growing districts of the Central Region contributing 25–30% of the total domestic maize production in Malawi. Even though maize is grown on a large area, it competes with tobacco which is a major cash crop in the district. Other crops grown include soyabeans, beans, groundnuts, sweet potatoes, cassava, finger millet and vegetables. According to the third round crop estimates for the 2006/2007 season for the district, a total of 133,651ha was under maize and the production was estimated to be around 309,598 metric tonnes. The district has a total land area of about 787,800ha of which 324,906 ha is the potential arable land. Of the total land area, 162, 332 ha is under customary tenure, 162,574ha is under estates, 213,500ha is protected land for game and wildlife, while 249,394ha of land is *dambo* and hills. The potential land for irrigation is 151,000ha. The district has an average landholding of 1.86ha.

Mchinji District is another major producer of maize and other cereals because of the nature of the soils and topographical features. It has a total land area of 335,660ha of which arable land covers an area of 208,500ha. Of the total arable land, 93,825ha is under estates while 114,675ha is held by smallholder farmers. There are three land tenure systems in the district which are customary land, public land and private leasehold. Customary land covers an area of 15,645ha, public land 20,135ha and private leasehold 55,104ha. The average landholding per farm family is 1.07ha with the smallest land size being 0.5ha according to the 2006/2007 crop estimates and extension report.

Lilongwe District has a total land area of 626,049ha with an estimated arable area of 574,100ha. Of the total arable area only 333,402ha was cultivated during the 2006/07 season. The average land holding size per farm family is 0.62ha according to the crop estimates and extension report for the 2006/2007 season.

Sampling strategy

The Ministry of Agriculture and Food Security is divided into eight Agricultural Development Divisions (ADDs) for administrative reasons. This baseline study took place in two selected ADDs. These two ADDs were further split into their respective districts, where four districts, namely Dedza, Kasungu, Mchinji and Lilongwe were selected based on two criteria, that the district should be one where maize is important and at the same time where *Striga* is a problem. About 55–60% of the maize grown in Malawi comes from these four districts which is why they are usually referred to as the breadbaskets of Malawi.

2 *A shallow, seasonally waterlogged depression at or near the head of a drainage network*

The Ministry further subdivides every district under each ADD into Extension Planning Areas (EPAs) for administrative and convenience reasons. In each selected district the EPAs meeting the double criteria that maize production is a major agricultural activity and *Striga* is one of the top constraints, were listed and five EPAs were randomly selected. The EPAs are further subdivided into sections which make up villages. As Malawi is a relatively small country, a section is similar to a village in terms of size in bigger countries such as Tanzania. Therefore, the section was bypassed to randomly choose two villages per EPA from the list of all the villages falling in the sampled EPAs. As a result, ten villages per district were randomly sampled. Listing of all the households in a village was done with the help of Agricultural Extension Development Officers (AEDOs) since the local offices in the sampled villages did not have the current lists of households. From each list 7–10 households were randomly selected from each village.

In summary, the survey was conducted in 4 districts entailing 20 EPAs covering 40 villages and 300 households, 75 from each district (Appendix 1). The geographical and spatial distribution of sampled districts and households is shown in Figure 2.

Data collection

Data was collected using a structured questionnaire (Appendix 2). Themes included in the questionnaire related to household characteristics; productive resources endowment; productivity, costs, labour and marketing; *Striga* extent, severity and control techniques; and vulnerability, capitals and livelihoods aspects. The questionnaire was administered with the assistance of trained extension workers (AEDOs). These extension workers were trained in a three day methodology workshop that addressed the themes of the survey, Global Positioning System (GPS) recording and anthropometric data collection techniques. In addition to the survey questionnaire, each extension worker received a UNICEF weighing scale and a gauge with which to take anthropometric measurements of children under five years of age as well as of their mothers or female guardians. They were also trained on GPS handset use to record the geo-referenced coordinates and area determination. One Crop Protection Officer in each district assisted in monitoring and supervising the progress of data collection implemented by AEDOs. The IITA country research supervisor undertook the second quality check in the field before the questionnaires were accepted.

Data analysis

Analysis of household characteristics

Descriptive statistics and tabulation were used to summarise household characteristics such as gender of household heads, household size, dependency ratio and years of schooling for household head. The dependency ratio was calculated by dividing the total number of dependents (children below 15 years, the elderly and the permanently sick) over the total number of able bodied members.

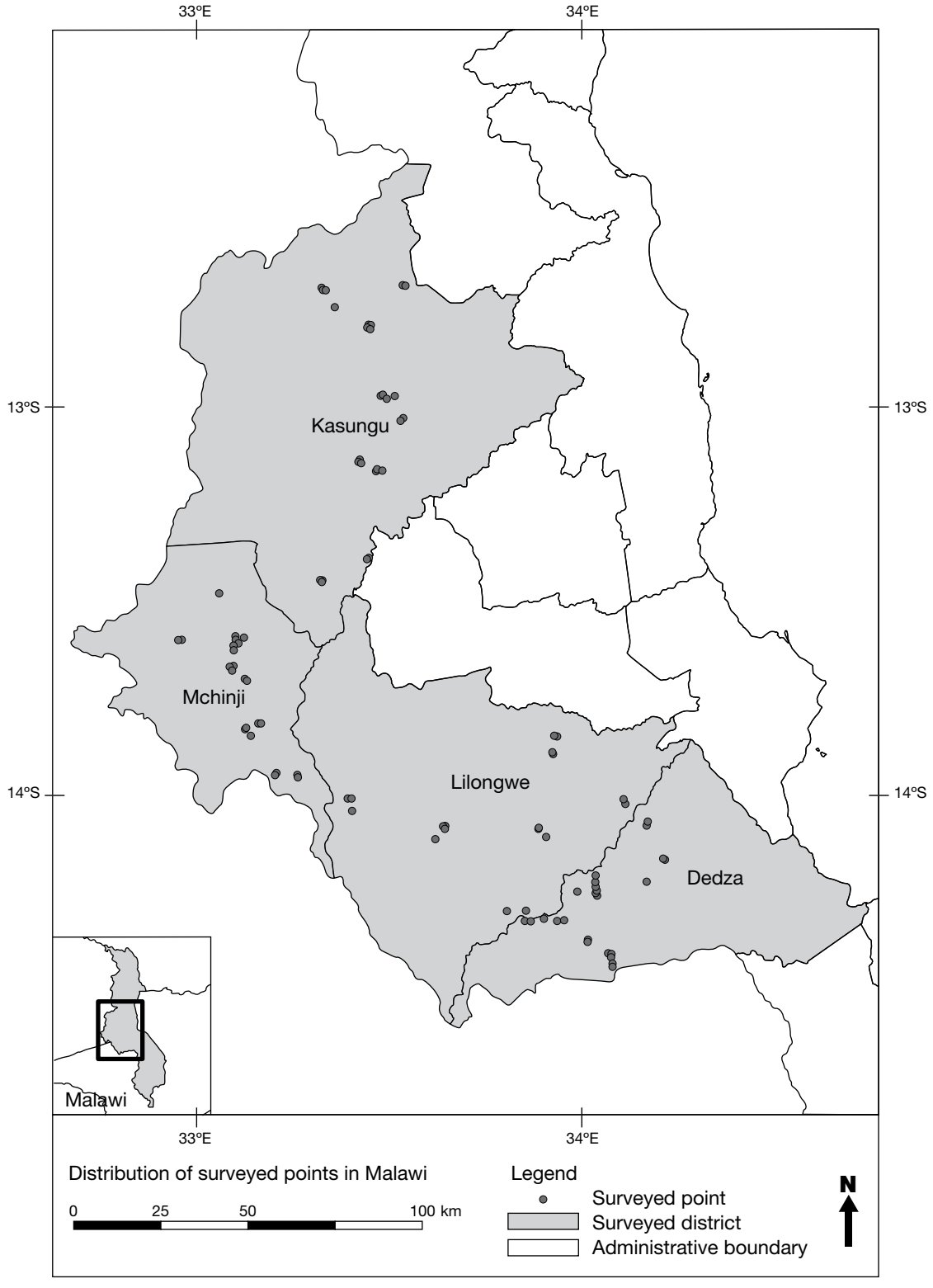

Figure 2: GIS map showing districts and households sampled in central Malawi

Household size was adjusted for composition and economies of scale. The concept behind this adjustment is that it costs less to feed four children than four adults (composition effects) and doubling the size of the family does not imply doubling the amount of expenditure necessary to maintain living standards (scale effects).

a) Adjustment of household size for composition

Based on the equivalent units presented in Table 1, the household size was adjusted to address composition effect as expressed in Equation 1.

$$H_i = \alpha_1 N_1 + \alpha_2 N_2 + \alpha_3 N_3 + ... + \alpha_n N_n \quad \textbf{(1)}$$

Where:

H_i = gender and age weighted of the i^{th} household in the sample

$\alpha_1 \ldots \alpha_n$ = the relative weight given to individuals with respect to age and gender

$N_1 \ldots N_2$ = the size of components of households with similar sex and age range.

b) Adjustment of gender and age weighted household size

Household size adjusted for composition effect was further adjusted to scale economies as expressed in Equation 2.

$$HE_i = (H_i)^{\psi} \quad \textbf{(2)}$$

Where:

HE_i = the household size of the i^{th} household in the sample adjusted to both composition and scale effect

H_i = the gender and age weighted of the i^{th} household in the sample

ψ = scale economies within the household.

Richards et al (2003), suggested the following equivalent units used to adjust the sample households (Table 1).

Analysis of livelihood capital

a) Natural capital

Natural capital encompasses all biophysical components of which land quantity and quality are a part. People own and manage land for the sake of producing farm produce needed to improve their livelihood through direct or indirect use. In this study, land ownership was described as the acreage which the household had under different tenure arrangements namely, private ownership, use rights only, borrowed, gifted, rented in or out, and sharecropped land. Land use was assessed in terms of the proportion of land allocated to the various crop types: annuals, perennials, mixed cropping, fallow and grazing.

Table 1: Adult equivalent scales for adjusting aggregate household size

Adult equivalent scales based on age and sex (= composition) of household members			Adjustment based on number of persons (economies of scale) in the household	
Age category (years)	Male	Female	Household size	Economies of scale
0 to 2	0.40	0.40	1 to 2	1.000
3 to 4	0.48	0.48	3	0.946
5 to 6	0.56	0.56	4	0.897
7 to 8	0.64	0.64	5	0.851
9 to 10	0.76	0.76	6	0.807
11 to 12	0.80	0.88	7	0.778
13 to 14	1.00	1.00	8	0.757
15 to 18	1.20	1.00	9	0.741
19 to 59	1.00	0.88	10	0.729
60+	0.88	0.72	10+	0.719

Source: Adapted from Richards et al (2003)

b) Physical capital

Physical capital comprises productive tools, amenities and consumer durables. Productive tools are those used in the production process which lead to the attainment of livelihood outcomes. Amenities and consumer durables indicate the living standard and wealth status. Core analyses of physical capital include derivation indices for productive tools and wealth.

The productive tools considered in this study were farm machinery, tools and equipment. The Productive Tools Index (PTI) was estimated by combining the number and working condition of the productive tools and expressed mathematically in Equation 3.

$$PTI_i = \sum_{j=1}^{m} n_{ij} W_{ij} \quad \textbf{(3)}$$

Where:

PTI_i = the Productive Tools Index of the i^{th} household (i = 1 … 300)
n_{ij} = the number of productive tools j^{th} in the i^{th} household
j … m = a portfolio of productive tools
W_{ij} = the working status of the j^{th} productive tools of the i^{th} household.

The working status of any productive tool was coded as an ordered variable: 1 = working improperly, 2 = working moderately, and 3 = working properly. This means that the larger the PTI, the better off the household is in terms of adequacy and working quality of farm tools. The PTI was then divided by the adjusted household size for comparison purposes.

Amenities and utility assets were used to construct the index that indicated long run wealth status. These assets and amenities were grouped as follows: consumer durables (watch, iron, sofa set, bed and mattress), transportation (bicycle, motorbike and car), communication (radio, television, cell phone and landline), water and energy (source of drinking water and energy for cooking and lighting), and housing (toilet, building materials and ownership of more than one house). The wealth index was estimated using the statistical procedure, Principal Component Analysis (PCA), which is closely related to factor analysis. This procedure was used to determine the factor that attached weights to the amenities and assets. The first principal component is the linear index of variables with the largest amount of information common to all the variables in the dataset (Filmer and Pritchett, 2001). The result of the Principal Component Analysis was the physical wealth index for each household based on the formula presented in Equation 4.

$$PWI_j = \sum_{i=1}^{n} f_i(a_{ji} - a_i)/s_i \qquad \textbf{(4)}$$

Where,

f_i = factor scoring for the first asset as determined by the procedure

a_{ji} = the j^{th} household's value for the first asset

a_i and s_i = the mean and standard deviation of the first asset variable over all households.

The factor loadings of the components were summed up to account for at least 50% of the explained variance. The summed factor loadings formed the scoring factor used in Equation 4 above. Furthermore, graphical analysis was used to depict possession of amenities and assets between the relatively poor and rich households. In creating the poverty groups, the wealth index variable was sorted in descending order defining increasing poverty depth. Three groups were created from the top entailing 20%, 40% and 40% of the rich, middle and poorest strata respectively, following Filmer and Pritchett (2001). Possession of amenities and assets was graphically mapped for the two contrasting groups of rich and poor households.

c) Human capital

The quality of education of the household head and its members indicates the quality of the existing human capital. Other dimensions of human capital include dependency ratio, number of extension visits per household per year, and number of years of education of the household members. Illness (Ill Health Intensity indices) and nutrition (Body Mass Index and Z-scores) can also affect human capital directly or indirectly. BMI and Z-scores are examined in the livelihood outcome section.

The health status of household members affects the quantity and quality of the labour force available to the household. The IHI was constructed using ten diseases: malaria or fever, dysentery or diarrhoea, respiratory diseases, measles, typhoid fever, tuberculosis, under nutrition, HIV/AIDS, injurious accident and lifetime disease or disorder. For each disease, a disease intensity index was calculated as shown in Equation 5.

$$IHI_j = \sum_{k=1}^{m}\left[\sum_{i=1}^{n}\left(\frac{d_{ij}}{N_j}\right)\bullet\theta\right] \quad \textbf{(5)}$$

Where:

IHI_j = Ill Health Index of the j^{th} household suffered from diseases $k^{th} = 1 \ldots m$

d_{ij} = number of days the i^{th} member of the j^{th} household suffered from diseases k^{th}

N_j = unadjusted size of the j^{th} household

$i \ldots n$ = members of household j^{th} who suffered from disease k^{th}

$k \ldots m$ = portfolio of diseases inflicted on the j^{th} household

$\bullet\theta$ = annualisation factor = 1/365

IHI increases with the increasing intensity of household members suffering from diseases during a reference period. IHI, therefore, explains the level of ill health or morbidity in the household.

d) Financial capital

Different households can access different sources of capital depending on the kind of other resources which a household has. The forms of financial capital considered in this study were cash at home or pocket, cash at bank, formal and informal credit, jewellery, cash remittances, and in kind transfers from relatives and friends. Frequencies and cross tabulation analyses were used to show the proportion of households accessing a given source of capital. The value of non working animals was also computed and described to reflect the financial endowment of households.

Composite Liquidity Resources (CLR) index combines the access to the various sources of financial capital with ordinal ranks of their easiness to raise or command and spend. The easiness to command assesses the ability of a household to access that source of capital while easiness to spend addresses the aspect of household ability to use in the event that a financial obligation arises. The sources of finance can be classified into three groups: current resources (cash at bank, cash in hand, claim on good debtors and jewels), conditional credit (formal and informal credit), and social transfers (cash remittances and in kind transfers from relatives and friends).

Computationally, the CLR index was constructed from the respondent's ranking of the sources of financial capital which he or she could access in relation to its magnitude, and its ranks on the easiness to raise and spend. These ordinal ranking's were reordered to reflect the weight in the index as: 1 = not easy, 2 = moderate, and 3 = very easy to realise. These ranks were averaged to get a weighted rank (r_{ij}). CLR can be mathematically expressed as shown in Equation 6.

$$CLR_{ij} = \sum I_{ij}\left(\frac{R_i}{r_{ij}}\right) \quad \textbf{(6)}$$

Where:

CLR_{ij} = the liquidity resources index of household i = 1 … n and financial capital source j = 1 … m

I_{ij} = an indicator variable equal to 1 if household i accessed a source of capital and 0 for otherwise

r_{ij} = the average cardinal rank given to source j among sources accessed by house hold i computed by averaging the ranks across easiness to raise and spend at tributes

R_i = the number of sources of finance ranked.

The CLR index increases with the number of financial capital sources a household has access to and their easiness to realise and spend.

e) Social capital

This is shown by subscription of household members to social associations like women groups, community development, and safety net groups. Social capital analysis was used to establish the proportion of households belonging to each type of association and how such group networking might be influencing their livelihood.

Livelihood contexts and strategies

Analysis of livelihood contexts examined the land allocation by households by estimating mean land allocated to various crops. Productivity of maize was expressed in terms of yields of different maize varieties and cropping systems. The varieties included local maize monocropped, improved envisaging OPV and hybrid varieties. The cropping systems entailed monocropping, single stand and intercropping for both local and improved maize varieties.

Household income obtained from market participation was derived from the summation of gross incomes from enterprises the household engaged in. These enterprises included farm and non farm undertakings in the market place. Per capita income for each household was then calculated by dividing the total income by household size as shown in Equation 7.

$$I_i = \sum_{j=1}^{n} E_{ji} / HS_i \qquad \textbf{(7)}$$

Where:

I_i = annual income per capita of the i^{th} household from various livelihood enterprises

E_{ji} = income from the j^{th} livelihood enterprises (crop production, livestock, business, formal employment, wage work, technical and artisan works, natural resources, traditional medicine and resource rent) of the i^{th} household

HS_i = adjusted household size of the i^{th} household.

The amount of land which a household is willing to spare for a novel technology not only explains the adoption decision but also the extent of adoption of that technology. In this respect, this study derived the binary dependent variable for households which allocated more than 50% of land farmed during the reference season being assigned a value of '1' and '0' if otherwise. The logistic model was used to estimate factors behind the decision of a household to allocate more than 50% of its farmed land to improved maize varieties. The specification of the binary choice logit model is presented in Equations 8–10.

$$P_i^* = \mathbf{X_i}\beta + \varepsilon_i \quad \textbf{(8)}$$

$$P = 1 \quad \text{if} \quad P > 0 \quad \textbf{(9)}$$

$$P = 0 \quad \text{if} \quad P \leq 0 \quad \textbf{(10)}$$

Where β and ε_i represent the vector of parameters and influences not modelled, respectively. We consider P_i^*, a response variable and define a dummy variable p_i which takes the value of 1 if the household is poor and 0 if otherwise, X_i stands for predictor variables of the model indicated in Table 26 in the results section.

Livelihood outcomes

Anthropometric measurements are useful in assessing the nutrition status of individuals as one of the livelihood outcomes. The Body Mass Index (BMI) measures the nutritional status based on the height and weight of the individual. It is used to compare and determine the health effects of body weight on human beings. A BMI score between 22 and 24 is considered normal. Below the lower limit, the individual is underweight; and above the upper limit, the individual is overweight or obese. The mathematical expression of the BMI is shown in Equation 11.

$$BMI_i = W_i/(H_i)^2 \quad \textbf{(11)}$$

Where:

BMI_i = the Body Mass Index of the i^{th} mother or female guardian
W_i = weight of the i^{th} mother or female guardian
H_i = the height of the i^{th} mother or female guardian.

Another nutritionally vulnerable category of individuals are children under five years of age. The most common indicators for assessing the nutritional status of such children are Z-scores. The Z-score is the difference between the value (weight) for a child and the median value (weight) of the healthy reference population of children of the same age or height, divided by the standard deviation of the reference population as shown in Equation 12.

$$Z_i = (V_i - M)/S \quad \textbf{(12)}$$

Where:

Z_i = the Z-score (SD score) value of the i^{th} child
V_i = the weight of the i^{th} child

M = median weight of the reference population
S = the standard deviation of the reference population.

The Z-score based indices used to indicate nutritional status of younger children were weight for height (wasting) or ZWFH, weight for age (underweight) or ZWFA, and height for age (stunting) or ZHFA. Generically, the Z-score cut-offs used in the classification of child nutritional status were as follows: Z>-1.00 is normal; -1.00>Z<-2.00 is mild malnutrition; -2.00>Z<-3.00 is moderate malnutrition; Z<-3.00 is severe malnutrition.

Analysis of determinants of poverty

Empirical identification of what critical factors lie behind poverty is the centre piece task of most livelihood studies. This is because exposition of such critical factors is needed to guide targeting poverty reduction efforts. In pursuit of this, a Tobit[3] (censored model) was estimated by regressing absolute wealth index against a set of explanatory variables. The Tobit model uses Maximum Likelihood Estimation (MLE) method to estimate the parameters assuming normality and homoskedasticity conditions. The general specification of the Tobit model is presented in Equations 13 and 14.

$$y^* = \alpha x + \mu \; ; \; \mu|x \sim N(0, \delta 2) \qquad \textbf{(13)}$$

Where:

y^* = the latent variable, but we only observe $y = \max(0, y^*)$

α = estimates the effect of x on y^*, not y.

Note: The idea is that there is an underlying variable y^* that can be modelled as $y^* = \alpha o + \alpha x + e$, but we only observe $y = 1$, if $y^* > 0$, and y = 0 if $y^* \leq 0$.

$$POVERTY = \alpha_0 + \alpha_1 X_1 + ... + \alpha_n X_n + \mu \qquad \textbf{(14)}$$

Where:

POVERTY = poverty (based on absolute wealth index)

α_0 = constant or an intercept of the regression equation

$\alpha_i \ldots \alpha_n$ = the parameters to be estimated ranging from ith = 1 to n^{th}

$X_1 \ldots X_n$ = independent variables fitted in the model ranging from ith = 1 to n^{th}

μ = the error term.

Outline of this report

This report consists of six chapters. Chapter one is the introduction which gives the background information, conceptual framework and methodology. Chapter two gives information on the characteristics of the households and livelihood capitals in their reach. Chapter three explains livelihood contexts and strategies employed by

3 *For more econometric insights on the Tobit model and censoring concept, refer to Holloway et al (2004), Greene (2002), Gujarati (1995), and Goetz (1995).*

households in allocating resources among alternative activities which they are engaged in. Chapter four entails the analysis of the livelihood outcomes and Chapter five is the normative analyses that show micro–level determinants of wealth based poverty as an outcome. Chapter six gives the conclusions and recommendations of the study.

Chapter 2

Characteristics of households and livelihood capital

Characteristics of sampled households

Most of the sampled households were headed by men – who are expected to dominate household headship in patriarchal African societies (Table 2). A woman might assume the household headship on becoming a widow. Compared to other districts, Dedza had a notable proportion (33%) of households headed by women, supposedly widows. Dedza also had the largest proportion of household heads who never received any formal education. Implicitly, those female household heads in Dedza never had the opportunity to attend formal schools. Compared to other districts, Lilongwe had more households that received off school (informal) education entailing vocational and short term, non extension training on farming skills. Proximity to Lilongwe city offers an opportunity to farmers in Lilongwe District to access urban based vocational training institutes while development Non-Governmental Organisations (NGOs) offer special training to the rural poor. Crop production was the major livelihood occupation of most households. Livestock and off farm enterprises were more rare among household heads across districts. Crop production remains the livelihood mainstay for most households in rural Malawi.

Table 2: Socio-demographic characteristics of sampled households

Characteristics	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Male household heads	220	73.3	50	66.7	57	76.0	56	74.7	57	76.0
Household heads attended formal school	231	77.0	49	65.3	65	86.7	60	80.0	57	76.0
Household head trained off school										
None	240	80.0	70	93.3	54	72.0	65	86.7	51	68.0
Vocational training	22	7.3	1	1.3	9	12.0	2	2.7	10	13.3
Short term training	38	12.7	4	5.3	12	16.0	8	10.7	14	18.7
Major occupation of household head										
Crop production	279	93.0	73	97.3	72	96.0	70	93.3	64	85.3
Livestock	2	0.7	1	1.3	0	-	1	1.3	0	-
Business	13	4.3	1	1.3	1	1.3	2	2.7	2	2.7
Employment	3	1.0	0	-	2	2.7	1	1.3	2	2.7
Wage work	3	1.0	0	-	2	2.7	1	1.3	0	-
Household head working off farm	41	13.7	10	13.3	6	8.0	12	16.0	13	17.3

n = Number of cases

In all districts, the average household heads were in their economically active age of not more than forty six (46) years (Table 3). This is a positive indicator, as younger heads that are at the centre of decision making would be enthusiastic about bringing modern prosperity to their households. Household heads across districts spent less

than the eight years required completing primary education level. Formal illiteracy was more pronounced among household heads in Dedza than in other districts. The adjusted average household size was three members. The dependency ratio of one is a common feature in most developing countries whereby one able bodied member has to take care of one member who is dependent.

Table 3: Socio-demographic characteristics (descriptives) of sampled households

	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Age of household head	300	43.2 (18)	75	44.5 (17)	75	42.8 (17)	75	39.5 (15)	75	45.9 (18)
Years in school of head	300	4.5 (4)	75	2.7 (3)	75	5.8 (4)	75	4.8 (4)	75	4.7 (4)
Unadjusted household size	300	4.7 (2)	75	4.5 (2)	75	4.8 (2)	75	4.7 (2)	75	4.7 (2)
Adjusted household size	300	3.0 (1)	75	3.0 (1)	75	3.0 (1)	75	3.0 (1)	75	3.1 (1)
Dependency ratio	282	1.1 (1)	70	1.1 (1)	70	1.1 (1)	72	1.3 (1)	70	1.0 (1)

n = Number of cases; number in open is mean while number in closed brackets is standard deviation (SD)

Livelihood capitals

Natural capital

Land tenure implies access and security to the land resource which is the basic endowment of agrarian families. Tenure security dictates the type of activity that can be carried out and investment that can be committed to land by a land user. Table 4 shows that many households owned land under customary tenure arrangements which grant a farmer the right to use land only (usufruct). More secure tenure arrangements through formal legal titling involved few households. On average, and despite its infrequency, private land titling accounted for larger land size (5.2 acres) compared to other tenure arrangements. The practice of renting in land is also widely practised suggesting evolution of rural land markets. Irrespective of the level of practice, the land tenure structure in rural Malawi is very diverse including even old fashioned arrangements like share cropping. The existence of some tenure arrangements such as borrowing and gifting suggest strong social relationships.

Table 4: Average land access (acre) by tenure arrangements

Tenure arrangements	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Acre (SD)	n	Acre (SD)	n	Acre (SD)	n	Acre (SD)	n	Acre (SD)
Private titled land	12	5.2 (3)	2	2.5 (1)	7	5.3 (4)	3	6.9 (1)	0	–
Land with use rights only	267	3.2 (3)	71	2.1 (1)	62	5.0 (4)	61	3.6 (2)	73	2.4 (2)
Rented in land	44	1.5 (1)	13	1.3 (1)	3	1.5 (1)	12	2.3 (3)	16	1.0 (0)
Share cropped land	9	2.3 (2)	0	–	2	2.3 (0)	7	2.4 (2)	0	
Borrowed land	10	1.0 (1)	1	1.0 (–)	2	0.3 (0)	4	1.8 (1)	3	0.4 (0)
Gifted land (received)	14	1.0 (1)	6	1.0 (1	5	1.0 (1)	2	1.3 (0)	1	1.0 (–)
Rented out land	9	2.9 (4)	2	1.5 (1	1	2.0 (–)	2	8.5 (5)	4	1.1 (1)
Given out land	9	2.7 (2)	3	1.3 (1)	2	4.0 (3)	4	3.0 (1)	0	–

n = Number of cases; number in open is mean while number in brackets is standard deviation (SD)

Results in Table 5 indicate that households across districts allocated most arable land to annual crops. The mixed cropping system got the largest share of land in Dedza and Lilongwe districts compared to other districts. Based on land cultivated during the reference season, Mchinji District is typically annual crop based. Notable proportions of land were under fallow which suggests the possibility that landlessness might not be a serious problem.

Table 5: Land utilisation during the reference season

Types of utilisation	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean
Annual crops	284	89	66	91	75	85	75	95	68	84
Perennial crops	16	16	3	13	9	18	0	–	4	12
Mixed crops	21	83	13	79	0	–	0	–	8	89
Grazing	4	35	1	33	1	63	0	–	2	22
Fallow	51	32	5	38	23	27	7	25	16	42

n = Number of cases with multiple responses

Physical capital

Households in Kasungu District were the best in terms of the stock and quality of farm production tools (Table 6) while those in Dedza were the worst, having the smallest average Productive Tools Index (PTI). It is interesting to note that Kasungu District with the highest average Productive Tools Index also had the highest wealth index created from a stock of utility assets and household amenities. Such a strong connection between farm production tools and long run wealth has a weighty policy message for poverty reduction. This message is that improving the farm production tools is necessary to fast track the wealth creation required to break the poverty traps hindering the rural poor in escaping poverty. Arguably, commanding better and adequate amounts of farm tools would improve the efficiency of farm operations and, hence, increase productivity. Moreover, increased farm productivity is a harbinger of profitability which ultimately enhances the stock of wealth and living standards.

Table 6: Descriptive statistics of productive tools and wealth indices

Locality/index	Descriptive statistics				
	n	Mean	Std Dev	Minimum	Maximum
Productive Tools Index					
All	300	15.8	13.4	0.0	102.0
Dedza	75	10.7	8.1	1.0	37
Kasungu	75	23.0	17.7	0.0	84.0
Mchinji	75	15.5	13.6	1.0	102.0
Lilongwe	75	13.8	9.0	1.0	39.0
Wealth Index					
All	300	0.0003	9.2	-7.5	44.1
Dedza	75	-3.3	4.8	-7.5	18
Kasungu	75	2.7	10.6	-7.5	43.0
Mchinji	75	2.1	12.5	-7.5	44.1
Lilongwe	75	-1.6	4.9	-7.5	16.2

n = Number of cases

Human capital

The results in Table 7 suggest no clear gender discrimination regarding the ratio of female and male adults to all adults who received formal education. It can be said that a gender imbalance in education is generally perceived to be the case at societal level, although intra-household scrutiny might paint a different picture in some places, as the results of this study indicate. With respect to agricultural extension services, households in Kasungu and Lilongwe districts received more extension visits compared to farmers in other districts. The farm areas of these two districts are in proximity to urban influence which favours availability and convenient delivery of services such as agricultural extension. Habitually, public servants including extension staff, hesitate to work in remote areas resulting in understaffing of these areas.

Health status is another critical strand of human capital. To evaluate health, an Ill Health Index (IHI) constructed from the prevalence and intensity of ten human diseases characteristic to SSA was developed. Table 7 shows households in Kasungu and Lilongwe districts, having better linkages with urban influence, had members who were much healthier compared to those in the remote districts of Dedza and Mchinji. Contrary to people in remote places, those residing in or closer to urban centres would conveniently access better health services including public health education.

Table 7: Descriptive statistics of human capital attributes

Attributes	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Formally educated male ratio	300	0.3 (0.3)	75	0.3 (0.3)	75	0.4 (0.3)	75	0.3 (0.3)	75	0.4 (0.3)
Formally educated female ratio	300	0.4 (0.3)	75	0.3 (0.3)	75	0.4 (0.3)	75	0.4 (0.3)	75	0.4 (0.3)
Extension visits per year	300	14.3 (31.5)	75	7.3 (12.4)	75	25.8 (55.4)	75	9.0 (14.8)	75	15.2 (19.0)
Ill Health Index	300	0.01 (0.1)	75	0.02 (0.1)	75	0.004 (0.01)	75	0.02 (0.06)	75	0.01 (0.02)

n = Number of cases; number in open is the mean while the number in brackets is the standard deviation (SD)

Financial capital (liquidity)

Households in Kasungu District saved the largest amount of cash at bank, which was four and three times the average amount that households in Dedza and Lilongwe districts respectively were able to save at bank (Table 8). None of the sampled households had savings at bank in Mchinji District. However, the number of households able to save at bank in Dedza was higher than in other districts. With the exception of Dedza, in the remaining districts, more households tended to keep cash savings at home. Formal credit was important in terms of magnitude particularly in Kasungu and Mchinji districts. In terms of size, the liquidity commanded by the household through social transfers in both cash and in kind was more valuable in Lilongwe compared to other districts. Lilongwe District is on the outskirts of Lilongwe city where rural youths can seasonally or permanently, seek jobs or engage in street hawking business of consumable items and remit funds back to their families. The standard deviations of average liquidity for different sources are generally high suggesting high level of inequality in access among the households. Households in Lilongwe District were conclusively better off in terms of overall liquidity which suggests that better liquidity is brought by urban influence. This demonstrates a need for enhancing pro-poor rural micro–finance to ease the liquidity constraint widely faced by poor farmers in remote areas to enable them to afford productive investments.

Table 8: Descriptive statistics of liquidity (US$) per capita by sources

Liquidity types	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Cash savings at bank	30	175 (276)	4	62 (101)	14	277 (346)	0		12	94 (117)
Cash savings at home	218	57 (178)	50	22 (29)	46	60 (97)	64	34 (45)	58	111 (325)
Claim on debtors	54	24 (50)	19	7 (8)	23	27 (43)	5	22 (12)	7	68 (109)
Jewellery	7	8 (8)	5	8 (10)	0		2	9 (3)	0	
Formal credit	48	146 (371)	14	19 (20)	16	248 (391)	11	206 (605)	7	72 (93)
Informal credit	82	23 (68)	19	18 (32)	24	42 (120)	31	11 (11)	8	30 (19)
Cash remittances	84	48 (265)	11	5 (5)	23	14 (19)	33	8 (7)	17	197 (577)
In kind remittances	52	61 (332)	5	5 (9)	11	43 (58)	21	7 (6)	15	168 (618)
Overall liquidity	300	117 (394)	75	30 (61)	75	174 (378)	75	71 (254)	75	196 (630)

n = Number of cases; exchange rate as at August 2007 was US$ 1 = MK 140

In addition to absolute liquidity is how readily one can access diversity resources to ease the liquidity constraint. This is explained through a composite liquidity index measuring, in aggregation, an accessible portfolio of liquidity sources and their underlying easiness of access. The mean values did not exceed 2.6 for three types of liquidity index and 5.0 for the overall liquidity index, which indicates that the liquidity constraint is considerable (Table 9). Interestingly, accessibility to current liquidity sources and ease of realising cash from such sources matched that of social transfers in Lilongwe District. Social transfers in terms of remittances seem to be an important source of liquidity to farmers in areas that are nearer to urban influence than otherwise. Urban centres are places where family members can go to seek jobs and remit back home part of their earnings. Liquidity constraints seem to be more apparent in the rural areas of Malawi and should be redressed for poor farmers to be able to finance their production investments.

Another dimension of financial capital is the stock of non working animals valued at the price at which a farmer would be willing to sell. Apparently, livestock keeping is not a widespread practice in the surveyed areas. For all types of livestock, a household owned less than an average of one animal (Table 10).

Table 9: Descriptive statistics of liquidity index by type

Liquidity index	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Current[4]	300	1.8 (1.9)	75	1.5 (1.7)	75	2.6 (2.2)	75	1.4 (1.7)	75	1.9 (1.7)
Conditional	300	0.8 (1.2)	75	0.5 (0.8)	75	1.0 (1.2)	75	0.5 (1.1)	75	1.2 (1.5)
Social transfers	300	0.9 (1.5)	75	0.4 (0.9)	75	0.9 (1.3)	75	0.6 (1.2)	75	1.9 (2.1)
Overall	300	3.6 (3.7)	75	2.3 (2.6)	75	4.5 (3.8)	75	2.4 (3.5)	75	5.0 (4.1)

n = Number of cases

Comparatively more cattle were kept in Dedza, more poultry in Lilongwe, more pigs in Kasungu, and sheep and goats equally kept in all districts. From these results, it can be concluded that rural districts are ideal places for extensive keeping of cattle and pigs that require more space while urban ones are suitable for intensive systems like poultry rearing. Overall Kasungu and Dedza districts had more livestock and value compared to Lilongwe and Mchinji districts. Development of the livestock sub-sector is indispensable as it is important for supplementing income and supplying animal protein in rural areas.

Table 10: Descriptive statistics of livestock size (TLU) and value per capita (US$)

Livestock TLU/value	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Cattle (TLU)	300	0.2 (0.8)	75	0.2 (1.0)	75	0.1 (0.6)	75	0.3 (1.0)	75	0.1 (0.3)
Pigs (TLU)	300	0.1 (0.3)	75	0.1 (0.3)	75	0.2 (0.5)	75	0.01 (0.1)	75	0.04 (0.2)
Sheep and goats (TLU)	300	0.1 (0.3)	75	0.1 (0.3)	75	0.1 (0.2)	75	0.1 (0.2)	75	0.1 (0.3)
Poultry (TLU)	300	0.1 (0.1)	75	0.04 (0.1)	75	0.1 (0.2)	75	0.1 (0.1)	75	0.2 (0.2)
All livestock (TLU)	300	0.5 (1.1)	75	0.5 (1.5)	75	0.6 (1.0)	75	0.4 (1.1)	75	0.4 (0.6)
Livestock value per capita (US$)	300	37.1 (143.2)	75	47.7 (258.5)	75	35.3 (65.2)	75	32.1 (90.9)	75	33.2 (58.0)

n = Number of cases; exchange rate as at August 2007 was US$ 1 = Malawian Kwacha (MK) 140

Social capital

Group networking is a strong element of social capital which enhances societal development and integrity through information exchange and interactive learning. The majority of households in all the districts networked more through religious groups than they did through other groups. Generally, other important group settings were informal safety net, community development, HIV/AIDS and cooperatives (Table 11). Religious diversity is much lower in Malawi which is mostly a Christian country. Similar religious denominations forge trust from which bonding social capital stems. Therefore, church based groups would serve as social platforms for promoting developmental changes in rural Malawian societies.

Table 11: Membership of social associations

Group typology	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Community development	17	8	2	6	2	3	5	9	8	18
Cooperative	14	7	2	6	6	8	4	7	2	5
Religious group	122	58	16	47	49	63	38	68	19	43
Credit and savings group	11	5	1	3	4	5	0	0	6	14
Informal insurance (safety net)	19	9	4	12	9	12	4	7	2	5
Women group	5	2	3	9	2	3	0	0	0	0
HIV/AIDS group	14	7	2	6	1	1	4	7	7	16
Youth clubs	3	1	2	6	0	0	1	2	0	0
Irrigation associations	6	3	1	3	5	6	0	0	0	0
Natural resource management	1	0	1	3	0	0	0	0	0	0

n = Cases with multiple responses

Chapter 3

Livelihood contexts and strategies

Land allocation

Land allocation decisions among a mix of crop enterprises signal out land use at the household level. Arriving at a decision on how much land to allocate to a certain crop shapes the contexts around it. Such contexts might include crop marketability, food security objective, land and climatic suitability or policy advocacy. Although, these results spotlight the situation during the reference season of 2006, it paints a very likely picture of usual land allocation decisions in households. Of the six maize cropping systems identified in the study area, local maize:legume intercropping was practised very widely among households, especially in Dedza and Lilongwe districts (Table 12). Hybrid and local maize under monocropping systems were much popular in Kasungu and Mchinji districts. Compared to other districts, households in Kasungu District tended to allocate larger amounts of land to growing hybrid maize than other types of maize. Groundnuts were important to many households for which farmers in Mchinji District committed more land compared to farmers in other districts. Tobacco was more localised in Kasungu and Mchinji compared to other districts although it took less than two acres per household. Two non traditional crops that revealed a modest cross district prominence were soyabean and sweet potato. Cassava was somewhat common in Kasungu and very unpopular in other districts. Land allocation decisions indicate that maize, irrespective of variety and cropping system, is important to many households. Other crops like groundnuts, soyabeans and sweet potato appear to be gaining prominence.

Seed procurement, yield and profitability of maize enterprise

Maize seed procurement

The seed procurement system is important in the development of the maize sub-sector and hence, worth assessing. Farmers can either get seed to plant in a running season from the grain saved from a previous harvest or from the market. Results in Figure 3 indicate that most households that grew improved maize varieties procured seed from the market while the majority of those which grew local maize used home saved seed. This means that farmers are willing and able to invest in novel technologies once made available in convenient markets. However, significant proportions of households (>25%) across the districts recycled improved maize varieties. The tendency of recycling improved maize varieties, especially hybrids, is undesirable under best agronomic practice because the genetic productivity potential tends to decrease with recycling.

Table 12: Land allocation among crops

Crop types	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Local maize (sole)	76	1.5 (0.8)	7	1.2 (0.6)	21	1.3 (0.7)	28	1.8 (1.0)	20	1.3 (0.6)
Hybrid maize (sole)	76	1.6 (1.3)	7	0.6 (0.5)	28	2.2 (1.7)	22	1.5 (0.8)	19	1.2 (0.8)
OPV maize (sole)	26	1.5 (0.8)	2	1.0 (0.0)	10	1.8 (0.9)	7	1.5 (0.6)	7	1.2 (0.6)
Local maize intercropped	107	1.6 (0.9)	57	1.6 (0.9)	5	1.9 (1.5)	18	1.9 (1.1)	27	1.3 (0.6)
Hybrid maize intercropped	42	1.7 (1.1)	11	1.4 (0.8)	11	2.1 (1.5)	11	1.9 (1.2)	9	1.4 (0.6)
OPV maize intercropped	18	1.3 (0.7)	3	1.3 (0.3)	3	0.9 (0.6)	3	2.1 (0.9)	9	1.2 (0.6)
Bean	14	0.7 (1.2)	4	0.2 (0.0)	4	0.5 (0.1)	4	0.4 (0.1)	2	2.8 (3.2)
Soyabean	46	0.7 (0.7)	11	0.5 (0.3)	15	0.6 (0.4)	12	0.9 (1.3)	8	0.5 (0.3)
Groundnuts	160	1.2 (2.1)	28	0.8 (0.4)	27	0.9 (0.4)	68	1.7 (3.1)	37	0.6 (0.3)
Cassava	17	0.9 (0.6)	2	0.6 (0..6)	13	0.9 (0.7)	0	–	2	0.8 (0.4)
Irish potato	2	0.8 (0.4)	0	–	1	0.5 (–)	0	–	1	1.0 (–)
Sweet potato	56	0.6 (0.7)	10	0.4 (0.2)	22	0.5 (0.4)	13	0.9 (1.3)	11	0.6 (0.3)
Vegetables	5	0.3 (0.2)	4	0.4 (0.1)	0	–	0	–	1	0.04 (–)
Tobacco	83	1.3 (1.1)	3	0.7 (0.3)	34	1.7 (1.2)	39	1.2 (1.0)	7	0.6 (0.2)

n = Cases with multiple responses

Maize yields with levels of *Striga* infestation

Considering *Striga* as a stern constraint to maize productivity, assessment of maize yields without and with *Striga* infestation is analytically compelling. Yields of improved maize varieties were consistently higher than those of local maize varieties even under severe *Striga* infestation (Figure 4). This means that wider adoption of improved maize varieties over the local varieties in *Striga* infested areas would reduce the maize grain production deficit. There is still room to further improve productivity of improved

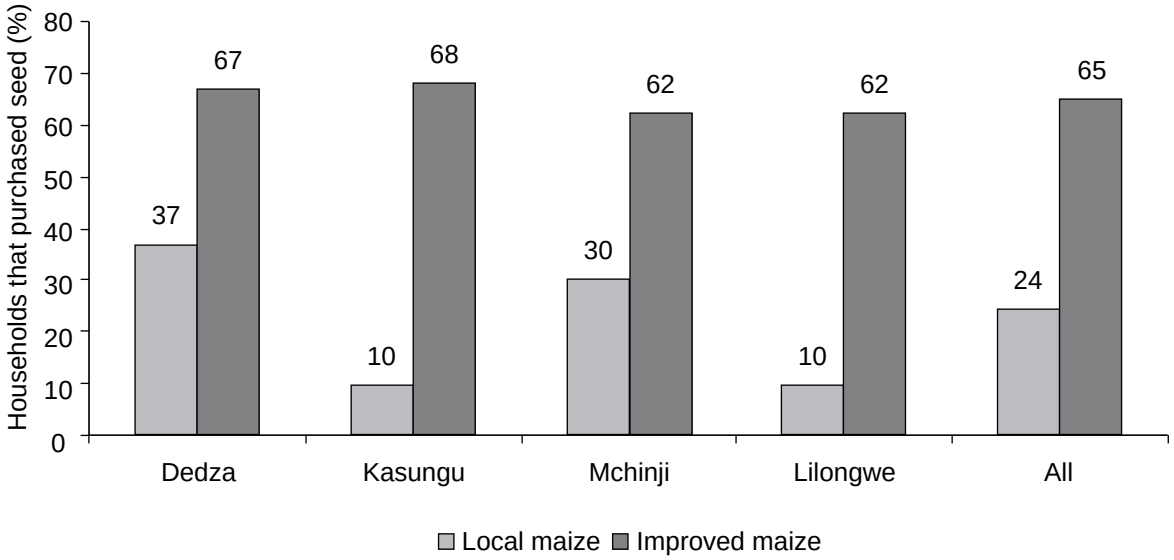

Figure 3: Procurement of maize input seed from the market by district

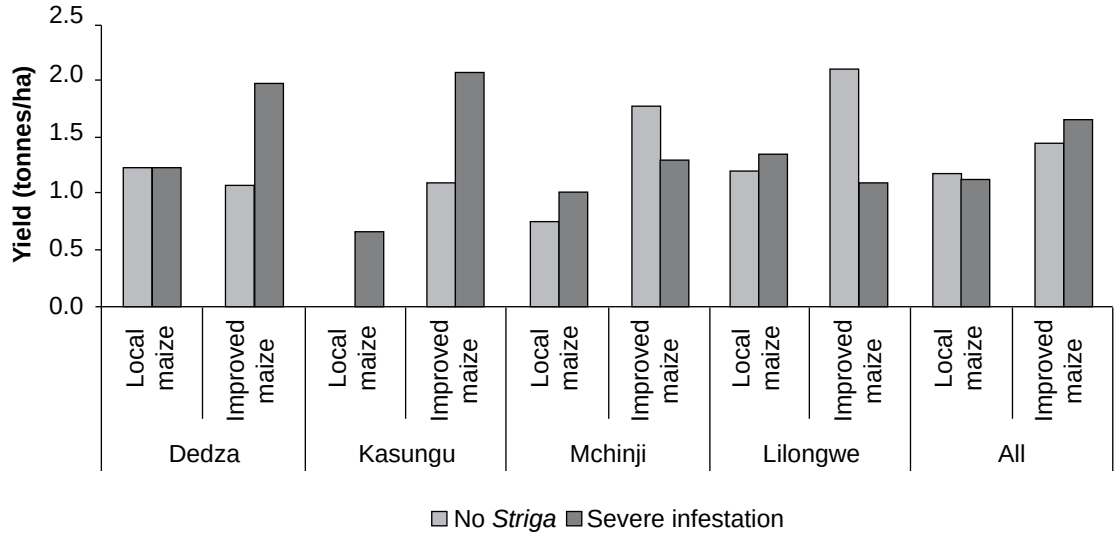

Figure 4: Yield of maize with different levels of Striga infestation by district

maize given the untapped yield potential of 4–6 metric tonnes/ha through better agronomic practices (Kabambe and Ganunga, 2003). Comparing the productivity of different maize varieties under *Striga* infestation gave mixed information. For example, in Dedza and Kasungu districts, improved maize varieties gave higher yield with severe infestation than in the absence of *Striga*. This underscores the possibility of other non-*Striga* factors hindering the productivity of maize.

Maize returns to land

The level of returns to land with and without *Striga* infestation informs about the income impact of *Striga* infestation (Figure 5). In terms of returns, improved maize outperformed local maize with severe *Striga* infestation in Dedza and Kasungu districts. Meanwhile in Lilongwe District, local maize gave higher returns than improved maize

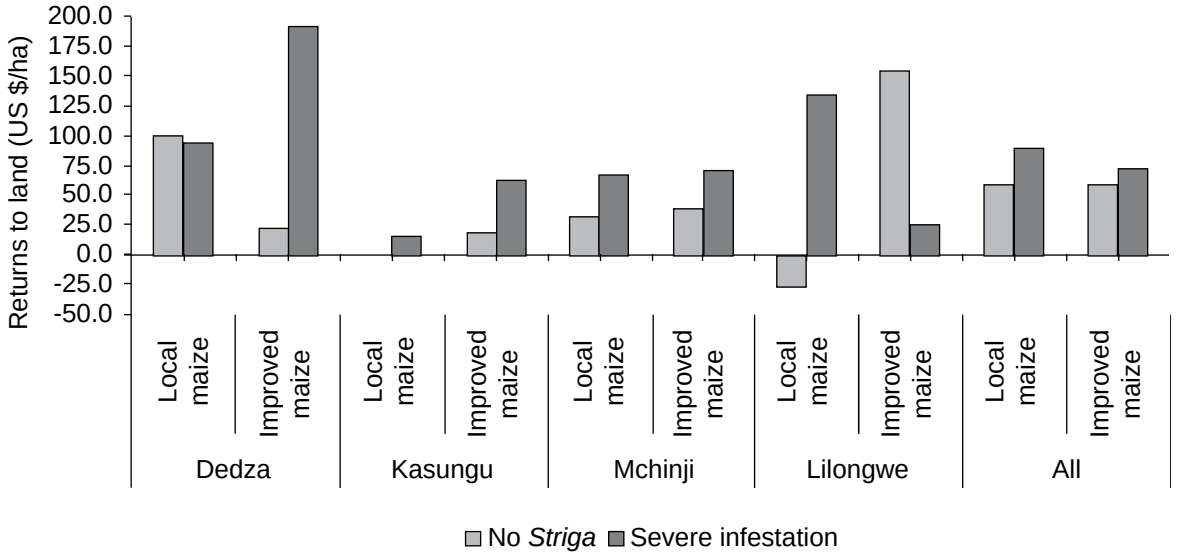

Figure 5: Returns to land from maize with different levels of Striga infestation by district

with severe *Striga* infestation. Differential returns to land across space, variety and *Striga* infestation status could also be a function of variation in price and cost structures. This is because the return structure did not consistently follow the physical productivity pattern. The yield potential of improved maize variety amid *Striga* infestation could significantly translate into higher returns if production efficiency is improved.

Determinants of land allocated to improved maize varieties

The extent of adoption expressed as land allocation to improved maize variety, indicates the importance with which a farmer attaches to the technology. Determinants of the probability of a household allocating more than 50% of its farmland to improved maize were identified by estimating a binary logistic model (Table 13). The extent of adoption of improved maize technology increased significantly with increasing stock of productive tools ($P<0.05$), number of farm extension visits ($P<0.01$), and the ratio of formally educated male adults to total household members ($P<0.05$). Better quality and stock of productive farm tools measured through a Productive Tools Index would increase the capacity of the household to manage more land. Also, the hypothesis was confirmed that increasing the frequency of access to agricultural extension services through farm visits would increase awareness by farmers of the potential of novel technologies hence promote extent of adoption. Formal literacy of the male adult members who dominate the decision making processes in a household would increase the likelihood of increased adoption of novel technologies. The marginal effects indicate that formal literacy of adult male members had a larger impact on the extent of adoption of improved maize technology. Age of household head was the only variable with a negative influence on the extent of adoption of improved maize technology at the 5% level of significance. Ageing is theoretically a positive correlate of risk-averse behaviour which hinders the extent of technology adoption. Increased access to the right information about a certain novel technology in place for adoption would reduce risk aversion and hence promote the extent of adoption. Post estimation diagnostics indicate that the model fitted the data well ($P<0.01$) with 70% accuracy of prediction.

Table 13: Determinants influencing amount of land allocated to improved maize

Determinants	Average	SD	Expected sign	β	Z-statistic	Marginal effects
Wealth Index	0.0003	9.20		-0.006	-0.36	
Productive Tools Index	15.76	13.43	Positive	0.026	2.14**	0.006
Total land managed	3.75	3.29		0.064	1.45	
Number of extension visits	14.30	31.52	Positive	0.026	3.01***	0.006
Dependency ratio	1.20	0.85		0.000	0.44	
Ratio of formally educated male adults	0.35	0.26	Positive	1.168	2.09**	0.291
Ratio of formally educated female adults	0.38	0.31		0.664	1.48	
Liquidity Index	3.56	3.72		0.047	1.34	
Liquidity per capita (US$/person/year)	96.42	359.62		0.000	0.25	
Livestock TLU	0.47	1.09		0.017	0.14	
Income per capita (US$/person/year)	64.78	101.69		0.002	0.96	
Intra household networking intensity	0.74	1.05		0.160	0.78	
Duration in social networking (months)	117.14	184.30		0.000	-0.54	
Engagement in off farm (1 = engaged)	0.11	0.32		-0.250	-0.57	
Age of household head (years)	46.20	17.25	Negative	-0.017	-1.90**	-0.004
Constant				-1.493	-2.21	

Diagnostic statistics	
Model and estimation	Binary choice logit and Maximum Likelihood Estimation (MLE)
Dependent variable	Adoption of improved maize: those allocated ≥50% of farmland to improved maize = 1 and 0 = Otherwise
Econometric software used	LIMDEP
Number of observations	300
Chi squared (df)	57.12 (15)
Prob[ChiSqd > value]	0.0000
Log likelihood function	-178
Prediction robustness	Actual 1s and 0s correctly predicted = 70%

** and *** = Significant at 5% and 1%, respectively

Crop productivity constraints

The production and post–harvest constraints were derived from the respondents' perception using direct questions. Such direct asking would give fuzzy answers that hardly distinguish problems from symptoms or causes from effects. Any post survey attempt to speculate what might be causes or effects will mislead the first hand information. However, in a broader context a constraint can be any problem which directly or indirectly the respondent feels undermines his or her livelihood situation. Table 14 shows that lack of inputs and *Striga* infestation were the most commonly cited constraints to crop productivity in all districts except Lilongwe where the major constraint cited was low productivity. Low productivity as a symptom can arise from a range of causal factors. The government of Malawi is already giving fertiliser subsidy to farmers which will improve access to this input. Increased fertilisation will improve soil fertility and reduce the effect of *Striga* on cereal production.

Table 14: Major crop productivity constraints (% of households)

Constraints	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Striga infestation	71	25.6	17	23.0	21	35.0	25	34.7	8	11.3
Land scarcity	15	5.4	9	12.2	0	0.0	3	4.2	3	4.2
Low soil fertility	20	7.2	11	14.9	3	5.0	1	1.4	5	7.0
Drought	15	5.4	2	2.7	2	3.3	1	1.4	10	14.1
Low productivity	48	17.3	5	6.8	5	8.3	9	12.5	29	40.8
Lack of inputs	73	26.4	27	36.5	27	45.0	16	22.2	3	4.2
Lack of labour	7	2.5	2	2.7	2	3.3	0	0.0	3	4.2
Lack of capital	21	7.6	1	1.4	0	–	17	23.6	3	4.2
Crop pests and diseases	7	2.5	0	–	0	–	0	–	7	9.9

n = Multiple responses

Striga infestation and seasonality are critical contexts affecting crop productivity, particularly maize which is a major cereal crop in central Malawi. The rating of *Striga* infestation severity is based on farmer perceptions. The *Striga* severity levels were ascertained in the minds of respondents after considering aspects such as population of *Striga* plants in the plot, size of the plot infested and number of *Striga* shoots on the host maize plant. Both mild and severe *Striga* infestation in maize plots accounted for more than three quarters of valid responses across districts (Table 15). The *Striga* problem was found to be widely severe in Mchinji and Kasungu districts compared to Dedza and Lilongwe districts. It should be noted that when *Striga* featured mildly, it was thought of under a big umbrella of crop productivity constraints. However, the *Striga* problem became amplified when it probed specifically to maize plots.

In tropical areas such as central Malawi, farmers face a season which is either above average, normal to average or below average based on the amount and distribution of

rainfall. Based on the perception of recorded rainfall data, an above average season is the one with a rainfall amount exceeding the long term mean with good distribution or vice versa for below average season, while a normal to average season is a mediocre situation. Results on seasonality in Table 15 are based on farmer perceptions as they rated the quality of the reference season in their maize plots. Most farmers in Kasungu (68%) rated the crop season below average than farmers in other districts who reported the season to be average. This finding implies the possible case that Kasungu has low rainfall compared to other districts. Below average seasons suggests agricultural drought characterised by a situation where soil moisture cannot meet the crop water requirement. Farmers could be compelled to apply rainwater harvesting and soil water conservation practices that help to reduce the effect of drought at the field level.

Table 15: Severity of *Striga* infestation and seasonality in maize plots

Constraints	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
***Striga* infestation**										
No infestation	22	7.5	7	9.5	7	10.3	3	4.0	5	6.8
Mild	123	42.3	41	55.4	19	27.9	22	29.3	41	55.4
Severe	146	50.2	26	35.1	42	61.8	50	66.7	28	37.8
Season quality										
Above average	32	11.0	8	10.8	5	7.4	13	17.3	6	8.1
Normal to average	165	56.7	41	55.4	17	25.0	53	70.7	54	73.0
Below average	94	32.3	25	33.8	46	67.6	9	12.0	14	18.9

n = Number of cases with multiple responses

The trend of *Striga* infestation was captured by asking a farmer to estimate the percentage of land infested during the survey compared to that infested ten years ago. Figure 6 shows that the encroachment of *Striga* in all districts has increased appreciably over the ten years. The rate of infestation of *Striga* is least in Dedza compared to the other districts where almost half of the land used to grow *Striga* prone crops, such as cereals, is infested. As *Striga* is spreading in the study area, measures to curb it, such as IR maize are urgently needed.

Traditional *Striga* control methods

Farmers have their own methods to control *Striga*. In this regard, it was important to assess a constellation of current *Striga* control measures which have generally failed to solve the problem. In the study area, uprooting and burning were the most cited conventional weed management technologies used by farmers to manage *Striga* (Figure 7). Manure application was next to uprooting and burning in popularity as reported in about 30% of all responses. In order of diminishing prominence, others include field abandonment, intercropping with legumes and the use of multiple technologies

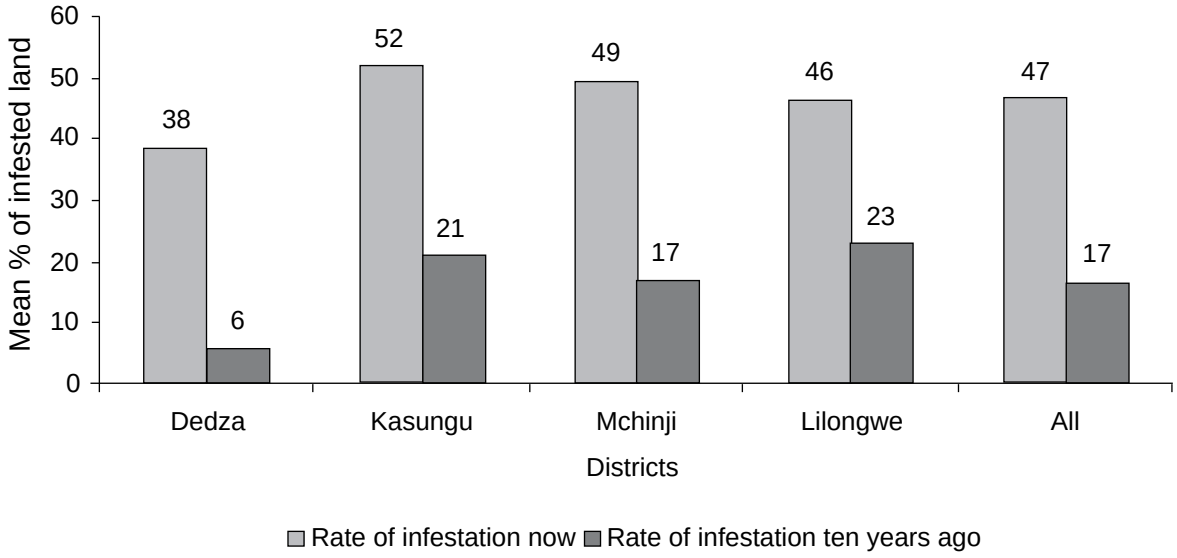

Figure 6: Striga infestation rate over the period of ten years by district

which could be termed as Integrated *Striga* Control (ISC). Apparently, abandonment of infested fields was more widely practised (>20%) among households in Kasungu compared to other districts.

Livelihood income strategies

Providing the livelihoods of households vested in the household heads as key bread earners is predominantly crop production based (Table 16). In other words, the diversification strategy which is believed to be crucial in fostering resilience of rural livelihoods is almost non existent. Other means of living are very marginal. It is logical that, as poverty is a multi–faceted phenomenon, the successful war against it has to use a multiple of weapons. In principle, rural poverty reduction efforts in Malawi cannot disregard the development of the crop sub-sector. However, the diversification of income enterprises beyond the crop sub-sector has to be promoted vigorously to fast track poverty reduction.

Table 16: Major livelihood occupation of household heads

Occupation	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Crop production	279	93.0	73	97.3	72	96.0	70	93.3	64	85.3
Business	13	4.3	1	1.3	1	1.3	2	2.7	9	12.0
Professional employment	3	1.0	0	–	0	–	1	1.3	2	2.7
Wage work	3	1.0	0	–	2	2.7	1	1.3	0	–
Livestock keeping	2	0.7	1	1.3	0	–	1	1.3	0	–

n = Number of cases

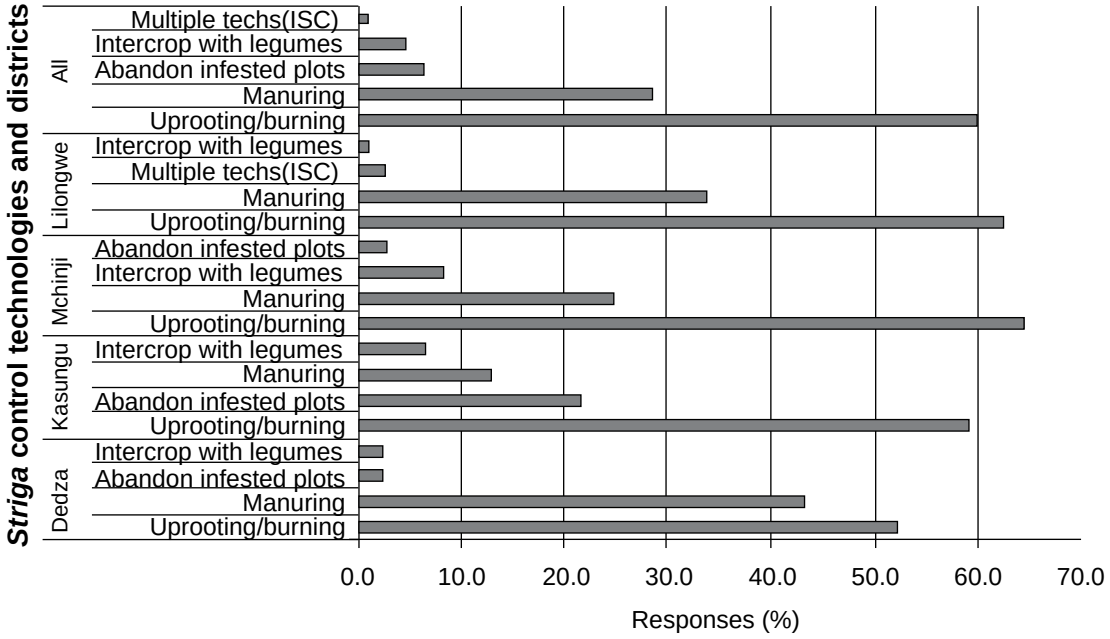

Figure 7: Traditional methods of Striga *control*

Livelihood shocks

Shocks experienced by households

In pursuit of its livelihood strategy, a household always faces shocks, either common or specific in nature. Food deficit was the most common shock experienced by the majority of households across districts (Table 17). The second, third and fourth most widespread shocks were illness, famine and death of an important household member accounting for 26%, 16% and 15%, respectively. Comparatively, food deficit was more pronounced in Dedza than in other districts. As indicated in Figure 6, Dedza District had the highest rate of *Striga* infestation at the time of the survey compared to ten years before. Possibly, *Striga* infestation in Dedza District could have decimated maize production to bring about the food deficit.

Table 17: Livelihood shocks experienced by households in the past five years

Types of shocks	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Food deficit	173	58	61	81	46	61	35	47	31	41
Famine	48	16	15	20	12	16	8	11	13	17
Loss of property	16	5	5	7	3	4	6	8	2	3
Illness	78	26	23	31	15	20	19	25	21	28
Death of an important household member	44	15	13	17	14	19	9	12	8	11
Loss of animals	17	6	3	4	3	4	2	3	9	12

n = Number of cases with multiple responses

Major causes of livelihood shocks

Causes of livelihood shocks were assessed in totality without attributing any to a particular shock. This is because causality of a certain shock is multi-factoral and multi-directional. A single casual factor can be the driver of more than one shock. Results in Table 18 indicate that human diseases were felt to be the most prominent cause of livelihood shocks that forged illness and possibly death. *Striga* was the second most prominent cause of livelihood shocks, likely occasioning food deficits. Drought and lack of inputs ranked third and fourth in contributing to shocks like food deficit and famine, respectively. Theft ranked fifth for all districts.

Table 18: Causes of livelihood shocks

Causes of shocks	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Human disease	108	36.0	30	40.0	26	34.7	26	34.7	26	34.7
Striga infestation	98	32.7	40	53.3	20	26.7	27	36.0	11	14.7
Drought	56	18.7	16	21.3	9	12.0	12	16.0	19	25.3
Lack of inputs	40	13.3	11	14.7	20	26.7	1	1.3	8	10.7
Theft	21	7.0	6	8.0	3	4.0	9	12.0	3	4.0
Livestock diseases	9	3.0	2	2.7	1	1.3	0	–	6	8.0
Crop pests and diseases	5	1.7	2	2.7	0	–	0	–	3	4.0

n = Number of cases with multiple response

Effects of livelihood shocks

Effects of shocks are immediate consequences resulting from shocks that sampled households encountered. Farmer perceptions are that low crop production was the most widely experienced effect of factors causing low productivity such as *Striga* infestation (Table 19). Reduced family labour supply and ill health were the second and third most common effects that could be associated with illness. Because of shocks, some households reported to have lost part of their means of earning an income. Depletion of resources through liquidation to obtain cash was the most rarely experienced effect from livelihood shocks. It appears that the consequences of shocks are all impoverishing in nature. Therefore, helping households with the means of addressing the root causes of the underlying shocks would reduce vulnerability and increase resilience to shocks.

Response to livelihood shocks

It is important to analyse measures taken to mitigate shocks and to cope with their effects *ex-post*. Exchanges of casual labour for cash and food was the *ex-post* strategy used mostly by households to cope with shocks that require cash and/or food (Table 20). Adoption of *Striga* control measures was an important responsive measure taken to mitigate shocks arising from *Striga* infestation especially in Dedza District. Other

coping strategies applied to survive the shocks were reliance on relief food aid, selling animals, selling crop stock and spending savings. Selling crop stock would be viable for non food shocks like illness.

Table 19: Effects of livelihood shocks

Effects of shocks	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Low crop production	183	61.0	56	74.7	48	64.0	41	54.7	38	50.7
Reduced family labour	61	20.3	16	21.3	9	12.0	17	22.7	19	25.3
Health disorder or ill health	38	12.7	17	22.7	7	9.3	7	9.3	7	9.3
Loss of source of income	32	10.7	8	10.7	7	9.3	6	8.0	11	14.7
Low use of inputs	22	7.3	7	9.3	7	9.3	4	5.3	4	5.3
Depletion of resources	13	4.3	5	6.7	4	5.3	2	2.7	2	2.7

n = Number of cases with multiple response

Table 20: Response to various livelihood shocks

Responses	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Casual labour for cash and food	99	33.0	28	37.3	20	26.7	25	33.3	26	34.7
Adopt *Striga* control measures	42	14.0	24	32.0	11	14.7	3	4.0	4	5.3
Receive relief food	37	12.3	13	17.3	5	6.7	13	17.3	6	8.0
Sell animals	36	12.0	13	17.3	6	8.0	8	10.7	9	12.0
Receive remittances	28	9.3	4	5.3	5	6.7	8	10.7	11	14.7
Sell crop stock	27	9.0	7	9.3	5	6.7	6	8.0	9	12.0
Spend savings	27	9.0	5	6.7	15	20.0	5	6.7	2	2.7
Liquidate durables	12	4.0	4	5.3	3	4.0	2	2.7	3	4.0
Migration of some members	12	4.0	5	6.7	2	2.7	2	2.7	3	4.0
Try maize in winter season	4	1.3	0	–	1	1.3	3	4.0	0	–
Shift to *Striga* free plots	3	1.0	3	4.0	0	–	0	–	0	–
Switch from maize	3	1.0	0	–	0	–	2	2.7	1	1.3

n = Number of cases with multiple response

Trends in livelihood situation

Figure 8 shows that most of the respondents felt that the livelihood situation of their households has worsened over the period of the past five years. Apparently, Kasungu District seems to be badly hit by having the largest proportion of households (63%) that faced a downward livelihood trend. Lilongwe District which would relatively benefit from its proximity to the city had the least percentage of households with worsening livelihoods. Some households experienced a rather stagnated course of livelihood over the reference period. Deteriorating livelihood situations over time as expressed by the poor themselves, questions the delivery of the Millennium Development Goals (MDGs) in Malawi. It also raises a concern as to whether macro–level efforts in poverty reduction have really impacted positively to break the traps holding the poor in deeper poverty.

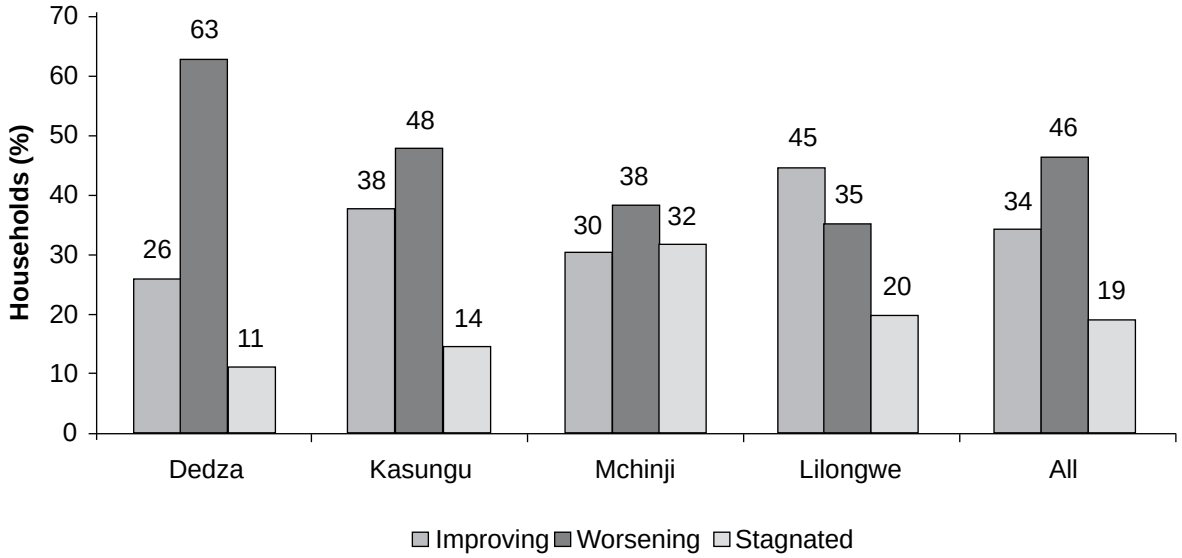

Figure 8: Livelihood situation trend (situation between now and five years ago)

Chapter 4

Livelihood outcomes

Health and nutrition

Ill health

Health is an important aspect of livelihood as it determines the level of human capital in terms of quality and supply of labour. On the other hand, ill health or morbidity depletes the badly needed financial resources in meeting disease treatment and prevention costs. In extreme cases, ill health leads to loss of human life especially of vulnerable groups like women and young children. The incidence of ten diseases was plotted in comparative scatter graphs to portray the importance of different diseases over space. In this graphical analysis, the incidence variable took a binary nature with a value '1' when a household had any member who suffered from the disease and '0' when none suffered. The relative length of red bars at 0- and 1 y- coordinates suggest the intensity of valid cases at that particular coordinate. The purple bars sandwiched in the 0–1 coordinate plane represent the mean incidence obtained by averaging all 0's and 1's. Figure 9 shows comparative scatter plots which map out the incidence of common and uncommon diseases. Diseases that hit many households across districts were malaria, dysentery or diarrhoea and respiratory system diseases.

By construction, the Ill Health Index for a particular disease consolidates the incidence and prevalence of that disease in the household. The prevalence component captures the intensity and duration, that is, the total number of members who contracted the disease and its annualised duration for which the suffering persisted. Results in Table 21 indicate that malaria and respiratory related diseases were the most prevalent diseases in all districts. Respiratory diseases were highly localised in Dedza compared to other districts. Measles which can be controlled through vaccination in childhood, was a localised problem in Lilongwe District. As a communicable disease, the spread of measles is favoured by immense interactions of people likely to occur among households in Lilongwe District which is located in the neighbourhood of the city.

Tuberculosis was more pronounced in Mchinji than in other districts. Unexpectedly, the respondents in all districts reported no incidence of HIV/AIDS. Non reporting of HIV/AIDS could be due to the widely held stigmatisation of people living with HIV since the prevalence of HIV/AIDS is known to be high in Malawi. Dysentery and diarrhoea, which are associated with access to unsafe water and bad sanitation, prevailed across districts. Typhoid fever which also tends to spread by poor water and sanitation services, was localised to Mchinji and Lilongwe Districts only. Nevertheless, large standard deviations of Ill Health Indices for some diseases imply high levels of discrepancy of ill health among households. Results have indicated that different

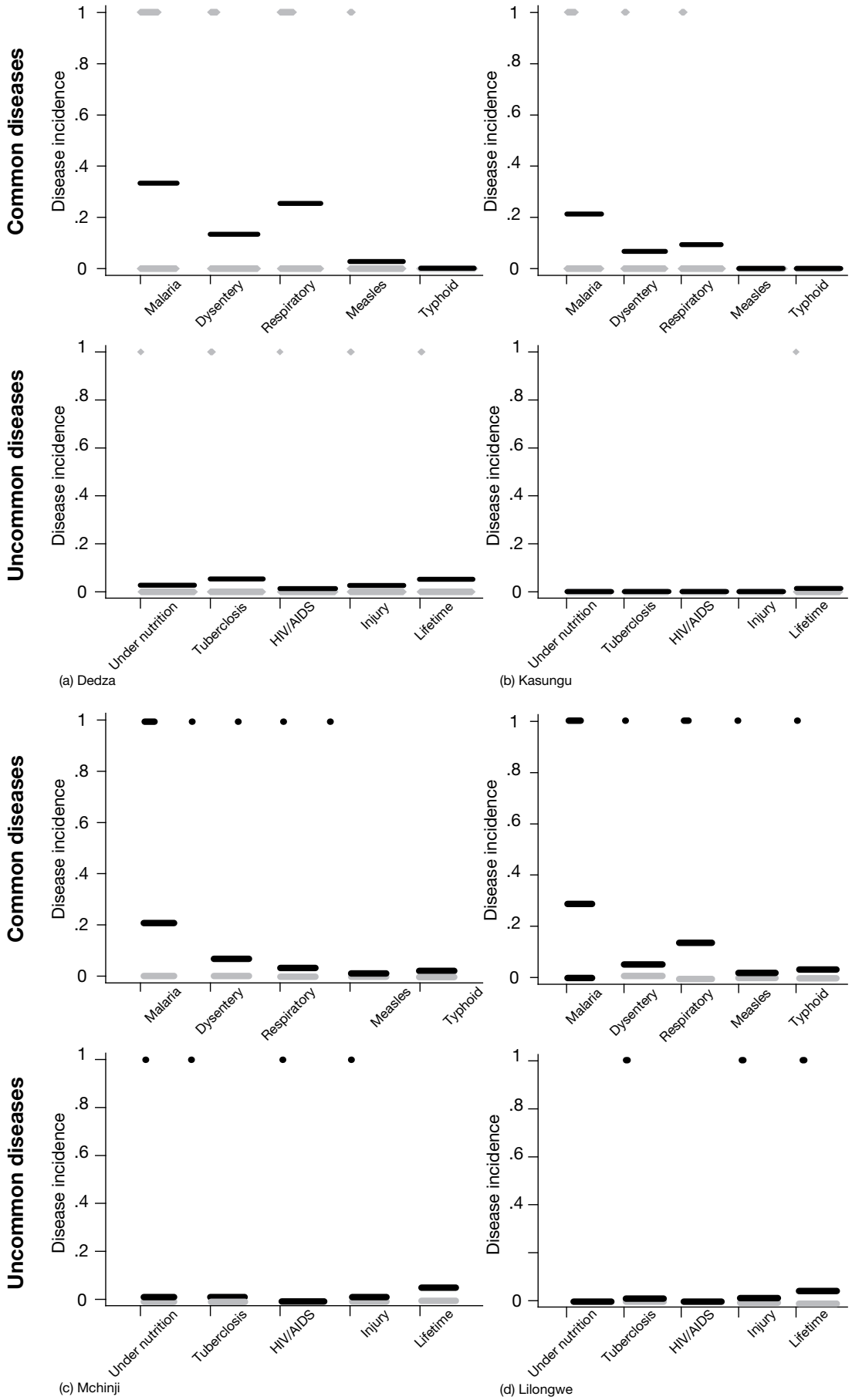

Figure 9 : Incidence of various human diseases characterising household ill health

diseases are important in different localities and some, like malaria, are widespread. Localisation of diseases commends locality-specific health interventions.

Table 21: Descriptive statistics of Ill Health Index (x 10^{-3}) for different diseases

Diseases/Ill Health Index	All (n = 300)		Dedza (n = 75)		Kasungu (n = 75)		Mchinji (n = 75)		Lilongwe (n = 75)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Malaria	3.5	11.0	6.0	18.3	3.3	9.6	1.6	4.4	3.1	6.4
Dysentery/diarrhoea	0.7	5.0	1.5	9.5	0.7	3.0	0.5	2.8	0.3	1.6
Respiratory	3.7	31.0	10.7	58.5	0.4	2.0	0.5	3.2	3.2	16.7
Measles	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.2
Typhoid	0.3	4.0	0.0	0.0	0.0	0.0	0.4	2.6	0.9	7.0
Under nutrition	0.1	1.0	0.1	1.2	0.0	0.0	0.1	1.2	0.0	0.0
Tuberculosis	1.8	28.0	0.5	2.8	0.0	0.0	6.5	55.4	0.1	1.2
HIV/AIDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Injury/accident	1.7	20.0	4.5	38.1	0.0	0.0	1.5	9.3	0.7	4.7
Lifetime disorder	1.4	15.0	1.3	7.8	0.0	0.0	3.9	29.0	0.3	1.6
Overall ill health	13.2	50.0	24.7	73.8	4.4	10.0	15.1	62.4	8.7	20.2

Deeper insight into ill health was achieved by splitting the Ill Health Index variable for the country into three strata of equal numbers of households, here termed terciles. The country level ill health terciles were cross tabulated against districts to see how households in the district distributed among these terciles. Kasungu was best-off with more than three quarters (76%) of its households falling in the least ill health tercile. However, households in Lilongwe were in the middle and more severe ill health strata, and none was in the least ill health tercile. Kasungu and Lilongwe districts can be contrasted to give insights into the rural–urban mismatch in human disease prevalence. Closeness of Lilongwe to urban influence usually associated with better health services has not excluded its people from the peril of diseases.

Table 22: Distribution of households in different ill health levels (terciles)

Ill health terciles	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
Upper least ill health	100	33.3	36	48.0	57	76.0	7	9.3	0	–
Middle ill health	100	33.3	10	13.3	0	–	45	60.0	45	60.0
Most ill health	100	33.3	29	38.7	18	24.0	23	30.7	30	40.0

Nutrition status of mothers and children

Across districts, about three quarters of mothers were either underweight or obese based on the BMI (Table 23). Relatively, obesity was more pronounced in Mchinji and Lilongwe than in other districts. Under nutrition suggested by the underweight

scenario is marginally above a quarter of mothers whose anthropometric measurements of height and weight were taken. This is a significant under nourishment rate which needs attention in terms of maternal health care. However, the problem of obesity is widespread among mothers at a rate comparable to being underweight. In health science, obesity is undesirable as it puts an obese person at risk from ill health situations like hypertension.

The three indicators of child nutritional disorder show interesting trends. With child wasting, three quarters and over of children under five years of age were normal in all districts. With the child underweight measure, more than half, but less than three quarters, of under fives were normal. However, with child stunting, over three quarters of under fives were malnourished at differing levels. Wasting and underweight measures explain short and medium term nutritional disorders compared to the stunting index measure which underscores long term malnutrition. Therefore, long term under nourishment among younger children in *Striga* infested areas of central Malawi is widespread. Comparison across districts shows that Mchinji had a greater percentage (54%) of severely stunted children whereas Kasungu had the least percentage of children who were observed to be too short relative to their ages (11%).

Market based enterprise income and long run wealth

Market based enterprise income

Crop production is the widely dependable source of income for the majority of the sampled households. Despite its popularity, crop enterprises paid modestly compared to some less popular enterprises like business and casual works. The income analysis considered only gross revenues from goods and services that were exchanged in the markets leaving aside home consumption. The aim was to portray the picture with respect to the income benefits associated with market participation. As crop production is the most widely undertaken livelihood endeavour, improved linkages to profitable markets will have a far reaching poverty reduction impact in rural Malawi. Other important sources which gave more income through market participation were livestock, business and casual works. Formal employment was highly remunerative but it was restricted to fewer households making it insignificant in the rural context. Households in Kasungu registered much higher income from market participation compared to other districts.

Long run household wealth

The average wealth indices reveal high levels of inequality among households across districts (Table 25). Apparent differences exist between the three strata of wealth entailing 20%, 40% and 40% of rich, middle and poor households respectively, rated after sorting wealth indices in descending order. Inequality is much higher between those endowed with quality amenities and utility assets and the rest in the middle and poor brackets.

Table 23: Anthropometrics based nutritional status of mothers and under fives

Nutritional status	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	%	n	%	n	%	n	%	n	%
BMI of mothers										
Normal	78	29.5	26	37.1	17	24.3	21	31.8	14	24.1
Underweight	86	32.6	22	31.4	27	38.6	17	25.8	20	34.5
Obese or overweight	100	37.9	22	31.4	26	37.1	28	42.4	24	41.4
Child wasting (W/H)										
Normal	205	84.4	49	84.5	40	74.1	67	88.2	49	89.1
Mild malnutrition	30	12.3	6	10.3	13	24.1	5	6.6	6	10.9
Moderate malnutrition	5	2.1	3	5.2	0	–	2	2.6	0	–
Severe malnutrition	3	1.2	0	–	1	1.9	2	2.6	0	–
Child underweight (W/A)										
Normal	166	60.1	35	59.3	44	60.3	50	58.1	37	63.8
Mild malnutrition	46	16.7	10	16.9	13	17.8	15	17.4	8	13.8
Moderate malnutrition	42	15.2	9	15.3	14	19.2	10	11.6	9	15.5
Severe malnutrition	22	8.0	5	8.5	2	2.7	11	12.8	4	6.9
Child stunting (H/A)										
Normal	57	22.6	16	26.7	19	34.5	9	11.4	13	22.4
Mild malnutrition	54	21.4	8	13.3	22	40.0	13	16.5	11	19.0
Moderate malnutrition	44	17.5	8	13.3	8	14.5	14	17.7	14	24.1
Severe malnutrition	97	38.5	28	46.7	6	10.9	43	54.4	20	34.5

Mchinji District had the greatest difference among the groups of the poor compared to other districts. Lilongwe District had a narrower gap between the wealthy and poor groups. Generally, most households were in the poorer groups in the middle and bottom wealth strata. Proportionately, Kasungu had more households in the upper rich stratum compared to other districts. Physical wealth based poverty afflicted more households in Dedza District where more than half (53%) of all households fell into the poorest category. The results suggest that upgrading the physical wealth status of rural households should go hand in hand with efforts to address inequality. This can be wealth creating interventions that are pro-poor by design and targeting to enable the poor to create and sustain more assets.

Furthermore, comparative scatter plots were generated to compare the possession of assets and amenities between 20% and 40% of households in the upper rich and bottom poor strata, respectively. Stratification was done after sorting the wealth index of the sampled households in descending order of magnitude with cut offs at 20% and 40%, embracing the 60 and 120 richest and poorest households, respectively.

Table 24: Market based enterprise income per capita (US$)

Income activity	All		Dedza		Kasungu		Mchinji		Lilongwe	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Crop production	251	47 (79)	62	15 (19)	63	98 (129)	65	41 (42)	61	34 (52)
Livestock	48	27 (39)	18	15(29)	5	31 (33)	13	45 (42)	12	25 (47)
Business	32	65 (126)	8	21 (37)	6	61 (45)	3	29 (29)	15	97 (176)
Formal employment	5	143 (112)	2	42 (28)	1	198 (–)	0		2	216 (125)
Casual work	45	23 (31)	32	22 (31)	1	129 (–)	3	29 (25)	9	12 (6)
Technical work (apprentice)	2	98 (130)	1	6 (-)	1	190 (–)	0		0	
Handcraft	7	26 (20)	3	32 (26)	1	2 (–)	2	22 (13)	1	38 (–)
Natural resource exploitation	7	27 (26)	3	8 (5)	3	47 (27)	1	22 (–)	0	
Traditional medicine or healing	3	11 (9)	1	4 (–)	1	21 (–)	0		1	7 (–)
Resource rent	4	47 (34)	0		2	75 (9)	1	32 (–)	1	6 (–)
Overall income	291	61 (93)	75	30 (35)	75	100 (126)	75	47 (55)	66	67 (–)

n = Number of cases; Exchange rate as at August 2007 was US$ 1 = Malawian Kwacha (MK) 140

Table 25: Wealth index and groups of the poor

Wealth strata	All		Dedza		Kasungu		Mchinji		Lilongwe	
Wealth index (n; mean (sd))										
Upper 20% rich stratum	60	14.1 (12.1)	5	11.3 (4.7)	29	13.1 (10.3)	15	21.4 (16.9)	11	7.9 (4.6)
Middle 40% stratum	120	-1.2 (1.7)	30	-1.7 (1.5)	21	-1.5 (1.8)	37	-0.7 (1.8)	32	-1.2 (1.6)
Bottom 40% poor stratum	120	-5.8 (1.2)	40	-6.3 (1.2)	25	-5.7 (1.2)	23	-5.8 (1.2)	32	-5.4 (1.3)
Wealth strata (n; %)										
Upper 20% rich stratum	60	20	5	6.7	29	38.7	15	20.0	11	14.6
Middle 40% stratum	120	40	30	40.0	21	28.0	37	49.3	32	42.7
Bottom 40% poor stratum	120	40	40	53.3	25	33.3	23	30.7	32	42.7

The scatter plots were generated for five categories covering consumer durable assets, communication assets, transportation assets, housing amenities, and sources of energy and drinking water, respectively (Figures 10a, b, c, d and e).

Figure 10a shows that possession of a bed, foam mattress, sofa, watch and an iron box was a clear indicator of wealth related poverty. This is evident by comparing relative positions of the intermediate bar representing the average binary possession of assets (1's and 0's) in the left and right graphs for the rich and poor respectively. As the intermediate bar shifts upward towards the blue diamond bar at 1 on the y-axis it indicates that, on average, most households possessed that asset and, contrarywise if it orientates downward towards the blue bar at 0 on the y-axis. The lengths of the bars aligning horizontally at 1 and 0 on the y-axis explain the intensity of households possessing and lacking a particular asset or improved amenity, respectively. These assets are easy to see living standard indicators that can be used in poverty targeting in rural Malawi.

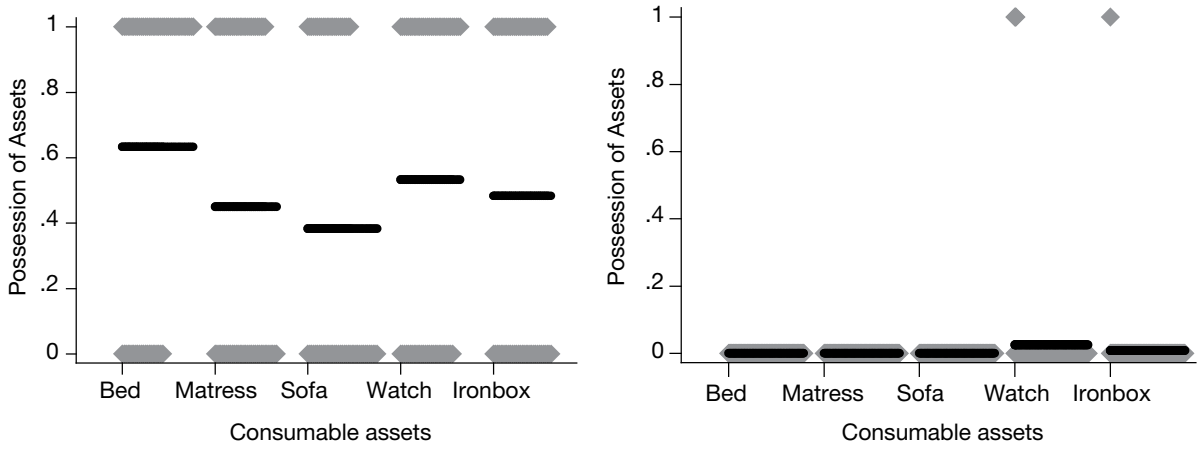

Figure 10a: Consumer durable assets owned by the rich (left graph) and the poor (right graph)

The poor households were overwhelmingly deprived of most communication assets compared to the rich (Figure 10b). None of the poor possessed a television set, cell phone or a landline but some at least had radios. Despite being good indicators of poverty, communication assets facilitate the flow of information among people in time and over space. Integration of the poor into the development process is hindered by poor access to information caused by lack of necessary communication technologies. Policy measures that can increase access to information and communication technology (ICT) by the poor in rural areas include making the hardware (devices) affordable and increasing access to energy.

On transportation assets, some rich households possessed cars and motorbikes and many of them had bicycles. However, the poor possessed none of these transportation assets except a few who had bicycles (Figure 10c). Means of transportation are central to poverty reduction as they help the movement of people, goods and services especially in the market places. In this respect, poorer households are already disadvantaged regarding access to efficient means of transport like cars and motorbikes even bicycles.

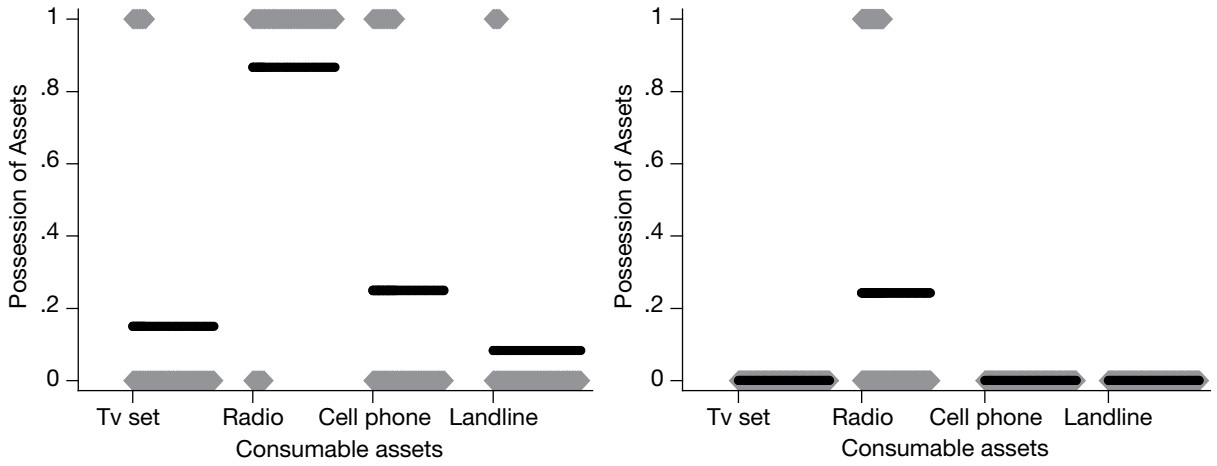

Figure10b: Comunication assets owned by the rich (left graph) and the poor (right graph)

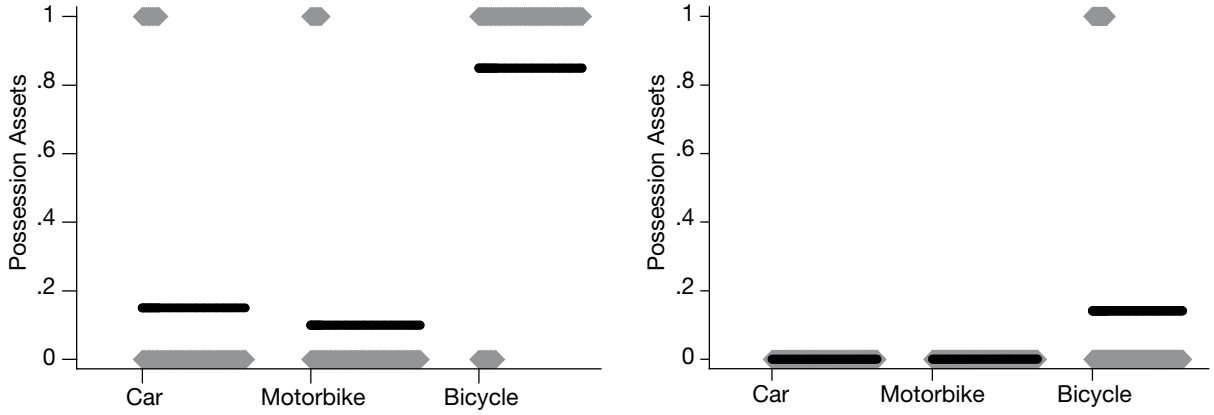

Figure 10c: Transportation assets owned by the rich (left graph) and the poor (right graph)

At this juncture, the means of transport which most of the poor can access is determined by their ability to pay for public transport.

On building materials, poor households were worse off in terms of having quality roof and floor materials for their main dwellings (Figure 10d). Impressively, the poor had quality toilets though not as widespread as the rich had. The wealth status of rich households surfaced above that of poor households with respect to quality of housing amenities. Improving the quality of housing amenities such as better sanitation is one of the dimensions of poverty reduction.

Seemingly, majority of both the rich and poor households relied on primitive sources of energy and water as the intermediate mean bars were biased towards zero (Figure 10e). In the first place, this pattern indicates that inequality related to access to quality energy and water between rich and poor households is almost non existent. Not only Malawi but also many countries in Sub-Saharan Africa (SSA) are far behind in supplying sustainable energy and quality sources of drinking water in rural areas.

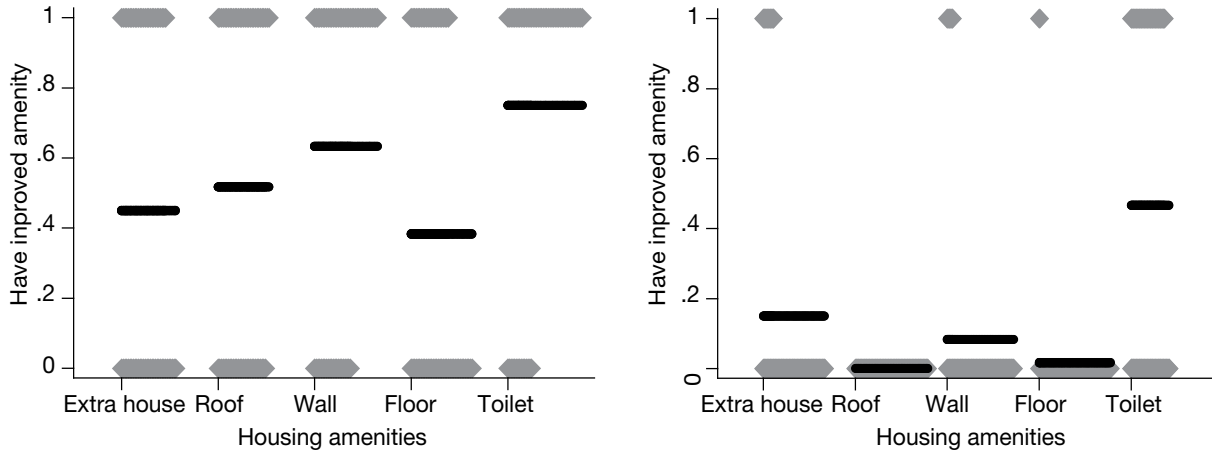

Figure 10d: Housing amenities owned by the rich (left graph) and the poor (right graph)

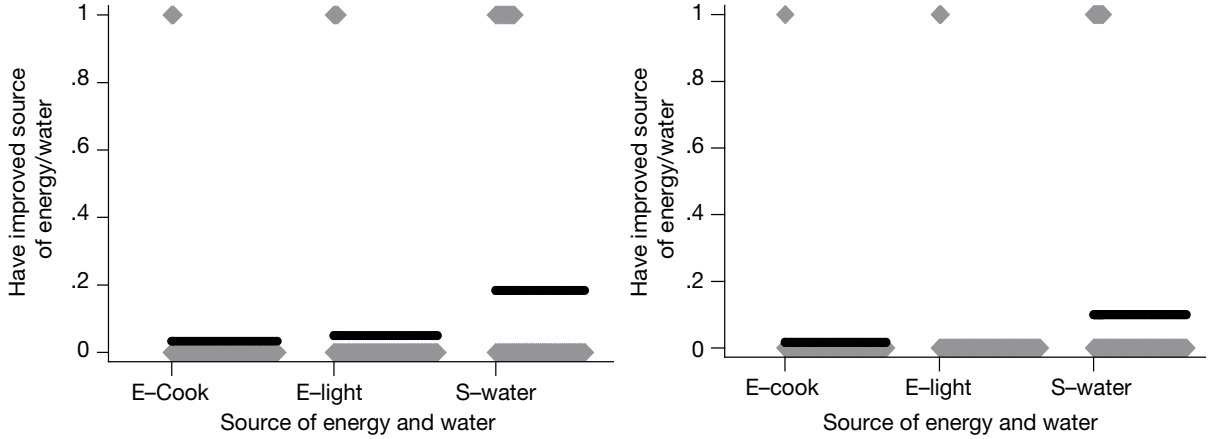

Figure 10e: Sources of energy and water used by the rich (left graph) and the poor (right graph)

Chapter Five

Micro-level determinants of livelihoods

Determinants of poverty

The major determinants and correlates of poverty appear in Table 26. The respective pseudo R-square fit measures of ANOVA and DECOMP of 58% and 43% respectively were satisfactory for a multi-factoral phenomenon like long run wealth. The stock and quality of tools used in the production process, formal literacy of both male and female adults, and size of livestock were significant drivers that enhanced the long run wealth status of households. It can be seen that only about 24% of the fitted predictors were significant, that is four (4) out of seventeen (17). The Productive Tools Index included the adequacy and quality dimensions of most of the tools used in farm production. The household with better and more adequate supply tools is expected to operate at a higher level of farming efficiency compared to the household constrained by having few working tools or using poor tools. Farming efficiency translates into increased farm productivity which in turn contributes to wealth creation. As more adult members, both men and women, receive formal education, the quality of the labour force in the household improves. The improved quality of the household labour force helps in making better decisions which, in turn, contributes to higher crop productivity, reduced waste and greater wealth creation. In rural Africa, livestock is the form of capital that households can quickly transform into other forms of wealth.

Table 26: Tobit model estimates of determinants of poverty

Determinants	Average	SD	Expected sign	β	Z-statistic
Productive Tools Index	15.76	13.43	Positive	0.378	3.87***
Gender of household head (1 = Male; 2 = Female)	0.73	0.44		0.098	0.00
Age of household head (years)	43.20	16.73		3.586	0.45
Age squared of household head	2145.09	1663.97		0.498	0.34
Education of head (years in school)	4.48	3.54		0.005	0.29
Number of extension visits	12.86	32.01		0.400	0.15
Ratio of formally educated male adults	0.35	0.25	Positive	0.033	2.53***
Ratio of formally educated female adults	0.37	0.30	Positive	6.823	0.01**
Participation off-farm (1 = Participates, 0 = Otherwise)	0.09	0.29		5.050	0.05
Dependency ratio	1.13	0.84		3.863	0.48
Current Liquidity Index	1.84	1.90		0.007	0.40
Conditional Liquidity Index	0.80	1.25		0.703	0.30
Social Transfer Liquidity Index	0.92	1.54		1.079	0.97
Livestock numbers (TLU)	0.55	1.25	Positive	0.899	0.16***
Income from market participation (US$ per capita)	59.64	91.68		0.873	0.00
Striga being a constraint (1 = Yes)	0.95	0.23		0.012	0.45
Ill Health Index	0.01	0.05		5.082	0.76
Constant				22.552	0.92
Diagnostic statistics					
Model and estimation	Censored Tobit model and Maximum Likelihood Estimation (MLE)				
Dependent variable	Wealth index, -infinity to +infinity				
Econometric software used	LIMDEP				
Number of observations	300				
Log likelihood function	-440				
LM test for Tobit (df)	58 (18)				
Threshold values	Lower = 0.000 censored through zero, upper = +infinity				
ANOVA based fit measure	0.584270				
DECOMP based fit measure	0.435914				

** and *** = Significant at 5% and 1%, respectively

Chapter Six

Conclusions and recommendations

This report presents the results from a livelihood study carried out in four districts of central Malawi namely, Dedza, Kasungu, Mchinji and Lilongwe. These four districts form the breadbasket in terms of maize production which is the major staple in rural and urban areas of Malawi. However, the productivity of maize is crippled by *Striga* infestation among other constraints. The main objective of this study was to analyse the current livelihood status of farming households in *Striga* infested maize growing areas and develop measurable indicators of livelihood that could be used to evaluate technological changes brought about by new *Striga* control technologies in Malawi. Data was collected from 20 Extension Planning Areas (EPAs), 40 villages and 300 households which were selected using multi-stage random sampling techniques. Data was analysed and policy relevant conclusions and recommendations drawn.

Household characteristics

In Dedza District, a notable proportion (30%) of households was headed by women. As female household headship is not common in African households this finding suggests the presence of more widows and/or out migration of males from Dedza District relative to other districts. Linking female household headship and poor access to formal education, Dedza District also had the largest percentage of heads of households who had never gone to school. This finding calls for pro-women development interventions to make female headed households less vulnerable.

Crop production was the most prominent livelihood activity serving the majority of households in all sampled districts. On the one hand this finding underscores the importance of crop production and the need to address vital constraints undermining crop productivity so as to sustain the livelihood of the majority. On the other hand, the finding urges the need to promote other livelihood enterprises such as livestock production and rural non agricultural businesses that will complement crop production to fast track poverty reduction.

Natural capital

Land was mainly owned in the context of customary usufruct right only for most farmers. In SSA, customary and statutory laws coexist in the legal framework governing land administration but, practically the former is less secure than the latter. That is why land reforms have been suggesting formalisation of the informal customary system through legal titling of land currently held under customary tenure. Land is the primary endowment of smallholder farmers. In other words it is everything to them, they settle on it, they cultivate it to get produce for home use and income, and when they die they are buried in it. Formal titling of customary land which is sluggishly underway in many SSA countries should be promoted to increase security of land

tenure by smallholder farmers. There is also a possibility that a farmer can use his or her formally titled land as collateral to secure loans from lending institutions.

The cropping system across districts was predominantly annual crop based. Unlike perennial crops, annual cropping requires farm planning every year to ensure that inputs are delivered on time. This is important in Malawi where the government is involved in administration of inputs, mainly fertiliser, through price subsidisation and delivery through farmer organisations. As Malawi is a highly decentralised country, district level extension departments are to be facilitated to ensure that agricultural messages and technology are delivered early each year before the farming season starts.

Physical capital

Households across districts differed in terms of their stock of tools used in the farm production process. Kasungu District had the highest while Dedza had the lowest average index measuring the productive tools in terms of its adequacy and working status. An interesting causal relationship is that Kasungu District registered the largest wealth index and Dedza the least. This highlights what would be the positive impact of access to farming tools in adequate supply and better working conditions to the livelihoods of farmers. Access to better tools by farmers in rural areas can be made possible by making the tools adequately available and affordable in convenient market places such as village based stockists. For example affordability and adequate availability can be achieved through import or manufacturing incentives such as reduction of import duties and taxes on farming tools.

Human capital

In the agrarian context, human capital dimensions take different forms entailing formal education, agricultural extension and education, and the health of members of the household. The level of formal education was low. No apparent gender based discrimination in the form of the ratio of male and female adults to all adult members in the households who received formal education was noted. In terms of access to agricultural extension, farmers in Kasungu and Lilongwe districts were favoured. These districts are nearer urban areas and, hence, endowed with social services that attract staff to stay compared to other remote rural districts which tend to be understaffed. Urban influence would also have contributed to improved health in Kasungu and Lilongwe districts that had the lowest ill health measures. The results infer that access to extension and health services in Dedza and Mchinji have to be seriously improved. Improvement of these dimensions will improve the human resources needed in transforming other livelihood capitals.

Financial capital

The majority of households kept much of their cash savings at home with only a few managing to have bank savings accounts. Some households in Kasungu and Lilongwe

kept their cash savings at a bank. Mobilisation and integration of rural savings into the formal financial system is indispensable to enhancing access to credit by rural agro-entrepreneurs as it develops the credit base of rural areas serving micro-finance institutions. Cash remittances were popular in Kasungu District and higher in magnitude in Lilongwe District. This underlines the importance of urban influence which provides more jobs for people who remit money back home. Therefore, creation of more jobs in urban and peri-urban townships which are already equipped with economic opportunities has spill over benefits to neighbouring rural areas.

In the areas surveyed in central Malawi, the livestock sector seems to be underdeveloped as most of the households did not own animals. On average, households in all districts kept less than one animal, even small animals like local chicken which are known to be affordable by the rural poor. This means that the livestock sector has to be further developed for it to contribute to reducing rural poverty.

Social capital

Networking through religious groups was common across districts. As a result, church based organisations can serve as avenues to launch development. Moreover, group formation in other forms such as savings and credit societies should be promoted in rural areas.

Land allocation

The total land allocated to various crops did not exceed two acres with the exception of about three acres allocated to maize in Lilongwe District. Local maize: legume intercropping was widely practised among farming households in all districts, but especially in Dedza and Lilongwe. Hybrid and local maize varieties under mono cropping were popular in Kasungu and Mchinji. Traditionally, non maize crops that were grown to some extent across districts were soyabean, sweet potato and cassava particularly in Kasungu District. Irrespective of the variety, maize took the largest share of the land compared to other crops. This indicates the importance of maize in the study area and the need to address constraints that decimate maize productivity such as *Striga*. Also, promotion of traditionally non tradeable crops like soyabean and cassava might contribute to addressing income and food security problems.

Seed procurement, yield and profitability of maize

Most farmers procured maize seed from the market when they grew improved varieties and used home saved seed when they grew local varieties. Thus, farmers are shown to be ready to invest financially to access novel technologies from the market, provided that they are aware of the benefits of those technologies. The yield and returns to land of improved maize variety were much higher than those of local maize even under severe infestation of *Striga*. The ability of improved maize to reduce the negative impact of *Striga* on yield and associated returns underlines the importance of promoting improved maize varieties in *Striga* infested areas. This will reduce the negative impact of *Striga* on cereal production and hence improve income and food security.

Indicators of the extent of adoption of improved maize

The likelihood of allocating more land to improved maize increased significantly in line with farm production tools, number of extension visits and the ratio of formally educated male adults. The age of the household head was the only variable which corelated negatively with the probability of acreage based extent of adoption of improved maize varieties, meaning that promotion of improved maize should prioritise targeting younger farmers. Improved access to farming tools, extension services and formal education of men would increase the chance of adopting improved maize to a larger extent by allocating more land. Ageing instils risk aversion behaviour which hinders the extent of technology adoption. However, the supply of adequate information on the benefits of the technology can enhance technology adoption among the aged.

Crop productivity constraints

Lack of inputs and *Striga* infestation were the most widely reported crop productivity constraints. The government of Malawi is already subsidising fertiliser but it still seems that most farmers cannot afford to buy fertiliser in sufficient quantities. Since most of the households are liquidity constrained when the planting season sets in, it is difficult for them to afford purchased inputs. Micro–credits can assist farmers in easing the liquidity constraint and enable them to buy inputs in the needed amounts.

Over three quarters of the sampled households in all districts reported *Striga* infestation in their maize plots ranging from mild to severe infestation. The encroachment rate of *Striga* into arable land over time has been high in the study districts. In managing *Striga*, the majority of farmers applied technologies usually used to manage normal weeds such as uprooting. These traditional weed management practices are less effective in controlling noxious weeds like *Striga*. It is therefore important to introduce other more promising *Striga* control technologies such as IR maize to complement existing ones.

Livelihood income strategies

Livelihood diversification is almost non existent as the majority of household heads live predominantly on crop production. In poor countries with underdeveloped public safety nets, lack of diversification puts the poor at risk in case of unexpected events in the single dependable livelihood enterprise. It is recommended that livelihood diversification be promoted to broaden the safety net base.

Livelihood shocks

Food deficit was the major shock experienced by most households in the study area. Improving the productivity of food crops, mainly cereals, is paramount in addressing the chronic food deficit. One of the stumbling blocks to increased cereal productivity is *Striga* which needs to be managed. However, households applied responsive measures following their exposure to livelihood shocks. Casual labour exchange for either cash or food was the most widely used *ex-post* strategy to cope with negative externalities.

Striga infestation shock prompted the *ex-post* adoption of some measures to control *Striga*. Other ways of addressing the *Striga* problem include the adoption of improved varieties of cereals and use of fertiliser to mitigate the downside effect of *Striga* on crop yield.

Furthermore, most respondents felt that the livelihood situation of their households was worsening over time. This suggests that increased public effort should be put into partnerships with other development stakeholders to manage factors impoverishing rural populations.

Livelihood outcomes and determinants of poverty

Human diseases which afflicted most households were malaria, dysentery, diarrhoea and those related to the respiratory system. Serious efforts are needed to fight malaria as its economic impact on rural livelihoods is devastating. Despite its effect in reducing labour supply and quality of the work force at the household level, it is costly in terms of frequent treatment and uncalled for loss of lives especially of vulnerable children and pregnant women. Dysentery and diarrhoea are strongly related to poor water, sanitation and lack of health education.

About three quarters of mothers in the study area were either underweight or obese. These abnormalities are nutritionally undesirable. The rate of severe child stunting manifested itself at an alarming rate in all sampled districts. Child stunting is an indicator of nutritional stress which a child has experienced in the long run. In the first place, underweight and obesity of mothers and stunting of children could be addressed through education programmes on better nutritional practices, given the availability of adequate nutritious food. Moreover, efforts that will increase productivity of various food crops at household level will positively impact on the improved nutrition of vulnerable mothers and children.

Long run household wealth and determinants of poverty

Wealth based poverty varied over space in all the four districts especially Dedza. In addition, wealth inequality was apparent in all four districts. This means that efforts to address poverty based on material assets and social amenities should go parallel with addressing inequality among the poor. Households in the poor category were also deficient in assets that serve different developmental purposes like transport and communication. As poverty is characterised by a notable degree of inequality, poverty reduction interventions should be sufficiently pro-poor not to bypass the utterly poor. In this respect, targeting the poor in anti-poverty programmes and projects to increase their ability, creates and sustains assets.

It has been found that wealth based poverty can be reduced by increasing farmers access to adequate and better farming tools, improving education of both men and women, and building up a stock of animals. Better productive tools being available in

adequate quantity will upgrade farming efficiency. Literacy improves the quality of labour in thinking out better farming practices and managerial decisions. Livestock are important in rural economies as they store wealth and operate as mobile banks. However, encouragement of livestock numbers build up should be within the carrying capacity of the land given the environmental implications of overstocking. This can be done through broadening animal species diversity and improving genetic productivity potential of animals.

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Appendices

Appendix 1: Study sites and sample size

1. Dedza District

EPAs>>	Kabwazi		Kaphuka		Chafumbwa		Linthipe		Lobi	
Villages>>	Mtanthira	Mphande	Kuchombe	Mphenzi	Tembwe	Kachiramadzi	Dzoole	Nyankhwi	Khomani	Saidi
Population	76	12	119	174	45	41	179	101	107	76
1	06	03	25	14	06	05	17	04	07	06
2	08	08	38	32	16	08	32	24	32	21
3	17	09	58	40	27	16	75	32	40	27
4	27	11	99	66	34	24	82	33	41	40
5	34		108	75	39	34	118	75	66	51
6	40		117	83	40	36	133	82	71	56
7	46		65	118	21	39	158	95	75	
8	52			158	32		171		83	
9	56								94	
10	74									
11	63									
Total	11	4	7	8	8	7	8	7	9	6

2. Kasungu District

EPAS>>	Santhe		Chulu		Chipala		Kaluluma		Lisasadzi	
Villages>>	Mangadzi	Nkhunda	Simbani	Mandevu	Chisazima	Chiwelera	Mende	Mbuzi	Saizi	Mkusa
Populations	27	33	26	17	51	47	38	47	43	15
1	02	02	03	03	05	09	02	06	04	03
2	05	07	06	04	07	17	05	08	07	06
3	09	10	08	06	09	23	09	16	09	08
4	10	17	10	07	11	36	11	21	11	09
5	11	21	15	14	27	39	27	24	12	11
6	19	29	16	15	30	42	30	27	14	
7	27	30	20	17	38	45	38	39	16	
8		32	24		41			43	21	
9									25	
10									36	
Total	7	8	8	7	8	7	7	8	10	5

Appendix 2: The household questionnaire

Smallholder Livelihoods in the *Striga* Infested Maize Areas of Eastern and Southern Africa: Baseline Study in Malawi

AATF/IITA PROJECT

Part A: Interview and Household Details

I-a: Interview Information

A1 Interviewer's Name		
A2 Name of Respondent		
A3 Name of Household Head		
A4 Agric Development Division (ADD)		
A5 District Name		
A6 Extension Planning Area		
A7 Section		
A8 Village Name		
GPS Readings	Way point number	
	N/S	
	E/W	
	Altitude (Metres)	

A9 DATE dd mm yy | |	A10a TIME START Hr Min |	A10b AM or PM |	A11a INTERVIEW END Hr Min |	A11b AM or PM |

A12 INTERPRETER 1 = YES 2 = NO	A13 QUALITY CHECKING BY SUPERVISORS			
		Date	Signature	Rating
	Quality check 1 District supervisor			
	Quality check 2* District supervisor			
	Quality check 3 AATF/IITA supervisor			
	* If the rating of quality check 1 is poor, the enumerator must correct for the mistake at his/her own cost. Then a quality check 2 by same supervisor would be required. Any final form MUST be rated GOOD to pass through.			

Part B: Household characteristics

B1. Household socio-demographics as of end of 2006 (December)

ID	Name of a Household member	Sex 1 = Male 2 = Female	Age (In years, but in months for infants, ie <1 year)	Relationship to the household head 1 = Head 2 = Spouse 3 = Son or daughter 4 = Relative 5 = Unrelated	Formal schooling 1 = Attended before 2 = Attending now 3 = Never attended 4 = Too young to attend	Number of years of schooling completed (If attended or is attending school)	Off school training 1 = None 2 = Vocational training 3 = Short term training on best agric practices (non extension)	Working on the farm 1 = Full time 2 = Part time	Working off farm 1 = Yes 2 = No	Major livelihood occupation
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										
11										
12										

13										
14										
15										
16										
17										
18										
19										
20										
21										

Major occupation: 0 = None, 1 = Crop production, 2 = Livestock keeping, 3 = Business, 4 = Salaried employment, 5 = Wage work, 6 = Technician, 7 = Artisan/ handcraft, 8 = Natural resource (wood, charcoal, etc), 9 = Traditional healing or medicine, 10 = Rent income, 11 = Others (Specify) _____

Part C: Productive resource endowment

C-1: Land tenure and use structure

C1.1. Please provide information on land tenure and use (first season 2006)

Land tenure structure	Size (Acres)	Size of land (Acres) under different land uses				
		Annual crops	Perennial crops	Annual or perennial crops	Grazing	Fallow
Private (titled) land						
Land with use right only (customary)						
Rented in land						
Share cropped land						
Borrowed land						
Gifted land						
Rented out						
Given out						

C-2: Productive assets

C2.1. Please provide information on the following key productive assets

Asset	Number owned	Working status 1 = Is it or are most of them working properly; 2 = Is it or are most of them working moderately; 3 = Is it or are most of them working improperly; 4 = Not working	Total value (Current value if liquidated/if it can be sold)
Hand hoe			
Panga/Knife			
Axe			
Ox plough, weeder, ripper, etc			
Ox cart			
Wheelbarrow			
Oxen			
Donkeys			
Horses			
Sprayer			
Watering can			
Irrigation pump or treadle pump			
Tractor			
Pick up, lorry			
Others (Specify)_____			

Part D: Productivity, costs, family labour and marketing

D1. Land allocation, *Striga* infestation and inputs during the first season 2006

Crop system ID	Crop Enterprise	Area (Acres)	Extent of *Striga* infestation 1 = Not infested 2 = Mild 3 = Severe	Intercropped with	Proportion of maize area (%)	Planted seed type **	Organic fertiliser Farm yard manure (FYM)			Inorganic fertiliser			Seeds (For all intercrops if so)				Pesticides (For all intercrops if so)		
							Qty	Unit*	Unit price	Qty	Unit*	Unit price	Crops	Qty	Unit*	Unit price	Qty	Unit*	Unit price
01	Local maize, mono																		
02	Hybrid maize, mono																		
03	OPV maize, mono																		
04	Local maize, intercropped																		
05	Hybrid maize, intercropped																		
06	OPV maize, intercropped																		
07	Beans																		

08	Sorghum																		
09	Millet																		
10	Soyabeans																		
11	Groundnuts																		
12	Cowpea																		
13	Sunflower																		
14	Cassava																		
15	Irish potato																		
16	Sweet potato																		
17	Vegetables																		
18	Banana																		
19	Tobacco																		
20	Sugarcane																		
21	Rice																		
22	Others (Specify)																		

Seed type codes: Maize: 1 = Purchased improved/hybrid non *Striga* resistant; 3 = Purchased OPV non *Striga* resistant; 5 = Retained OPV non *Striga* resistant; 6 = Purchased local variety; 7 = Retained local variety; 8 = Retained hybrid non *Striga* resistant

Seed type codes: Sorghum: 3 = Purchased improved non *Striga* resistant; 4 = Retained improved non *Striga* resistant; 5 = Purchased local variety; 6 = Retained local variety (Why are some crossed?)

Seed type codes: Other crops: 1 = Improved variety purchased; 2 = Improved variety retained; 3 = Local variety purchased; 4 = Local variety retained

Measurement unit codes: 1 = Kilogram, 2 = Litre, 3 = Other (specify in Kgs) (how yet we have an option for kgs?)

D2. Production costs and labour inputs for the first season 2006

Valid crop system ID (as in D1)	How do you rate the season with regard to rainfall/ soil moisture in your farms? 1 = Above average 2 = Normal 3 = Below average	How much did you harvest (IN KG PLEASE)			Direct costs and family labour input Family labour: people (A..E.) X effective days x effective hours AE = Adult equivalents (1 Adult = A person of 15 years of age and above; A child of 10–14 years of age will be equated to 0.5 of an Adult Equivalent)													
		Crop 1	Crop 2	Crop 3	Land rent if rented in	Land preparation		Planting		Fertiliser/chemical application		Weeding (all)		Harvesting and transporting		Storage (shelling + storage equipment)	
					Cost	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour & items	Family labour

D3. Crop marketing aspects for the first season 2006

Valid crop system ID (as in D[2]	Name of the crop	Quantity in store based on measurement unit of sale	Quantity sold	Month most of the produce was sold (month/ yr)	Average unit sale price during a peak month of sale	Market place where most of the produce was sold[1]	Who bought most of the produce[2]	What is the most limiting marketing constraint[3]	Does this market constraint limit your willingness to adopt productivity enhancing technologies? 1 = Yes 2 = No	Mention any technologies you have declined to adopt because of lack of market incentives

[1]**Market place:** 1 = Village, 2 = Neighbouring village/location/road/junction, 3 = Nearby township, 4 = Distant township, 5 = Regional market, 6 = Others (Specify) _____

[2]**Trader typology:** 1 = Local consumer, 2 = Small trader/broker (bicycle or on foot), 3 = Large trader (vehicle), 4 = Institution (school, prisons, etc), 5 = ADMARC, 6 = Others (Specify) _____

[3]**Constraint:** 1 = Low producer price, 2 = Poor road to the market, 3 = Poor access to information, 4 = Lack of reliable transport, 5 = Others (Specify)_____

Part E. *Striga* extent, severity and control technologies

E1. What are the most important maize production and post–harvest constraints?

Production constraint	A constraint? Yes = 1 No = 2	If yes, what is the level of severity (Intrinsic ranking) 1 = Highly severe 2 = Severe 3 = Less severe	If yes, what is the level of severity compared to other constraints (Comparative ranking, 1st being most severe)	If yes, to *Striga*, which year did it start to be a major constraint in your farm?
Striga				
Stalk borer				
Storage pests (large grain borer, weevils, etc)				
Low and erratic rainfall				
Waterlogging (excessive moisture)				
Low soil fertility				
Inadequate input supply				
Land shortage				
Others (Specify) _____				

E2. What is the extent and severity of the *Striga* problem in your farm plots usually under cereals?

Plots (SN)	Acreage (Acres)	Proportion of land infested by *Striga* (%)			Perceived level of severity (impact on maize production) Codes: 1 = More severe, 2 = Severe, 3 = Less severe, 4 = Not yet a problem			
		Now	Ten years ago	Control measures used (multiple answer possible)* 1, 2, 3	1st season 2006 (most recent and complete)		Ten years ago	
					Severity	Average (kgs)	Severity	Average (kgs)

Codes for *Striga* control measures: 1 = Uprooting, 2 = Burning, 3 = Manuring, 4 =Shifting to *Striga* free plots, 5 = Intercropping with other crops, 6 = Others (Specify) _____

E3. Which of the following *Striga* control technologies are you aware of and what is your current use status? If you are currently using a *Striga* control technology, what is the associated per acre maize yield?

Technology ID	*Striga* control technology	Aware of the technology? 1 = Yes 2 = No	If aware, current use status 1 = Currently using 2 = Abandoned 3 = Never adopted 4 = No *Striga* on the farm	When did you know of the existence of this technology?	Since when did you start to use it (year)?	If you are aware from who did you received information?*	If you are practicing it who demonstrated it to you?* (There seems disconnect in questions – should we rearrange or leave as is?)
01	Use of farm yard manure						
02	Use of inorganic fertiliser						
03	*Striga* resistant maize grown with legumes						
04	*Striga* resistant maize without legumes						
05	Intercropping of legumes followed by cassava or Desmodium (Maize in the 3rd year)						
06	Push-Pull (Maize : Desmodium strip cropping)						
07	Integrated ____; _____; _____; (Use technology IDs)						
08	Other non conventional (Specify) _____						

*Codes for source of information and technology demonstration: 1 = Farmers in the village, 2 = Farmers in other villages, 3 = Mass media (radio, newspapers), 4 = Extension workers, 5 = Local NGOs, 6 = Research institutes, 8 = Farmer Community Based Organisations (CBOs), 9 = Others (Specify) _____

E4. If you are aware of any *Striga* control technology but have not adopted any, what is the most important reason for non adoption? (Multiple answers possible)

SN	Reason for non adoption	Reason status (1 = Yes, 2 = No)	Ranking (1st being the most important reason)
1	Gathering more information about the technology		
2	Traditional control practice is better		
3	Too risky to adopt		
4	Cash constraint to buy seed and other inputs		
5	Lack of improved seed (*Striga* resistant varieties)		
6	Others, for example cultural factors (Specify) _____		

E5. If you are aware of any modern *Striga* control technology mentioned in E5, how would you rank these various Striga control technologies you have been introduced to relative to your own traditional control practice?

Technology ID	*Striga* control technology	Rank based on				
		Maize yield (Most to the least yield enhancing) 1 = Most yield enhancing 2 = Moderately yield enhancing 3 = Least yield enhancing	Technical simplicity (Simplest to most complex) 1 = Simplest 2 = Simpler 3 = Complex	Labour demand (Least demanding to the most demanding) 1 = Least demanding 2 = Moderately demanding 3 = Most demanding	*Striga* population (Most *Striga* reducing to the least) 1 = Most *Striga* reducing 2 = Moderately *Striga* reducing 3 = Least *Striga* reducing	Soil fertility (Most to the least fertility enhancing) 1 = Most fertility enhancing 2 = Moderately fertility enhancing 3 = Least fertility enhancing
01	Use of farm yard manure					
02	Use of inorganic fertiliser					
03	*Striga* resistant maize grown with legumes					
04	*Striga* resistant maize without legumes					
05	Intercropping of legumes followed by cassava or Desmodium (Maize in the 3rd year)					
06	Push-Pull (Maize Desmodium strip cropping)					
07	Integrated ____; _____; _____; (Use technology IDs)					
08	Other non conventional (Specify)_____					

Part F. Vulnerability, capital assets and livelihoods

F1: Food security and livelihood aspects

F1.1. Post–harvest losses first season 2006

Crop (as in D3)	Crops	Date of last harvest (Month-Year)	Amount of this harvest in store now	When store depleted/will be depleted (Month-Year)	Loss in store? 1 = Yes 2 = No	Estimated quantity lost in store	Reasons for loss**
			Quantity (kgs)	Approx date		Quantity (kgs)	

*Crops: 1 = Maize, 2 = Beans, 3 = Sorghum, 4 = Millet, 5 = Soyabeans, 6 = Groundnuts, 7 = Cowpea, 8 = Sunflower, 9 = Cassava, 10 = Irish potato,

11 = Sweet potato, 12 = Banana, 13 = Others (Specify) _____

**Reasons for loss: 1 = Rodents, 2 = Insects, 3 = Damp/rot, 4 = Theft, 5 = Others (Specify) _____

F1.2. What are the major sources of food insecurity in your household (ability to access food through both own production and market procurement)

Source of food insecurity	Rank (1 = Most important, 2, ... n = Least important

F1.3. What are the nature of, effect and response to shocks, and livelihood situation of the household in the last five years (Take note of the codes)

Shock[1]	Description of the cause[2]	When happened/ started (date)	Effect of the event/shock[3]	Response to event/shock[4]	How is your livelihood situation now as compared to the past five years? 1 = Improving, 2 = Worsening, 3 = The same	What is the single most reason for such a livelihood situation?

[1]Shocks : 1 = Food deficit, 2 = Famine, 3 = Loss of property, 4 = Illness, 5 = Death of important family member, 6 = Loss of animals
[2]Cause: 1 = *Striga* infestation, 2 = Drought, 3 = Floods, 4 = Theft, 5 = Human disease, 6 = Crop pest/disease, 7 = Livestock disease, 8 = Strong wind, 9 = Others (Specify) _____
[3]Effects: 1 = Low production, 2 = Reduced labour, 3 = Low use of inputs, 4 = Health disorders (malnutrition, susceptibility to diseases), 5 = Loss of source of income, 6 = Depletion of assets, 7 = Any other (Specify) _____
[4]Responses: 1 = Adopt *Striga* control technologies, 2 = Shift to *Striga* free/less infested land, 3 = Abandon maize because of *Striga*, 4 = Sale of animal for cash, 5 = Received relief help, 6 = Remittances, 7 = Sale of crop stock, 8 = Sale of durable assets (land, durables), 9 = Spend cash savings, 10 = Casual labour for food or cash, 11 = Household members migrated, 12 = Other (Specify) _____

F2: Financial capital

F2.1. Please indicate the types of your financial capital and rank them in order of importance

Financial capital	Do you have access to such a financial capital? 1 = Yes 2 = No	How much in absolute terms can you access/command per month and per year?		Rank your portfolio of financial capitals in order of importance in relation to magnitude of value, easiness to access/raise/command, and easiness to spend		
		Month	Year	Monetary value	Access/raise/command (1 = Very easy, 2 = Moderate, 3 = Not easy)	Easiness to spend (1 = Very easy, 2 = Moderate, 3 = Not easy)
Cash savings at bank						
Cash savings at home/ pocket						
Claim on your good debtors						
Formal credit	*					
Informal credit	*					
Cash remittances from relatives or friends						
Remittances from relatives or friends (easily transformable into cash)						
Others (Specify) _____						

* The question needs to be addressed as whether the household can get formal or informal credit when needed.

F2.2. Please indicate the type and number of non working livestock which the household owns

Type	Number		Value	
	Young animals	Adult animals	Average price per young animal	Average price per adult animal
Cattle				
Goats				
Sheep				
Pigs				
Poultry (chicken, ducks)				
Rabbits				
Doves				
Donkeys				
Others (Specify) _____				

F3: Physical capital

F3.1. Qualitative typologies of amenities and possession of quasi productive assets

What is the roofing material of the main house? 1 = Mud/cow dung 2 = Leaves/grass 3 = Timber/wood 4 = Corrugated iron sheets 5 = Cement concrete 6 = Tiles 7 = Asbestos sheets 8 = Others (Specify) _____	What is the wall material of the main house? 1 = Mud/cow dung/raw bricks 2 = Stones 3 = Burnt bricks 4 = Cement blocks 5 = Wood/bamboo 6 = Iron/metal sheets 7 = Others (Specify) _____	How many sleeping rooms does this main house contain? Is there any other dwelling apart from this main house which is used for sleeping? 1 = Yes 2 = No
What is the floor material of the main house? 1 = Earth 2 = Cement 3 = Other (Specify) _____	What kind of toilet is mostly used? 1 = No any toilet (bush) 2 = Pan/bucket 3 = Pit latrine uncovered 4 = Pit latrine covered 5 = Own flush toilet 6 = Shared flush toilet 7 = Others (Specify)_____	What is the main source energy for cooking? 1 = Firewood 2 = Charcoal 3 = Paraffin 4 = Gas 5 = Electricity 6 = Crop residues 7 = Animal dung 8 = Others (Specify) _____
What is the main source of energy for lighting? 1 = Parafin 2 = Gas 3 = Electricity 4 = Generator 5 = Candles 6 = Battery 7 = Firewood 8 = Others (Specify)_____	What is the major source of water for drinking? 1 = Piped in dwelling 2 = Piped outside dwelling 3 = Public tap 4 = Borehole 5 = Protected well/spring 6 = Unprotected well/spring 7 = Rain water 8 = Vendor/tanker truck 9 = River/lake/stream 10 = Others (Specify) _____	Does the household own any of the following items? 1 = Luxurious car 2 = Motorbike 3 = Television 4 = Bicycle 5 = Radio 6 = Bed 7 = Iron box 8 = Mobile phone 9 = Landline 10 = Sofa 11 = Spongy mattress 12 = Wrist watch/wall clock

F3.2. Accessibility to various services/facilities

Services/facilities	How long does it take (IN MINUTES) from your homestead to a place where you usually get this service or the facility is located? 1 = 0–14 2 = 15–29 3 = 30–44 4 = 45–59 5 = 60+	What kind of transport do you always use to get to this service /facility? 1 = Public transport (car, bus) 2 = Public transport (motorbike, bicycle) 3 = Own transport (car) 4 = Own transport (motorbike) 5 = Own transport (bicycle) 6 = On foot 7 = Oxen driven cart (hired) 8 = Oxen driven cart (owned/borrowed)	How many KILOMETRES from your homestead to this service/facility?
Source of drinking water			
Offices where to get extension services			
Market place for agricultural inputs			
Market place for agricultural produce			
Market place for household needs			
Stand or main road to catch public transport			
Primary school			
Secondary school			
Dispensary, health centre or hospital			
Remotest farm plot			

F4: Human capital

F4.1. Please provide the following information on the types of agricultural technologies introduced

Agricultural technology	Have you ever been in contact with extension agents from different sectors? 1 = Yes 2 = No			Number of extension visits last year		
	Public	Private	NGOs	Public	Private	NGOs
Improved maize varieties						
Control of *Striga* or other weeds						
Soil fertility management						
Improved food grain storage						
Collective product marketing						
Livestock technologies						

F5: Social capital

F5.1. If a member of the household belongs to any local association or group, please provide the following information

Household member name	Household member ID (See Section 1)	Association/ group*	Since when?	What are three main activities of the association/group		
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.

*Association/group: 1 = Community development, 2 = Cooperative, 3 = Religious group,

4 = Credit and savings group, 5 = Informal insurance (safety net), 6 = Women's group, 7 = AIDS group,

8 = Others (Specify) _____

F5.2. What is the likelihood that you will adopt or copy a novel technology from people of ...

Type of new technology	Wealth status		Ethnic/tribe		Age category		Sex category		Occupation		Religious faith		Political denomination	
	Same	Different	Same	Different	Same	Different	Same	Different	Same	Different	Same	Different	Same	Different
Cash crop														
Food crop														
Seed or cultivar														
Fertiliser														
Agro–chemical														
Crop husbandry practice														
Market opportunity														
Socio-cultural aspect														

Likelihood codes: 1 = Not likely, 2 = Likely, 3 = Very likely

F5.3. In the past one year, how many people of […] you have interacted with in exchange of information on development issues?

Different wealth status	[ ]	Same wealth status	[ ]
Different ethnic/tribe	[ ]	Same ethnic/tribe	[ ]
Different age category	[ ]	Same age category	[ ]
Different occupation	[ ]	Same occupation	[ ]
Different religious faith	[ ]	Same religious faith	[ ]
Different political denomination	[ ]	Same political denomination	[ ]
Codes: 1 = None, 2 = Around ten people, 3 = More than ten people			

F6: Livelihood strategies and outcomes

F6.1. Please provide information on income sources, the family members involved, the average income per year, and the seasonal stability of income generated

Major occupations or livelihood enterprises	Name of the most most important income activity under this enterprise	Amount/ turnover per year from this activity	Propotionate contribution of this activity to the overall household income 1 = Up to a quarter (25%) 2 = Between a quarter to a half (25–50%) 3 = Between a half to three quarters (50–75%) 4 = Between three quarters to a hundred (75–100%)	How stable is this source of income (ENTERPRISE)? 1 = Stable 2 = Somewhat stable 3 = Unstable	How is the situation/ robustness of this ENTEPRISE now compared to the past ten years? 1 = Worsened 2 = Improved 3 = The same	If the enterprise situation has worsened what is the major drawback factor?
Crop production						
Livestock keeping						
Business						
Salaried or professional employment						
Wage work						
Technician						
Artisan or handcraft						
Natural resources (wood, charcoal, fish, minerals)						
Traditional medicine or healing						
Resource rent income						

Major drawback factor for enterprise: 1 = *Striga* infestation, 2 = Drought, 3 = Floods, 4 = Theft, 5 = Illness, 6 = Crop pest/disease outbreak, 7 = Livestock disease outbreak, 8 = Declining purchasing power of customers, 9 = Poor access to profitable markets, 10 = Others (Specify) _____

F7: Anthropometrics, morbidity and mortality

F7.1. Measurements on mothers and children below or equal to five years of age

ID of biological mother /female guardian (from roster)		Marriage order (1st, 2nd, etc)	Age of mother/ guardian	Weight of mother/ guardian [kg]	Pregnancy status of mother/ guardian 1 = Yes 2 = No	Height of mother/ guardian [cm]	Child's ID (from roster)		Child's sex Male = 1 Female = 2	Date of birth of the child (dd/mm/ yy)*	Weight of the person carrying the child [kg]/(A)	Weight of the person carrying the child + child [kg]/(B)	Was the child seriously ill in the past 7 days? Yes = 1 No = 2	Height of child (cm)
SN	ID						SN	ID						
1							1							
2							2							
3							3							
4							4							
5							5							
6							6							
7							7							

*Use Hospital (Scale) card where available to confirm the exact age of the child

F7.2. Morbidity indicators (ENUMERATORS, this question, as much as possible, should be directed to mothers/female guardians within the household). Was there any member of the household who was sick in the year 2006? If yes, provide the information on each person who was sick in the following table

IDs as in roster for those who suffered from injury/ disease	Did, [Name] suffer from serious injury or disease in the past year (2006)? 1 = Yes 2 = No (If no go to next person)	Which injury or disease and how long did [Name] suffer from? (Mark most important injury/ disease)		What measures did the household take when [Name] fell ill? Use codes[2] please (Up to three answers are possible)		
		Disease[1]	Duration (days)	1st	2nd	3rd

[1]Codes for injury/disease
1 = Fever/malaria
2 = Dysentery/diarrhoea
3 = Respiratory problems
4 = Measles
5 = Typhoid fever
6 = Undernutrition
7 = Tuberculosis
8 = HIV/AIDS
9 = Injurious accident
10 = Lifetime disease/disorder
11 = Others (Specify)_____

[2]Codes for measures taken
1 = No measure was taken
2 = Taken to private dispensary/hospital
3 = Taken to public dispensary/hospital
4 = Taken to traditional healer
5 = Purchased drug from a pharmaceutical shop
6 = Others (Specify) _____

F7.3: Mortality indicators. Was there any member of the household who died in the year 2006? _____ 1 = Yes, 2 = No, If yes, provide information in the following table.

S/no	Gender of the deceased 1 = Male, 2 = Female	Age at death (Years)	Cause of death[1]
01			
02			
03			

[1]Cause of death: 1 =Fever/malaria, 2 = Dysentery/diarrhoea, 3 = Respiratory problems, 4 = Measles, 5 = Typhoid fever, 6 = Undernutrition, 7 = Tuberculosis, 8 = HIV/AIDS, 9 = Injurious accident, 10 = Lifetime disease/disorder, 11 = Others (Specify) _____

Part G: Recall and actual measurments of maize fields cultivated in 2006

G1. Recalled and GPS determined areas for plots under maize during the first season 2006

Crop system ID	Crop enter-prise	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6	
		Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)
01	Local maize, mono												
02	Hybrid maize, mono												
03	OPV maize, mono												
04	Local maize, inter-cropped												
05	Hybrid maize, inter-cropped												
06	OPV maize, inter-cropped												

G2. Coordinates and elevations for the measured maize fields

Crop system ID (as in G1)	Crop enterprise as in G1	Plot 1		Plot 2		Plot 3	
		Way point		Way point		Way point	
		N		N		N	
		S		S		S	
		Elevation		Elevation		Elevation	
		Way point		Way point		Way point	
		N		N		N	
		S		S		S	
		Elevation		Elevation		Elevation	
		Way point		Way point		Way point	
		N		N		N	
		S		S		S	
		Elevation		Elevation		Elevation	
		Way point		Way point		Way point	
		N		N		N	
		S		S		S	
		Elevation		Elevation		Elevation	

1 Current liquidity entails cash savings at bank, home, claim on good debtors and jewellery; conditional liquidity entails formal and informal credit; and social transfers liquidity entails cash remittances and monetised in kind



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