2

# *Exploring the link between food security, agriculture, HIV and AIDS*

This section presents the conceptual framework and research methodology used by FANRPAN to explore the impact of HIV and AIDS on agriculture and food security in the SADC region. It is important to note that the study is based on the understanding that agriculture is only one part of a complex and inter-related sectoral relationship. Any successful attempt to address the impact of HIV and AIDS on agriculture and food security needs to explore the factors upon which an individual's livelihood is based. The results of the study are presented in Section 3.

As part of the same study, FANRPAN developed a tool for quantifying the vulnerability of affected families – the Household Vulnerability Index (HVI). The HVI was computed for South Africa, Swaziland and Lesotho using 17 impact dimensions (developed during the study) through which HIV and AIDS can affect a household. A comprehensive discussion of the HVI methodology and results are presented in Section 4.

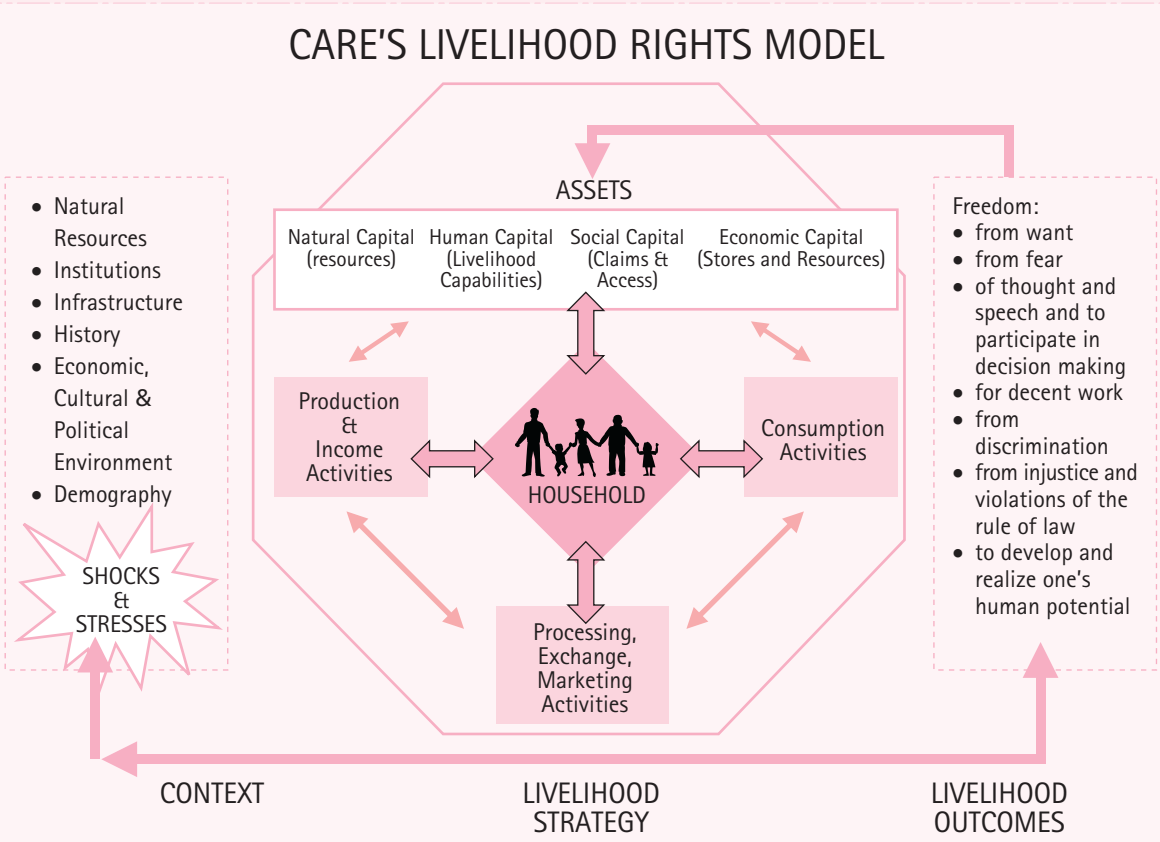
## 1. Conceptualising the impact of HIV and AIDS on agriculture and food security

Agriculture and rural development are not merely the total of various isolated sub-sectors (infrastructure, employment, education, health, etc.) Rather, they are dynamic, integrated and interdependent systems of production and other components operating through a network of interrelated sub-sectors, institutions and rural households with links at every level of activity. The efficiency and effectiveness of each sub-sector, institution and household depends, to a large extent, on the capacity of other parts of the system. When this capacity is eroded, partially or entirely due to a crisis, the system's overall ability to function is diminished.

Recently, a variety of factors have influenced agriculture and food insecurity in Southern Africa. The nature, extent and rate of this shift differ between countries. In Zimbabwe, the deterioration of the country's economy has exacerbated suffering among

rural and urban populations. In Malawi, which is a high density and largely agrarian society, food security remains a challenge because there are few generators of economic growth. Hence, the the capacity of the agricultural sector to support the population continues to deteriorate.

While the physical, political, economic and social factors contribute to changes in the agricultural sector and the countries' food security, the advent of HIV and AIDS has compounded the issue. International attention on HIV and AIDS has cast a spotlight on the links between the epidemic and the region's food insecurity. However, Harvey (2003) emphasised there is a risk with the "New Variant Famine" hypothesis that the impact of HIV and AIDS is transformed into an explanation of the current food crisis in southern Africa. Given the complex web of factors influencing agriculture and food security, it is important to understand the HIV epidemic as a co-factor of the food crisis and not an exclusive cause. It is important to take other contributing factors into cognisance (Harvey, 2003).




After Swift, 1989; Drinkwater, 1994; Carney, 1998; Frankenberger and Drinkwater, 1999, UNDP 2000

Figure 2.1: Livelihood Rights Model

## Livelihood strategy

The conceptual framework for livelihood strategy has been developed to analyse the multi-sectoral composition of the contemporary African in a rural setting, whether he or she is classified as a farmer or not. In addition, it shows how the dynamics of many sectors are used to demonstrate people's capabilities, the building or creation of assets and carrying out activities that make up the sum total of the lives of individuals, households and communities. CARE's livelihood rights model. Figure 2.1, is premised on this phenomenon.

CARE's livelihood model emphasises the need to consider the context in which an individual decides on their livelihood strategy. The context is composed of a combination of factors including natural resources, institution, as well as the economic, cultural and political environment and the demographics of the populations concerned.

The livelihood of the household is shown to revolve around different but interlinked activities such as production, consumption, processing and exchange. The various types of resources are reflected at the top of the model. These are natural capital, human capital, social capital and economic capital. On the right hand side of the model are the non-measurable, yet essential variables such as the different aspects of freedom. It is the dynamics of all these different sections of the model, that combine to give the livelihood strategy of the individual, whether they are farmers or non-farmers. For analytical purposes, the interconnectedness of all these variables in the model is critical.

A crucial variable that does not come out clearly in the model, although implied, is that of remittances. Earlier studies tended to emphasise the dichotomy between rural and urban areas. However, more recent studies have shown that resources flow across the rural-urban divide to create interdependence between them, as members of the same household are often on both sides of the divide. In Zimbabwe, urban remittances were considered of greater importance to rural livelihoods. Typically, these remittances funded items such as agricultural inputs and school fees, and were critical in the maintenance of production and consumption levels across an extended family (Drinkwater 2003).

## Models for Analysing the Impact of HIV and AIDS on Livelihoods

The sustainable livelihoods framework has been used to understand the mechanisms by which households are affected by HIV and AIDS. To understand the impact of HIV, there is need to know what happens to a household once a member is affected, and the extent to which this relates to other factors. Ideally, there is need to compare the situation of the household before and after a member is diagnosed HIV-positive or dies of AIDS.

With the understanding that HIV and AIDS is a contributing factor to a reduction in the productivity of the southern African agricultural sector and food security, Mdladla et. al (2003), have developed two tools; one to conceptualise and the other to analyse the impact of HIV and AIDS in agriculture. Their conceptual framework, (Figure 2.1) is similar to that developed by Mano and Matshe (Figure 2.2). For this research, FANRPAN considered both models, which are discussed below.

The analytical framework developed by Mdladla et. al (2003) can be used for both quantitative and qualitative analyses. It was used successfully in a vulnerability assessment committee (VAC) in some southern African countries. The SADC FANR VAC study, (2003), clearly

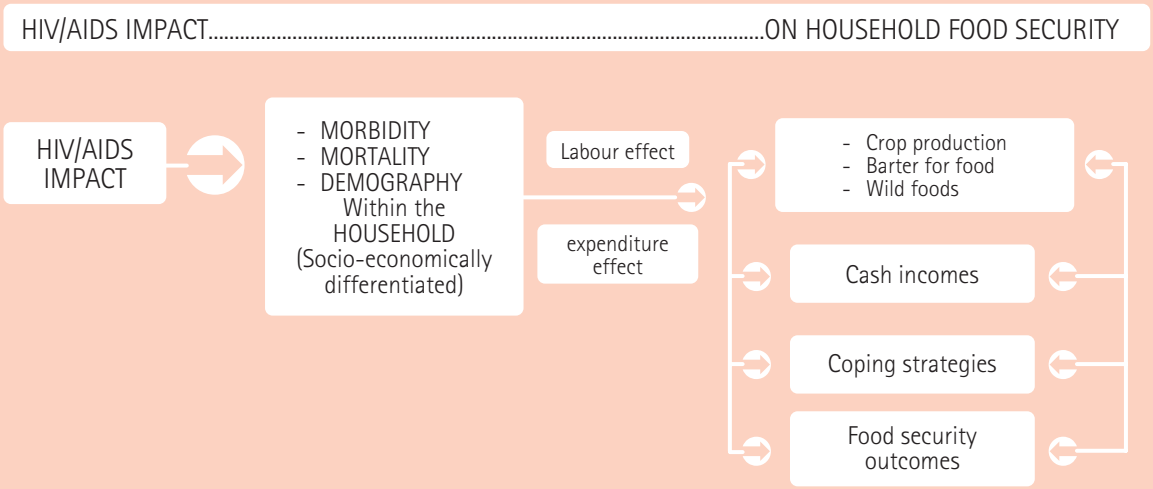



Figure 2.2: Conceptual Framework developed by Mdladla et. al (2003)

indicated that households affected by adult morbidity, mortality and with a high demographic load are significantly more vulnerable to food security shocks than other households. This analysis strongly implied that HIV and AIDS had significantly increased the vulnerability of households and exposed them to acute food insecurity.

The analysis showed that households suffer from marked reductions in agricultural production and income generation, leading to earlier engagement in distress coping strategies, and, ultimately, to a decline in food security. The cumulative impacts of HIV and AIDS on food availability, food access, and coping capacity are compounded, resulting in amplified negative impacts on overall household food security.

The analysis further demonstrated that different morbidity, mortality and demographic profiles have different effects on food security processes and outcomes. Key differences were seen according to whether or not the household had an active adult present, or a chronically ill person, whether the head of household was chronically ill, whether there was a high dependency ratio, or whether the household had taken in orphaned children. Each of these characteristics had further nuances that were affected by age and gender. The study suggested that the impacts of HIV on food security in the context of the 2002 food emergency were strong and negative (Mdladla et. al, 2003).

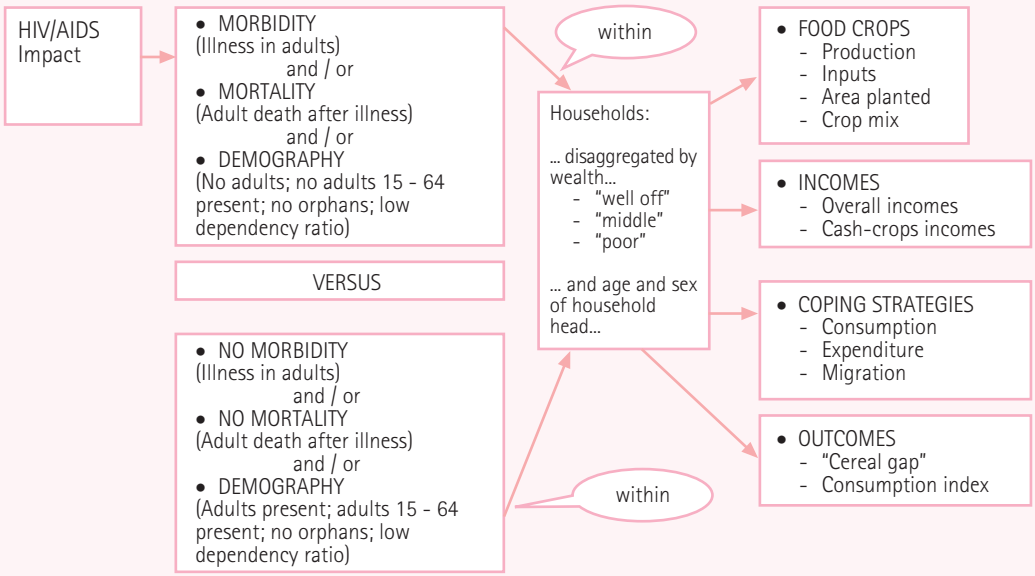



**Figure 2.3** Analytical Framework Developed by Mdladla et. al (2003).

Due to the comprehensive nature of the model by Mano and Matshe (2003), FANRPAN used this model as a starting point for selecting key variables for its research. The variables included farm-household production decisions, consumption expenditure, family size and composition, investment expenditure and capital stocks.

The scope and interacting nature of the above factors is illustrated in a conceptual framework - the "Conceptual Framework for the study on the impact of HIV and AIDS on Agriculture and Food Security in Rural Households" (Figure 2.3) - describing the "pathway" and conceptualisation for the study.

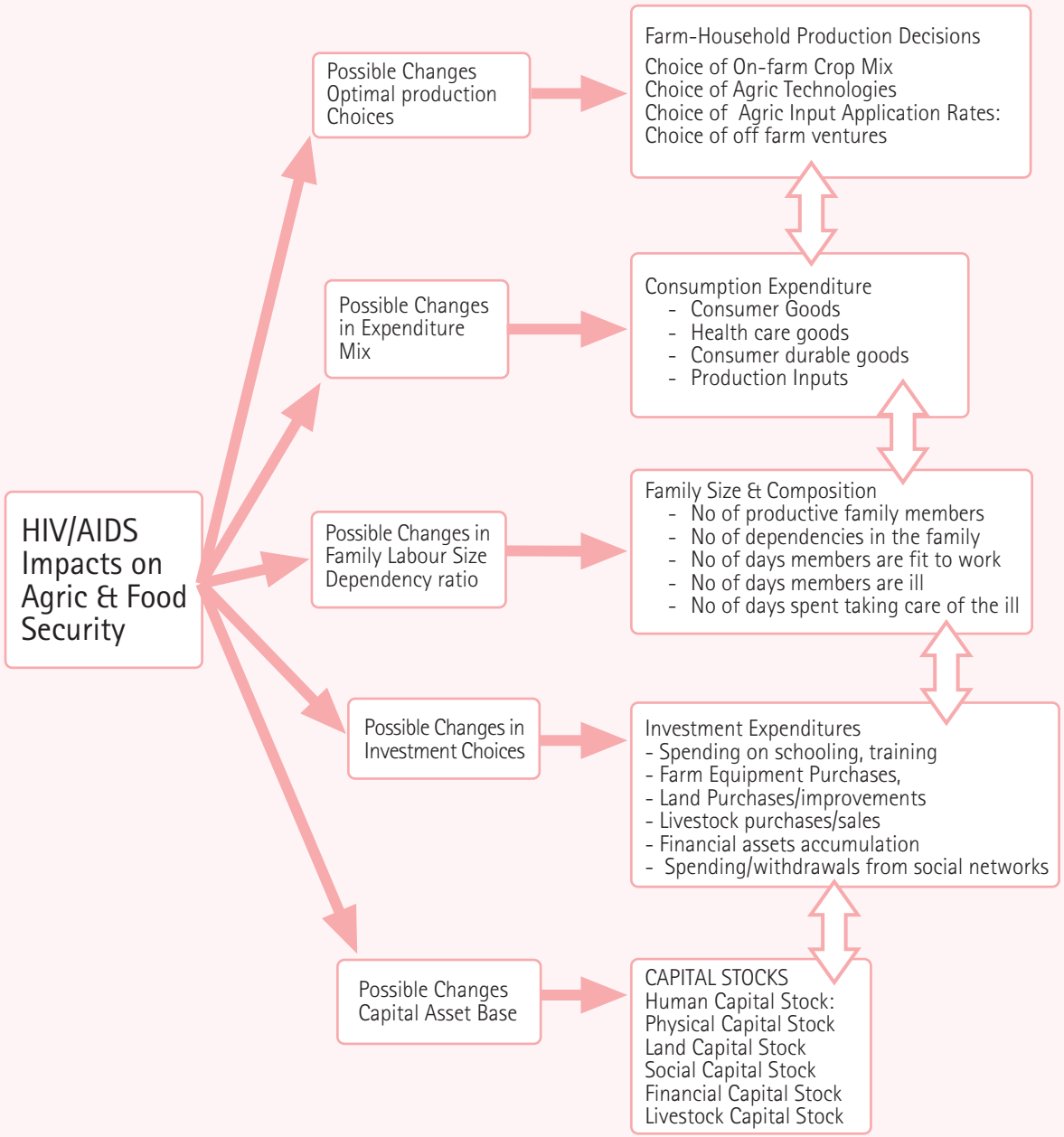



**Figure 2.4:** HIV/AIDS Analytical Framework Developed by Mano & Matshe (2003).

## 2. Research Study Framework

To explore the links between HIV and AIDS, agriculture and food security at a household level, there is need for a composite methodological framework, combining quantitative and qualitative approaches. Qualitative demographic, anthropological, and economic studies can provide important insights in the formulation of research questions. The use of survey questionnaires can expedite answers to the question of how HIV is impacting on the livelihoods of rural households. Drinkwater (2003) highlights that too often questionnaires are weak in their analysis, as they focus too much on the individuals. Drinkwater supports 'the concept of cluster analysis which aims to provide a more complete analysis of inter- and intra-household relations. A good livelihoods analysis should generate an understanding of context, social differentiation, and social desegregation (gender, generational and other diversity differences), and the technique of cluster analysis assists this (Drinkwater 2003). The data should be complimented by concrete case studies documenting how AIDS affected households are coping, and should also relate the livelihood strategies in detail (Mdladla et. al, 2003). Adding a rights-based lens to the analysis helps understand the rights and abuses occurring within communities, families and households.

In measuring the impact of HIV on agriculture and food security, it was essential to define agriculture and isolate the components that would be measurable in the context of food security and HIV. Agriculture is a chain that includes production, processing and marketing. At the household level, the main focus was on production and marketing. In this study, the unit of focus was the household. The study did not probe the impact at individual level. This is particularly critical in the case of food security because food is not always easily accessible to all members of the household (Maxwell and Frankenberger, 1992). Household members do not share common preferences regarding allocation of resources for income generation and food acquisition. Therefore, in selecting the household as the unit of study, the assumption is that if the household has access to food, then each member of the household is food secure.

The critical elements of food security were isolated. The general tendency is to assume that food security is synonymous with food availability or production. However, in most regions of the world, this is no longer the case; access and utilisation have become key priorities. Currently the main components of food security are: availability, accessibility and utilisation. In this study, each of these was tracked in the context of agriculture and HIV using Reutlinger's 1986 hypotheses, below, as key guidelines:

i. Food insecurity is basically the lack of purchasing power of a nation and its people

ii. Food security does not necessarily derive from food self-sufficiency nor directly from a rapid increase in production

iii. Long term food security is a matter of achieving economic growth with equitable distribution of benefits

iv. Food security in the short run is about re-distributing purchasing power and resources

v. Transitory food insecurity – due to fluctuations in domestic harvests, international prices, and foreign exchange earnings – can best be addressed through measures that facilitate trade and provide income relief to afflicted populations.

FANRPAN is a policy analysis network. Therefore the methodological framework focuses on the adaptations that need to be made on the policies of SADC countries, given the impact of HIV on agriculture and food security.

## Impact Dimensions and Hypotheses

A total of 17 impact dimensions were established. From the Mano and Matshe (2003) analytical framework presented earlier, five critical dimensions through which HIV and AIDS impact on agriculture and food security at household level were selected.

The Mano and Matshe framework was proposed at the start of the study, but its dimensions did not adequately cover the yield aspects of production (e.g. yield per food crop, land under cultivation etc). The framework also did not cover crop and livestock management services, such as extension, household income aspects, food availability, accessibility and utilisation. A total of 10 dimensions were added to the Mano and Matshe framework.

From literature review; five dimentions were added to the 10 from Mano and Matshe. These five covered aspects of mobility due to sickness; environmental impacts; demographic structure, as well as gender and social support networks.

In discussion with key stakeholders and researchers in the region, two additional dimensions (impact areas) were added. These included accessibility to food and utilisation of food.

In total, 17 dimensions were used in the study. The sum total of all these impacts is that - **HIV and AIDS increase the household aggregate vulnerability** to shocks and stress and increase household poverty (sum total of all declines at household level; school drop outs, orphans, child-headed homes, increased debt, sale of assets, etc.).

***i). Changes in optimal farm-household production decisions:***

**Hypothesis:** HIV and AIDS affects on-farm crop mix, agricultural technologies used, input application rates and off-farm ventures in households. Key variables to track are: choice of farm mix; choice of agricultural technologies; choice of agricultural input application rates; and choice of off-farm ventures.

***ii). Changes in household expenditure mix (consumption expenditure):***

**Hypothesis:** HIV and AIDS affect household consumption expenditure (i.e. consumer goods, health care goods, consumer durable goods, production inputs) – the variables tracked were: consumer goods; health care goods; consumer durables; and production inputs.

***iii). Changes in household labour, size and composition:***

**Hypothesis:** HIV and AIDS cause changes in the household demographic structure, reduce the number of productive members and number of workdays, whilst increasing the number of days spent taking care of the ill and the number of dependants in the household: – The key variables to track are: number of productive family members; number of dependants in the family; number of days members are fit to work; number of days members are ill; and number of days spent taking care of the ill.

***iv). Changes in investment choices (investment expenditure):***

**Hypothesis:** HIV and AIDS cause changes in household investment priorities: – and the variables tracked were; farm equipment purchases; land purchases/improvements; livestock purchases/sales; financial asset accumulation/depletion; and spending and withdrawals from social networks.

***v). Changes in the capital asset base (capital stocks):***

**Hypothesis:** HIV and AIDS erode the household's capital asset base: – the key variables were; human capital; physical capital stocks (livestock etc); social capital; financial capital; and natural capital stocks.

***vi). Decline in household agricultural production:***

**Hypothesis:** HIV and AIDS have led to a decline in agricultural productivity; – variables included; yield, overall output, agricultural inputs (type and quantity); number of productive households infected; number of households affected, education level; demographic variables, type and quality of equipment; gender of infected or affected; changes in household structure; extension and support services; area cultivated and gender implications.

***vii). Impact on household productive assets (covering the pentagon of assets):***

**Hypothesis:** HIV and AIDS erode the household productive asset base; – variables included reduction in number and quality of livestock; size of herd; price per head; expenditure on inputs; availability of labour; household's resource allocation; household's sources of income and household's expenditure patterns.

***viii). Impact on household food and nutrition security (food consumption):***

**Hypothesis:** HIV and AIDS cause a decline in household food consumption; – variables included types of food consumed; expenditure and income patterns; household income levels; size of household and dietary composition.

***ix). Impact on household market access, income and expenditure patterns:***

**Hypothesis:** HIV and AIDS reduce participation in markets; – variables included; sales (number of animals, number of bags); number of strayed animals; price per heard; number of animals sold to butcheries; crop sales; poultry sales; distance from nearest market place; who does the marketing and who is responsible for resource allocation.

***x). Impact on agricultural extension services:***

**Hypothesis:** HIV and AIDS result in erosion of extension and research services; variables included; absenteeism due to illness, farmer to extensionist ratios; number of deaths in the community; health status of extension workers and gender implications.

***xi). Mobility of household members:***

**Hypothesis:** HIV and AIDS increases mobility of household members; – variables included; travel expenditure; household size; changing household structure; number of patients at health care centres.

***xii). Environmental degradation:***

**Hypothesis:** HIV and AIDS cause increased environment degradation at household level; – variables included; accumulation of disposable litter; number of animals with measles; educational level; and gender issues.

***xiii). Household demographic structure:***

**Hypothesis:** HIV and AIDS increase household dependency ratios; – variables included number of children under 15 years; number of adults above 65

years; sex composition of household members; education levels of household members; employment status.

***xiv). Gender implications:***

**Hypothesis:** HIV and AIDS cause changes in gender roles; – variables included; property inheritance; land ownership and rights; resource allocation; female-headed households; child-headed households and decision making.

***xv). Support networks:***

**Hypothesis:** Support networks reduce the impact of HIV and AIDS on households; – variables included; number of government and non-governmental institutions providing support; number community associations providing support; number of social networks; traditional safety nets; remittances from relatives; existing sources of coping information.

***xvi). Accessibility to food:***

**Hypothesis:** HIV and AIDS cause transitory food insecurity in households; – variables included; sources (and amounts) of household income; existing food safety nets; household dependency ratio; and household expenditure (as compared to income).

***xvii). Utilisation of food:***

**Hypothesis and variables:** HIV and AIDS cause loss of productive labour in households, which leads to low-labour intensive cropping and poor crop management, which in turn lead to a decline in crop and nutritional variety and value, and subsequently a decline in food safety and quality.

## 3. Research Methodology

All the seven study countries used the concepts and framework agreed at the regional level. Each of the countries then adapted their research design to suit their specific context.

Site selection was designed to increase validity, rather than to ensure that the sample was representative of the given population. The study used purposive sampling, which was appropriate because certain important segments of the target population had to be represented in the sample. Households were selected on the basis of having been affected by HIV and AIDS.

Quantitative and qualitative methods and tools were used. These included an administered structured questionnaire, focus group discussions, observations and key informant interviews.

The interview questionnaire was based on the 17 dimensions detailed in the previous section. The researchers also adapted the tool to incorporate differences in each country, in particular, ethical issues as they relate to HIV. All countries relied on Central Statistical Offices, administrative boundaries, and other existing structures to purposively select a relevant sample. The researchers targeted support groups of people living with HIV and AIDS for focus group discussions; and used public health workers, traditional leaders, agricultural extensionists and programme implementers as key informants.

**Botswana**

A cross-sectional research design with a comparable group was used in Botswana. It involved comparing two groups; a selection of households affected by HIV and AIDS, and a similar group of households that is not

affected by HIV and AIDS. The groups were compared in terms of agricultural production and other selected outcome variables. Identifying affected households as well as finding a comparable group of households posed a significant challenge to the researchers.

A proxy variable for HIV and AIDS affected households was used. A household that had experienced a prolonged illness of one of its members was classified as "affected household." The use of proxy variables in HIV and AIDS studies is common.

Although a triangulation of data sources was used for qualitative analysis, the primary sources of data for Botswana were in-depth informal interviews with key informants such as the chiefs, district officers, senior health personnel, etc. in the three villages of Mmathethe, Mookane and Lentsweletau. Face-to-face informal interviews with farmers, extension workers, the business community, educators, local authority representatives and other workers resident in the villages, were also essential. Data were also collected using focus group discussions with representatives of different sections of the communities (e.g. out-of-school youth, extension workers, football clubs, etc.). Additional data came from observations, for example, the disposal of HIV support materials such as condoms and nappies for adult AIDS patients. Observation data was crucial for validating interview responses and identifying enabling or constraining factors likely to impact on the effective family labour for agricultural activities.

The descriptive qualitative survey approach was relevant for an impact assessment of this nature because it allows key informants (i.e. relevant government departments or agencies, local leadership, the community and of course farmers) to articulate their views and opinions regarding agricultural production activities in the era of HIV. The approach also enabled the different categories of farmers, families and agricultural extension workers, to share their experiences and ideas necessary to improve their work conditions. It is believed that an inclusive and participatory approach was the most appropriate, as HIV is considered a sensitive topic.

Three farming villages, representing three districts were purposively selected in Botswana. Originally the respondents were to be randomly selected from a roster of farmers maintained by the agricultural extension officers. However, this was not possible because of lack of updated records. Another option was to use census enumeration areas that are maintained by the Central Statistics Office (CSO). CSO usually has a list of households in each enumeration area used as a sampling frame. In this case, the first household in each of the enumeration areas was selected at random using the random number table. The remaining farming households were selected using the snowballing approach. That is, the first selected household will be asked if they knew a household that had experienced long illness or death in their neighbourhood during the last three years. The adjacent household was then included to constitute a comparable group of non-affected if they did not have a long illness or death in the last three years.

The unit of analysis was the household. The study targeted roughly between 5-10% of each of the three villages' population (proportionally stratified sampling). Since enumeration areas (EAs) have roughly the same population, the disproportionate sampling approach was used in the EAs. Data were collected using an interview schedule administered by research assistants employed and trained for that purpose.

The following villages were selected:

i) Mmathethe, a village from the Southern part of the country.

ii) Mookane, a village from the Central District
iii) Lentsweletau, a village from Kweneng District.

Sampling was purposeful in order to address issues of location, categories of farmers, community population diversity, gender and unique experiences. Detailed discussions with the different players in the field of agriculture were very instrumental in the sample frame. An average total of 5 focus groups per village were held, comprising of at least 6 and up to 10 people per focus group discussion. In addition to the focus group discussions, informal individual interviews with key informants were also conducted per village. These included owners of agriculture-related businesses, such as dairy, horticulture, sorghum milling and butchery as well as multi-purpose co-operatives. A total of 400 people participated in the focus groups and 10 individuals gave informal interviews. Altogether, the qualitative part of this impact study's sample was 410.

Qualitative data analysis occurred concurrently with quantitative data collection in Botswana, to facilitate further probing and clarification of issues. At the end of data collection, a comprehensive analysis that included coding, categorising and classification of the themes emerging from the data, was employed.

**Lesotho**

Lesotho is a very mountainous country with a population estimated at 2.3 million in 2005. Accessibility to most parts of the country is made difficult by the topography despite the size of the country [30,000 square kilometres].

The generic regional questionnaire was adapted to Lesotho and used to collect data. A stakeholder methodology workshop was held in order to make stakeholders aware of the study and to solicit their input in the data collection procedures. They made contributions to the questionnaire and the overall methodology. The questionnaire was pre-tested and modified accordingly. Research assistants were recruited among the National University of Lesotho students who had completed their degrees and were trained by the research team. They administered questionnaires to the household heads or their representatives, who provided most of the responses. For control purposes, respondents were asked to recall what used to happen before there was HIV and AIDS. There were also questions that investigated the situation during illness and where relevant, after death.

Another set of interviews was conducted with the orphans in the three areas of Queen II, Maluti and Mokhotlong. The two techniques complemented each other. The qualitative techniques captured in-depth information and allowed researchers to obtain information from orphans. Secondary sources of data were used to fill in specific gaps. Trained clerical assistants coded and entered the data in SPSS. Descriptive and comparative analysis - cross-tabulations, frequencies and means were then performed on the data. Focus group discussions and other qualitative responses were summarised for each region.

Of the ten districts in Lesotho, four that were representative of the zones were selected. Five Health Service Areas (HSA) in each district were selected from the government-run hospitals and those run by the churches. With the help of the HSA, the researchers identified the households that either had a patient, had lost a member of the family through chronic illness or families with orphans. Some of the patients had tested positive to HIV and were closely supported by community-based support groups. There were 210 households that were interviewed and quantitatively analysed. The largest sample was selected from Maseru district.

Selection of respondents for the study was done purposively with the assistance of the hospital management and the HIV

and AIDS support groups that worked within the selected areas. In most cases the support groups directed the data collection team to those families with which they had close contact, in the form of help of ill members who were either still alive or had died of AIDS-related diseases. Thirty-two orphans and six caregivers were also selected and interviewed using an interview guide.

**Namibia**

The research focused on three of Namibia's previously disadvantaged regions: Kavango, Oshana and Oshikoto. They are characterised by high rates of HIV infection and large numbers of people involved in agricultural production. The farmers studied in this survey all lived on communal lands and are considered as subsistence farmers. Together with the Ohangwena and Omusati Regions, they are home to almost 70% of Namibia's population.

These administrative units are located in the Northern and most populous parts of Namibia. This is also the area of the country with the highest overall rate of HIV infection.

**South Africa**

The Limpopo Province was selected because it is among the poorest provinces in South Africa, with more than 40% of the households experiencing transitory or chronic food insecurity. In addition, about 89% of Limpopo province can be classified as rural, and agriculture plays a major role in economic development. The unemployment rate in the province is about 42 percent (Nesamvuni et. al., 2003).

Capricorn, one of six district municipalities in the Limpopo Province, was selected for the case study. It was chosen due to established networks between the University of Limpopo, the Limpopo Department of Agriculture, and surrounding communities, which played a role in facilitating access to the sample. The Capricorn District has five local municipalities, namely Aganang, Blouberg, Lepelle, Molemolle and Polokwane, with a total of 106 wards.

The study was conducted in Molepo village Capricorn District, Limpopo Province and this site was selected purposively. It is amongst the poorest areas in the district with a large share of the population involved in subsistence agriculture and it has one of the highest prevalence rates of HIV and AIDS in the province. Ga-Molepo is a rural community situated South West of Polokwane, about 30km away from the University of Limpopo. The area has a small clinic situated close to Tshebela village. The clinic refers people needing anti-retroviral treatment to Mankweng Clinic and Pietersburg Clinic. The area has a few grocery stores, which are under stocked, and several primary and high schools.

The data for the survey were collected using a questionnaire at the household level as well as community seminars and focus group discussions. The focus group discussions were guided by a list of questions addressing the main issues of the survey. Fifteen enumerators, eleven from the School of Agriculture postgraduate programme, University of Limpopo and four local home-based-care workers, with reasonable competence in both English and Sepedi (Northern Sotho), were recruited for the fieldwork. The enumerators were trained and supervised by the researchers on the sampling procedure, interview techniques, interpretation and comprehension of questions, recording of responses, the participatory tools used for the group discussions and other logistics.

Prior to conducting the actual fieldwork, the draft questionnaire was pre-tested in ten households (five in the affected and five in the non-affected) to check on clarity, validity, correct understanding and translation

of the questions. The questionnaires were in English and the enumerators were required to translate the individual questions into Sepedi for the interviewee. The quantitative part of the survey was administrated over a period of one and a half weeks followed by qualitative data collection from the focus group discussions and community seminars.

Seven villages were covered in the survey and three villages participated in the focus group discussions and the community seminars. The key contact person in the community was the head nurse at Ga-Molepo clinic who played a pivotal role in all phases of the study. She introduced the research team to the members of the Molepo Home Based Care and Counselling Centre (MHBGC&CC). The home-based care group assisted by introducing the team to the local traditional authorities at the onset of the study and also arranged meetings for the focus group discussions. During the survey they assisted the team with information regarding households that were suffering from illness and deaths of household members resulting from AIDS-related illnesses.

Households from the seven villages of Molepo (i.e. sampling units in the sample frame) were stratified according to 'affected' and 'non-affected' and then randomly selected from the different strata. The definition of affected households used by the survey includes households in which at least one family member is chronically ill due to or related to HIV/AIDS, or in which at least one family member has died due to AIDS-related illnesses (such as TB and pneumonia) in the last three years. Non-affected households were defined as households in which no member had died of AIDS, or was living with HIV or HIV-related ailments. A higher probability of selection (0.6) was given to the affected households (both death- and illness-affected) and a lower probability (0.4) to the non-affected ones in order to give more relevance to impact. A total of 300 households were interviewed. However, finally data on 218 households were used for analyses. More questionnaires from the affected group were rejected at the analysis stage because of poor responses. This is a common problem in HIV related research since people in many societies stigmatise the disease and are reluctant to talk.

**Swaziland**

In Swaziland, two sets of tools were developed for the study. The first consisted of a survey questionnaire, which was used to collect data from households. The second was a list of focus group discussion questions, meant to compliment information obtained from the survey. The group discussions were guided by a list of questions addressing the main issues of the survey. The composition of the focus group discussions was the same for all the regions. At least three group discussions were held in each region surveyed and these included men, women and children respectively.

After developing the questionnaire, the study team pre-tested the instrument. Debriefing sessions with enumerators were held before the interviews as well as after the pre-testing. The questionnaires were in English and the enumerators were required to translate the individual questions into Siswati for the interviewee.

Eight enumerators with competence in both English and Siswati were recruited and assigned to the eleven Regional Development Areas (RDAs). The enumerators were trained and supervised by the researchers on the sampling procedure, community entry process, interview techniques, interpretation and comprehension of questions, recording of responses, group discussions and other logistics. The survey was carried out between May and September 2004.

In choosing study sites, the objective was to obtain a sample that was representative of the Swaziland rural

agricultural sector and to describe how HIV and AIDS has affected agriculture and food security. A stratified method of sampling was adopted in this study, where the four regions (Manzini, Lubombo, Shiselweni and Hhohho) were selected. RDAs from each of the regions were purposely selected, followed by a systematic sampling of households.

The selected RDAs representing the four regions were: Motsahne, Ntfonjeni, Mayiwane (Hhohho region); Ngwempisi, Ludzeludze and Luve (Manzini region); Tikhuba, Siphofaneni (Lubombo region) and Mahamba/Zombodze, Mahlalini/Madulini, Southern (Shiselweni region).

According to the CSO report (1997), Swaziland has 172,416 households, of which 113,797 are rural households. The sample size was 240 households from each region, making a total of 960. However, due to problems with enumerators, only 161 and 206 questionnaires were collected from the Lubombo and Hhohho regions respectively, whilst in the other two regions, all 240 questionnaires were collected as targeted. Therefore, the final sample used in the study was 847 households.

**Zambia**

In Zambia, data was collected using a questionnaire which was administered to randomly selected farming households in three selected districts. The survey elicited data from respondents, most of whom were household heads.

Owing to the respondents' unwillingness to report cases of AIDS-related deaths and chronic illness, a proxy indicator was used. The proxy for affected households was those caring for orphans (children up to 18 years old who have lost one or both parents through death). The survey was administered in August of 2004, the period immediately after the completion of the 2003/2004 agricultural harvesting period. The study followed a step-by-step approach involving two major components, a literature review, and a quantitative survey. The literature review made up the first phase of the whole study and it resulted in a report, which crystallited the major findings of past research studies on the impact of HIV and AIDS on agriculture, food security and natural resources, at national and regional levels. The review exercise also exposed knowledge gaps on the impact of HIV and AIDS on agriculture-based livelihoods.

The study was conducted in three districts of Southern Province of Zambia (Choma, Monze and Sinazongwe), a predominantly agricultural province in the country. The three districts were selected based on their high HIV prevalence rates, high level of agricultural dependency and their geographical location. The sample for this study was randomly selected from small-scale farmers within the selected districts, with a target sample size of 250 households.

The study used a sampling frame that was developed by FAO and the Farming Systems Association of Zambia (FASAZ) baseline study. Thirty two rural Standard Enumeration Areas (SEAs), were selected on the basis of chronic illnesses and deaths. Following this stratification, this study purposively selected SEAs that recorded the highest number of chronic illnesses and deaths in 2002. A total of 13 SEAs (4 in Choma, 3 in Monze and 6 in Sinazongwe) were selected. Without district level population-based HIV prevalence rates, this study had to purposively select SEAs with evidence of a high incidence of chronic illnesses and adult deaths.

Households were then randomly selected from the list of male- and female-headed households in the selected SEAs. The final sample of 230 rural households was representative of the rural population in those areas,

given the uniformity of livelihood systems within districts. The sample provided a basis from which to estimate parameters for the rural areas of the study districts.

**Zimbabwe**

The study team collected two types of data - secondary data and empirical survey data. A survey was carried out in two provinces in Zimbabwe. A total of 320 households was interviewed in Mashonaland East and Manicaland provinces, in the districts of Goromonzi and Makoni respectively. The sampling frame used in the survey was stratified to include both 'affected' and 'non affected' rural populations of the two communities. The study adopted the classification system of local community based care-givers (CBC) of households deemed to be affected by HIV and AIDS and those non-affected by the virus. In the study, a household was defined as 'affected' based on relative ability of the household to cope in the presence of HIV and AIDS. Affected households were thus taken to be those that CBCs had identified and were working with, in their respective community programmes. Households were identified from the records of CBCs.

Local partners provided key logistical support in the field. These included community based care-givers (from different programmes such as Homed based Care, Village Health Workers, etc), local political and traditional leadership, Agricultural Research and Extension agents and community based Organisations (CBO) or Non Governmental Organisations (NGO) operating in the study areas, such as the Girl Child Network.

Working in collaboration with the District Community-based Care, the team followed a stratified sampling frame targeting to interview at least 150 to 175 farm households among the affected households, and a similar number among the less affected households. For ethical reasons, the team had to ask permission from interviewed households to be part of the study and also if they wanted to put any form of restrictions on how the information will be used. It was surprising how open most individuals were about their conditions. This made the survey relatively easy to execute. The local caregivers validated the list of selected households. A total of 350 questionnaires were completed and after cleaning, 329 were complete, of which 57% were for affected households.

## Data Analysis

Data were analysed using the Statistical Package for Social Scientists (SPSS). For continuous variables, measures of central tendencies and student t-tests were used to summarise the data for meaningful interpretation. Proportions and chi-square tests were used to process categorical variables. To determine the strength of association between independent and key outcome variables, univariate and multivariate statistical modeling techniques were used.

Descriptive and comparative analysis i.e. cross-tabulations, frequencies and means were performed on the data. Focus group discussions and other qualitative responses were summarised for each country.

## Descriptive Techniques and Comparative Analysis

For every impact dimension, affected and non-affected households were compared using means and indices. Comparisons were further aided by graphing techniques. This method of comparison is easy but limited in its interpretation, and often requires further analysis to verify the importance of factors.

Econometric analysis was done to find out if HIV and AIDS status and intensity of affliction is important to explain observed variations in important impact

variables such as productivity, food security and food self sufficiency. Two analytical tools, multivariate regression and logistic regression were used in this econometric analysis.

## Linear and Multiple Regression Analysis

Multivariate regression models are used to estimate the impact of one or more explanatory variables on a dependant variable. The dependant variable is assumed to be a linear function of more than one independent variable and an error term. The error term measures the effect of other excluded variables and other sources of error. The model used in the study is the ordinary least squares (OLS) and can be represented as follows:

$$Y_i = \beta_0 + \sum_{j=1}^{k} \beta_j X_{ij} + \varepsilon_i, \quad i = 1, \cdots, N \qquad (3.1)$$

where:

$Y_i$ is the value of the response variable for the i$^{th}$ household,
$\beta_0, \beta_1, \cdots, \beta_k$ are parameters,
$X_{i1}, X_{i2}, \cdots, X_{ik}$ are known constants, namely, the values of the predictor variables, and
$\varepsilon_i$ is a random error term with mean $E(\varepsilon_i) = 0$ and variance $Var(\varepsilon_i) = \sigma^2$;
$\varepsilon_i$ and $\varepsilon_{i'}$ are uncorrelated so that their covariance is zero, for all $i \neq i'$.

The above model can be extended to a general linear regression that includes both quantitative and qualitative variables such as gender (male, female). In such cases, indicator variables that take values of 0 and 1 (called dummy variables) are used to identify classes of the qualitative variable. For example, gender of the household head is defined as

$$X_{i1} = \begin{cases} 1, \text{ if the household head is male} \\ 0, \text{ if the household head is female.} \end{cases}$$

where, for the tracked variable $X_{i1} = 1$ refers to a positive attribute

In general, the $p$ classes of qualitative variables are represented by means of $(p - 1)$ indicator variables.

### Logistical Regression Analysis

Logistical Regression uses the logit model to predict the likelihood that a given household with certain socio-economic characteristics and production choices falls within a certain group e.g. households can either be food secure or otherwise. The model can only be used when the dependent variable is binary i.e. can take on only two values, 1 and 0. The general model could be represented as follows;

$$\log \frac{P_i}{1 - P_I} = \alpha + \beta X_i$$

where $P_i$ = the probability that a given household will fall within a certain group given $X_i$.
$X_i$ = independent variable $i$

### Principal Component Analysis: Wealth Index

South Africa utilised the Principal Component Analysis. Principal components were used to determine the weights for an index of the asset variables, i.e. to calculate the wealth index. Principal components analysis is a technique for extracting from a set of variables those few orthogonal linear combinations of the variables that capture the common information most successfully. Intuitively the first principal component of a set of variables is the linear index of

all the variables that captures the largest amount of information that is common to all of the variables.

Assuming a set of $k$ variables, $y_{1j}$ to $y_{kj}$, representing the ownership of $k$ assets by each household $j$, principal components analysis starts by specifying each variable normalised by its mean and standard deviation: for example,

$$z_{1j} = \frac{y_{1j} - \bar{y}_1}{s_1}$$

where $\bar{y}_1$ is the mean of $y_{1j}$ across households and $s_1$ is its standard deviation. These selected variables are expressed as linear combinations of a set of underlying components for each household $j$:

$$\begin{aligned} y_{1j} &= a_{11}P_{1j} + a_{12}P_{2j} + \cdots + a_{1k}P_{kj} \\ &\vdots \\ z_{kj} &= a_{k1}P_{1j} + a_{k2}P_{2j} + \cdots + a_{kk}P_{kj} \end{aligned} \qquad (3.2)$$

where the $P_{ij}$'s, $j = 1,..., m$, are the components and the $a_{ij}$ are the coefficients on each component for each variable and do not vary across households. The first principal component $P_{1j}$ is computed as the linear combination of the original variables with maximum variance and the second one is also a linear combination of the variables, orthogonal to the first, with maximal remaining variance, and so on (Johnson, 1998).

The principal components are recovered by inverting the system implied by (3.2) and yield a set of estimates for each of the $k$ principal components. The first principal component, expressed in terms of the original variables, is therefore an index for each household based on the expression

$$P_{1j} = l_{1j}\left(\frac{y_{1j} - \bar{y}_1}{s_1}\right) + \cdots + l_{1k}\left(\frac{y_{kj} - \bar{y}_k}{s_k}\right)$$

where $l_{1j}$ is the loading of the j[th] variable for the first principal component and obtained by using $l_{1j} = a_{1j}\sqrt{\lambda_1}$, $\lambda_1$ is the variance of the first principal component. The crucial assumption for this analysis was that household long-run wealth explains the maximum variance and/or covariance in the asset variables.

## The Household Vulnerability Index (HVI)

After carrying out the descriptive and comparative statistical analysis – Lesotho and South Africa used the data to compute the Household Vulnerability Index (HVI) to establish the aggregate vulnerability (the overall household outcome) of the impact of the epidemic on individual households and on the whole study sample.

The theory used for the construction of the HVI begins from the work originally proposed by Costa[1]. The quest is similar to that of Costa, i.e. to quantify the multidimensional impacts of a health problem on a household. The specific quest of HVI is to assess at the household level, the impact of the HIV epidemic on agriculture and food security. A Fussy Set approach was used to analyse the data.

The HVI is calculated using a model developed in a spreadsheet application. The model computes the sum of the weighted vulnerabilities across all the 17 impact dimensions to give the particular household's total vulnerability $Vhh_i$ to HIV and AIDS. In this model, the weighted vulnerabilities relate to the contribution of the respective dimension to the households overall vulnerability. Because the unit of measure is the household, the HVI is calculated for each household in a given sample.

The theory for the construction of the Household Vulnerability Index (HVI) uses "the Fuzzy Set approach" to analyse data. The following definitions

[1] Costa, M. (2002). A Multidimensional Approach to the Measurement of Poverty: An Integrated Research Infrastructure in the Socio-Economic Sciences IRISS Working Paper Series No. 2002-05; and Costa, M. (2003). A Comparison Between One-dimensional and Multidimensional Approaches to the Measurement of Poverty An Integrated Research Infrastructure in the Socio-Economic Sciences IRISS Working Paper Series No. 2003-02.

help clarify how the approach is used:

- One can state that for the population N made up of n households i.e. ($N=\{hh_1, hh_2, hh_3 \ldots hh_n\}$, V is a subset of $v$ households that have some degree of vulnerability to HIV and AIDS and care hence impacted by the epidemic. Thus $v \leq n$ and $v=0$ implies that there are no vulnerable households, and $v=n$ implies that all households are vulnerable.
- One can also break down the vulnerability X into $m$ specific dimensions of impact, and give a corresponding weight ($w_{i.....}$, $i=1,\ldots,m$) to each dimension. The weights can be predetermined, or developed using an appropriate function.
- The vulnerability of any given household $hh_i$ $i=1\ldots n$ to the $j$th, $j=1,\ldots m$ dimension of impact can be expressed as $X_{ij}$, and set to take values between 0 and 1 such that 0 = no impact and 1 = full impact. A specific formula for calculating $X_{ij}$ is discussed later. Thus each $X_{ij}$ denotes the degree of vulnerability of household $i$ to the $j$th dimension of impact, and $X_{ij}xw_i$ will be the corresponding weighted vulnerability.
- The sum of the weighted vulnerabilities across all dimensions will give the particular household's total vulnerability $Vhh_i$ to HIV and AIDS, that is:

$$\sum_{j=1}^{m} X_{wj} / \sum_{j=1}^{m} w_j = Vhh_i$$

- It is also possible to sum down the dimensions and calculate the particular dimension's contribution to vulnerability to HIV and AIDS.
- For the study, the sum of the weights has been conveniently set to:

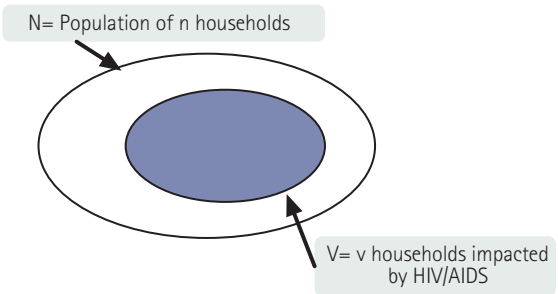
$$\sum_{j=1}^{m} w_j = 100$$

- The weights are preset using secondary data and previous analysis. The Vulnerability scores per dimension are based on nature (short, medium or long term), extent (ripple effects) and severity (depth of morbidity) of the impact of the different variables tracked within a given dimension.

From the HVI indices established it was then possible to categorize the households according to 3 different degrees of vulnerability:

1) **Vulnerability level 1 = Coping level Households (CLH)** – a household in a vulnerable situation but still able to cope;
2) **Vulnerability level 2 = Acute level households (ALH)** – a household that has been hit so had that it badly needs assistance to the degree of an acute health care unit in a hospital. With some rapid-response type of assistance the family may be resuscitated;
3) **Vulnerability level 3 = Emergency level Households (ELH)** – the equivalent of an intensive care situation – almost a point of no return – but could be resuscitated only with the best possible expertise.

The three vulnerability levels are set on the basis of a predetermined **coping** household based on the 17 impact areas and a specified socio-economic context.




The Household Vulnerability Index is calculated by applying the theory discussed above to the data collected

by the household questionnaires, observing a number of steps:

1. Selecting appropriate dimensions of impact.
2. Selecting appropriate variables from collected data to describe these dimensions.
3. Setting the goal posts for each variable: maximum and minimum values.
4. Developing a matrix of weights for the dimensions. Each variable is given an appropriate weight within its cluster using the predetermined weights.

5 Next we calculate the individual variable indices as a number between 0 and 100 by using:

$$\frac{\text{Actual value - minimum value}}{\text{Maximum value} - \text{minimum value}} \times 100$$

6. The Household Vulnerability Index (HVI) is then computed for the total mark using the formula:

Household Vulnerability Index (HVI) = average value of individual indices.

## 4. Data Storage

One of the key objectives of the study was to design a database for storing data collected. The database would be a source of baseline information to be used for subsequent analysis and longitudinal studies. In developing the database, hypotheses that the database sought to test were defined. This was deemed an important part of the database, as it would not only group and justify the variables that were included, but also form a basis for current and future analysis. The following hypotheses were proposed: (Table 2.1)

Developing the regional database was a regional process that involved input from the various stakeholders. First, a structure was proposed for the regional database and appropriate software selected; then a regional workshop was called, followed by a participatory database population initiative.

The structural design of the database, was based on the generic unified questionnaire. Samples of completed questionnaires used in the seven countries were analysed and an agreed set of variables identified for purposes of defining each of the 17 dimensions.

Table 2.1: Linking the Database to hypothesis tracked.

| **Indicator Area** | **Variables tracked by the study** |
|---|---|
| 1. Changes in demographic characteristics of Households. Hypothesis: HIV and AIDS negatively impacts on household compositions, with increases in child-headed households that are less equipped to contribute to food production. | 1.1 Who is the head of the household?<br>1.2 What is the highest level of education for the head of the household?<br>1.3 What is the highest level of education for most learned member of household?<br>1.4 Number of married people in the household<br>1.5 Average age of household members<br>1.6 Range of ages for households |
| 2. Changes in family health history. Hypothesis: HIV and AIDS results in increased morbidity and reduced well-being. | 2.1 Which diseases have occurred among family members recently<br>2.2 How many members of the household have suffered from AIDS-related diseases in the last three years?<br>2.3 How many members of this household died from AIDS-related illnesses in the last three years?<br>2.4 How does illness affect the family?<br>2.5 What percentage of family income is spent on health? |
| 3. Changes in death patterns at household level. Hypothesis: HIV and AIDS results in increased mortality of productive members of the households. | 3.1 How many deaths have you experienced in your household in the last three years<br>3.2 What was the cause of death?<br>3.3 Who generally provides financial support at a funeral in your household<br>3.4 Are deaths increasing or decreasing?<br>3.5 What is the monetary cost of funerals? |
| 4. Assessment of changes in household wealth. Hypothesis: Death of adult family members increases impoverishment and food insecurity. | 4.1 What property was left behind at the last adult death in the household?<br>4.2 How was each asset disposed of?<br>4.3 What is the asset composition for the household? (both for domestic and field use)<br>4.4 Which live-stock does the household own, and in what numbers?<br>4.5 How many animals were sold in the last year?<br>4.6 How much money was accrued from the sale of livestock?<br>4.7 How much money was accrued from the sale of livestock by-products (eggs, milk, and meat). |

| | |
|---|---|
| | 4.8 How much money does the household receive from sale of crops and animals, employment, government and family members? (What is the household's total income?)<br>4.9 How much is spent by the household per month on different aspects (school fees, farming inputs, savings etc)?<br>4.10 Which periods of the year does the household face food insecurity and shortages? |
| 5. Changes in land cultivation. Hypothesis: HIV and AIDS impacts land cultivation patterns | 5.1 What is the total size of fields?<br>5.2 What percentage of total household land is cultivable?<br>5.3 What are the prevailing soil types for cultivated fields?<br>5.4 What is the distance to the fields?<br>5.5 What is the annual seed and fertilizer input? Kgs and cost.<br>5.6 What changes in cultivable land due to illnesses?<br>5.7 What is the main source of inputs?<br>5.8 Who provides labour for cultivation?<br>5.9 What has changed as a result of illness in the family?<br>5.10 What is the total cultivable land that is available for the Household?<br>5.11 What percentage of cultivable land was cultivated in the last year?<br>5.13 What are the predominant crops grown?<br>5.14 What revenue is realized from the sale of crops?<br>5.15 What costs are associated with ploughing? Weeding? Harvesting? |
| 6. Copying strategies. Hypothesis: Households and communities are developing coping strategies that need to be supported. | 6.1 What are the main challenges with securing finances?<br>6.2 How are these overcome?<br>6.3 How does the community assist bereaved families or those with sick members?<br>6.4 What support is obtained from government and NGOs?<br>6.5 What is the main source of information on HIV and AIDS?<br>6.6 What safety-nets exist?<br>6.7 Labour saving? |

## Selecting Software Platforms

The researchers considered a number of issues when selecting the software mix. Of primary importance was what the database would be used for, by whom, and how the database would be stored. It was also important to consider the other platforms already used at the country level. For software, SPSS, Microsoft Excel, Microsoft Access and Epi Info were proposed and used:

- SPSS was chosen as the software for basic and advanced analysis. Six of the seven countries analysed their data using this software. A number of the FANRPAN nodes employed the services of qualified statisticians, and SPSS was their choice of software.
- Microsoft Excel was included because of its wide usage, and that it would serve as a platform for moving between different applications.
- Microsoft Access was included as the main database application.
- After analysing the country level data, it was noted that some additional data entry was going to be necessary. Epi Info is generally preferred when entering survey data into the computer. Epi Info also enters data into Microsoft Access database formats. Thus the data entry platform was developed in Epi Info.

The country-level databases were developed in SPSS, while the regional database was constructed in Microsoft Access. A data entry platform for the Access database was designed in both Epi info and Access.