

**POVERTY MEASUREMENT AND ANALYSIS USING  
NON-MONETARY APPROACH: THE CASE OF  
TANZANIA**

**Dissertation submitted in Partial Fulfillment of the  
Requirement for the Degree of Masters in Population Studies**

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## DECLARATION

In accordance with the regulations of the University of KwaZulu-Natal, I, Irenius Joseph Ruyobya declare that this Masters thesis titled “Poverty Measurement and Analysis Using Non-Monetary Approach: The Case of Tanzania” is my original and independent study. It has not been previously submitted for any degree, and is not being concurrently presented in candidature in any other University. All sources and literature have been dully acknowledged.

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5<sup>th</sup> May, 2006

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## ABSTRACT

*The thesis has considered an asset-based alternative to the conventional use of consumption or expenditure in defining well-being and poverty. The motivation for the study was to derive a measure of economic status by households in the absence of income or consumption data. This is particularly important for a country like Tanzania where consumption, expenditure and price data are either limited or unavailable. The thesis uses data from The Tanzania 2002 Population and Housing Census information on housing conditions and ownership of certain durable goods to construct an asset index. This index is a proxy for long-run household wealth. When tested for reliability the asset index was found to be robust, coherent and a good predictor for economic status among the “poor” and “non-poor”. The study has revealed that with further research, poverty analysts in Tanzania may also use the household asset index as an explanatory or as a means of mapping welfare in the country.*

## List of Acronyms

1. CGAP	Consultative Group to Assist the Poor.
2. DFID	UK – Department for International Development
3. EA	Enumeration Area
4. FGT	Foster-Greer-Thorbecke
5. GDP	Gross Domestic Product
6. GER	Gross Enrollment Rate
7. HBS	Household and Budget Survey
8. HDI	Human Development Index
9. HPI	Human Poverty Index
10. IMF	International Monetary Fund
11. MDG	Millennium Development Goals
12. NBS	National Bureau of Statistics
13. NER	Net Enrollment Rate
14. OECD	Organization for Economic Co-operation and Development
15. PPA	Participatory Poverty Assessment
16. PPP	Purchasing Power Parity
17. PER/MTEF	Public Expenditure Review/Mid Term Expenditure Framework
18. PCA	Principal Component Analysis
19. UNDP	United Nations Development Programme
20. UNFPA	United Nations Population Fund

## TABLE OF CONTENTS

<b>TITLE PAGE</b> .....	i
<b>DECLARATION</b> .....	ii
<b>ACKNOWLEDGEMENTS</b> .....	iii
<b>ABSTRACT</b> .....	iv
<b>LIST OF ACRONYMS</b> .....	v
<b>TABLE OF CONTENTS</b> .....	vi
<b>1. INTRODUCTION</b> .....	1
1.1    Problem Statement.....	1
1.2    An Overview of Poverty Measurement in Tanzania.....	3
1.3    Organisation of the study.....	5
<b>2. POVERTY: DEFINITION AND MEASUREMENT</b> .....	7
2.1    Introduction.....	7
2.2    Defining Poverty.....	7
2.3    Poverty Measurement.....	11
2.3.1    Absolute and Relative Poverty.....	11
2.3.2    Measurement of Absolute and Relative Poverty.....	12
2.3.3    Poverty Line.....	15
2.4    Composite Measures of Poverty.....	21
2.4.1    The Human Development Index.....	21
2.4.2    The Human Poverty Index.....	23
2.4.3    The Sen Index.....	24
2.5    Capabilities and Asset Approach.....	25
2.5.1    Capability Approach.....	25
2.5.2    Asset Approach.....	26
2.6    Development Index.....	27
2.7    Non-Monetary Measures of Poverty.....	28
2.8    Household Asset Index.....	29
2.9    Conclusion.....	30

<b>3. SOURCE OF DATA.....</b>	<b>31</b>
3.1 Introduction.....	31
3.2 2000/01 Household and Budget Survey.....	31
3.2.1 Coverage.....	31
3.2.2 Data Collection.....	31
3.2.3 The Questionnaire.....	32
3.2.4 Limitations of Household and Budget Surveys.....	32
3.3 Food Poverty Line.....	34
3.4 Basic Needs Poverty Line.....	34
3.5 2002 Population and Housing Census.....	35
3.5.1 Enumeration Procedures.....	35
3.5.2 Census Questionnaire.....	36
3.5.3 Limitations of Census Data.....	36
3.6 Conclusion.....	37
<b>4. POVERTY PROFILE.....</b>	<b>38</b>
4.1 Introduction.....	38
4.2 Profiling Poverty.....	38
4.3 Population of Tanzania.....	40
4.4 Incidence of Poverty.....	42
4.5 Education Indicators.....	47
4.5.1 Girls/Boys Ratio in Primary and Secondary Schools.....	48
4.5.2 Transition from Primary to Secondary Schools.....	51
4.5.3 Net Enrolment Rates.....	51
4.5.4 Gross Enrolment Rates.....	54
4.5.5 Drop-out Rates.....	55
4.5.6 Adult and General Literacy Rates.....	55
4.6 Water and Sanitation.....	57
4.6.1 Safe water.....	58
4.6.1 Sanitation.....	60
4.7 Housing.....	60
4.8 Access to Electricity.....	61

4.9	Conclusion.....	61
<b>5.</b>	<b>THE HOUSEHOLD ASSET INDEX.....</b>	<b>63</b>
5.1	Introduction.....	63
5.2	Construction of the Asset Index.....	63
	5.2.1 Assigning Weights.....	64
	5.2.2 Recoding of Variables.....	69
5.3	Results.....	70
5.4	Reliability of the Index.....	73
	5.4.1 Robustness.....	73
	5.4.2 Internal Coherence.....	74
5.5	Limitations of the Asset Index.....	75
5.6	Short Poverty Profile.....	77
	5.6.1 Housing.....	78
	5.6.2 Facilities and Services.....	80
	5.6.3 Ownership of Assets.....	82
5.7	Regional Differentials.....	82
5.8	Conclusion.....	84
<b>6.</b>	<b>RECOMMENDATIONS AND CONCLUSIONS.....</b>	<b>85</b>
6.1	Recommendations.....	85
6.2	Conclusions.....	86
7.	REFERENCES.....	88
8.	APPENDICES.....	94

#### **LIST OF TABLES**

Table 4.1	Tanzania Mainland Population and Growth Rates, 1988 – 2002.....	41
Table 4.2	Poverty Levels by Regions: HBS 2000/01.....	43
Table 4.3	Education Literacy Indicators by Regions – 2002 Census.....	47
Table 4.4	NER and GER by Sex and Location.....	54
Table 4.5	Literacy Rates by Sex and Location: 2002 Census.....	57



Table 4.6	Housing Conditions.....	61
Table 5.1	Recoding of Variables.....	69
Table 5.2	Scoring Factors and Summary Statistics for Variables entering the Computation of the First Principal Component.....	72
Table 5.3	Classification of Differences of the Poorest 40 Percent.....	73
Table 5.4	Percentage of Households and Building Materials.....	78
Table 5.5	Percentage of Households, Source of Drinking Water, Toilet Facilities and Availability of Electricity.....	81
Table 5.6	Percentage of Households by Ownership of Assets.....	82
Table 5.7	Distribution of Households in the Bottom Forty Percent of the Index and Percentage of Population below the Basic Needs Poverty Line by Regions.....	84

#### **LIST OF MAPS**

Map 4.1	Annual Population Growth Rates 1988/2002.....	42
Map 4.2	Mean Monthly Consumption Expenditure per Capita.....	44
Map 4.3	Percentage of Population below the Food Poverty Line.....	45
Map 4.4	Percentage of Population below the Basic Needs Poverty Line.....	46
Map 4.5	Girls/Boys Ratio in Primary Schools.....	49
Map 4.6	Girls/Boys Ratio in Secondary Schools.....	50
Map 4.7	Net Primary Enrolment Rate.....	53
Map 4.8	Literacy Rates for Population Aged 15 and Above.....	56
Map 4.9	Percent of Households Using Safe Water.....	59

#### **LIST OF FIGURES**

Figure 2.1	Pyramid of Poverty Concept.....	8
Figure 4.1	NER and GER by Sex.....	55
Figure 4.2	NER and GER by Location.....	55
Figure 5.1	Scree Plot.....	71
Figure 5.2	Floor Materials.....	79
Figure 5.3	Roof Materials.....	79

Figure 5.4	Wall Materials.....	80
Figure 5.5	Water Sources.....	81

# **CHAPTER 1**

## **INTRODUCTION**

Poverty measurement in Tanzania as in many other developing countries is mostly based on a money metric approach using information from household and budget surveys. Recently, however attempts have been made to measure poverty based on other human indicators. Poverty and Human Development Reports have been released which consider poverty in broader term than the money metric approach. The last two household and budget surveys in Tanzania were held in 2000/2001 and 1991/1992. The main objectives of these surveys were to collect poverty-monitoring indicators and to offer a set of baseline measurements for the future (National Bureau of Statistics, 2002: XVII).

The Population and Housing Census that was held in 2002 also collected information on ownership of assets and housing condition that also can be used for the same purpose of poverty measurement and analysis. Although the census questionnaire in Tanzania does not contain questions on income and expenditure but it contains useful information that is useful for monitoring poverty especially now that poverty reduction is one of eight Millennium Development Goals (MDGs) which the government of Tanzania has subscribed to (United Republic of Tanzania, 2005: 1).

This study uses population and housing census data to develop a poverty profile and construct a household asset index based on ownership of asset and household conditions to measure and analyse poverty in the country. The study also explains the importance of creating development indices based on information collected from the census.

### **1.1 Problem Statement**

The definition of poverty has broadened from a focus on command over market purchased goods (income and expenditure) to embrace the dimensions of living standards such as longevity, literacy and healthiness (Kanbur and Squire, 1999: 1). However, although the definition of poverty has been expanded, in most cases poverty is still measured on money metric – expenditure or income- bases. (There are number of reasons for this tendency and they are elaborated later). For example, a commonly

used poverty line for monitoring poverty progress in reducing poverty is the dollar-a-day measure introduced in the 1990 World Development Report. As the name implies this measure is money (expenditure) based and therefore does not capture other aspects of human development such as improved health or knowledge. Money metric measures also fail to capture other aspects of poverty like deprivation, vulnerability, or capabilities as defined by Sen (Blackwood and Lynch, 1994: 567). There is a general consensus that poverty is multidimensional (Van der Walt, 2004: 5) and that poverty is not just a problem of low incomes but deprivation with respect to a variety of basic needs which cannot be captured by monetary measures. For this reason, the inclusion of social indicators in arriving at an overall assessment of living standards or poverty levels is important.

Data to measure poverty through money metric means is collected from income and expenditure surveys also known as household and budget surveys. These kind of surveys have their own problems. Besides methodological problems, income/expenditure-income surveys are expensive to conduct and therefore they cannot be held as frequently as policy makers might require. In addition income and expenditure surveys fail to capture other aspects of human well-being, as Blackwood and Lynch (1994) point out, these surveys do not fully capture a household's (or individual's) command over goods and services. Besides these shortcomings, other problem facing developing countries in monitoring poverty reduction is lack of appropriate and recent data. Relying on income and expenditure surveys alone is definitely not enough for the reasons mentioned above. Alternative sources of data do exist and these can produce information that can be used to measure poverty more directly through its many dimensions, other than indirectly through a single indicator that serves as a proxy for actual poverty such as consumption or income (Van de Walt, 2004). These alternative approaches though not very accurate, may be appropriate in the context of studies whose main purpose is not an analysis of poverty like the population and housing census (Mturi *et.al.*: 2003). Examples of these alternative non-monetary sources are household based surveys like the Demographic and Health Surveys which are held regularier and include questions on non-monetary indicators that can be used to measure and analyse poverty. The Population and Housing census, though expensive and less regular, is another source of such

information that can be used to supplement income – expenditure data for poverty measurement and analysis..

## **1.2 An Overview of Poverty Measurement and Analysis in Tanzania**

As part of the Poverty Reduction Strategy a comprehensive monitoring system was introduced in the country to ensure timely availability of reliable information. Within the Poverty Monitoring System, The Research and Analysis Working Group is responsible for setting the research agenda and coordinating analytical work aimed at informing policy decisions related to the Poverty Reduction Strategy. Members of this group come from different Government Ministries/Agencies, Research Institutions, Non-Government and Community-based Organizations. In 2000/2001 the National Bureau of Statistics (NBS) conducted a household and budget survey, and poverty lines were developed as part of the analysis. Results of the survey indicated among other things that there was a small fall in income poverty of about three percentage points over the decade and that 36 percent of Tanzanians were below the basic needs poverty line and 19 percent below the food poverty line (National Bureau of Statistics, 2002: XXIII).

The Group however, understands the limitations of these money metric or nutritional methods and therefore encourages the use of alternative ways to analyse/measure poverty or to supplement those money metric indicators. The Group encourages the inclusion of ‘poverty module’ questions in household based surveys with the aim that the information collected will be used in poverty measurement and analysis. Following this advice, the 2002 Population and Housing Census included questions on housing conditions and ownership of essential assets with a view of using this information as proxy indicators of poverty.

The Group has also coordinated several surveys and research projects on poverty after the 2000/2001 Household and Budget Survey. One Demographic Health Survey and HIV/AIDS Prevalence Indicator Survey has been conducted, producing estimates down to the regional levels. These surveys, just like the census, contain information that can be used as proxy indicators of poverty. In 2002/2003 the Group coordinated a Participatory Poverty Assessment in the country with the main objective of presenting the big picture indicating what vulnerability is, how it affects people’s lives and what

is being done – and could be done better – to lessen its impact (The United Republic of Tanzania, 2004: 4). Participatory Poverty Assessment was necessary because it was agreed that although Household and Budget Surveys and sector-based Management System are powerful examples of data gathering tools that help monitor progress towards poverty reduction and service delivery targets, they fail to identify the reasons why Tanzania is ahead of schedule in some cases and behind in others (The United Republic of Tanzania, 2004: 4).

In an effort to include other human welfare indicators in explaining poverty, in 2002 the Group produced the first Human Development Report. This 2002 report presented an overview of the status of the main poverty indicators, their magnitudes and trends, and detailed analysis of various aspects of poverty and vulnerability. Due to the lack of data not all Poverty Reduction Strategy indicators were included (United Republic of Tanzania, 2002: VI). Data for this report were mainly from the 2000/01 Household Budget Survey, the 2000/01 Integrated Labour Force Survey, Demographic and Health and administrative data from sector Ministries like Ministry for Education and Culture and Ministry of Health.

The second Human Development Report was produced in 2003. Like the first one, this one also gave an overview of the status of poverty in the country and the second part of the report analysed topics of vulnerability, benefit incidence, governance and agriculture (United Republic of Tanzania, 2003: XIII). Sources of information were almost similar with the 2002 report. Although Population and Housing Census was held in August 2002, and contained information that can be used to monitor Poverty Reduction Strategy indicators, for some reason this has not been done. At the moment a poverty mapping project involving The World Bank and other stakeholders in the country is going on. The project is trying to combine the 2000/2001 Household and Budget Survey and the 2000/2001 Population and Housing Census to produce a poverty map for Tanzania.

In 1999, the 2000 UN Millennium Summit led to the adoption of the Millennium Declaration and the MDGs, by which the international community could measure progress on key dimensions of development. A framework of eight goals, 18 targets and 48 indicators to measure progress towards the Millennium Development goals

was adopted by a consensus of experts from the United Nations Secretariat and the IMF, OECD and the World Bank. Although the MDGs are global, their implementation must occur at the country level, through country-owned and led development strategies that respond to local conditions and priorities (IMF, 2004: 11). The poverty monitoring group in Tanzania has revised the list poverty monitoring indicators in response to the monitoring requirements of Poverty Reduction Budget Support (PRBS), Poverty Reduction Support Credit (PRSC) and *Millennium Development Goals* (MDGs). The indicators have been revised and supplemented in preference to establishing an additional, parallel monitoring mechanism (United Republic of Tanzania, 2004: 12). The focus of poverty reduction strategy/MDG indicators and the Poverty and Human Development Report is to assess whether welfare has improved rather than to report on progress in implementing the policies. Appendix 1 shows the revised indicators and targets for those indicators.

### **1.3 Organization of the Study**

The study is organized into five chapters. The first chapter is the introduction. This chapter explains the problem statement and main objective of the study. It also gives a brief overview of poverty measurement and analysis in Tanzania. The second chapter is a literature review in which concepts and definitions are explored in detail. Different approaches to measuring poverty are also explained, giving advantages and disadvantages of each approach. Chapter three is about the source of data used in this study. The chapter explains briefly the methodology, coverage and limitations of the 2000/01 Household and Budget Survey and the 2002 Population and Housing Census. Chapter four discusses the poverty profile of Tanzania based on human capabilities. The profile gives the socio-economic conditions based mainly on the information collected from the 2002 Population and Housing census. Indicators included are those that appear in the country's poverty monitoring master plan that was released in 2001. The indicators are education and literacy, housing characteristics and access to water and electricity. Chapter five is about the use of ownership of assets as a proxy for measuring household welfare. The chapter explains the theory behind the method giving its advantages and disadvantages. Steps in constructing the index are also explained and the results obtained are compared with results from household and budget survey. Analysis of data was done by the use of SPSS and Excel programs.

Arcview software was also used to present some of the findings in form of maps.  
Chapter six gives conclusion and makes recommendations.



## CHAPTER 2

### POVERTY: DEFINITION AND MEASUREMENT

#### 2.1 Introduction

This chapter explains in detail the meaning of poverty and how it is measured. The chapter is organized into nine sections. The second section is about the definition of poverty from the narrower perception of income/expenditure alone to the broader definition, which includes human dignity and freedom. Section three explains in detail how poverty is measured. The section elaborates the meaning of absolute and relative poverty and their measurements. Section four is about the other category of poverty measures – composite measures. Specifically the study looks at the most commonly used measures developed by United Nations Development Programme, which are the Human Development Index and the Human Poverty Index. Section five looks at the capability and asset approach as an alternative way of measuring poverty. Section six is about the two development indices developed by Statistics South Africa, explaining their usefulness for planning purposes. Section seven once again looks at other non-monetary measures of poverty. Section eight introduces the Household Asset Index as a proxy indicator of poverty. (The index is explained in Chapter five). Section nine is the conclusion.

#### 2.2 Defining Poverty

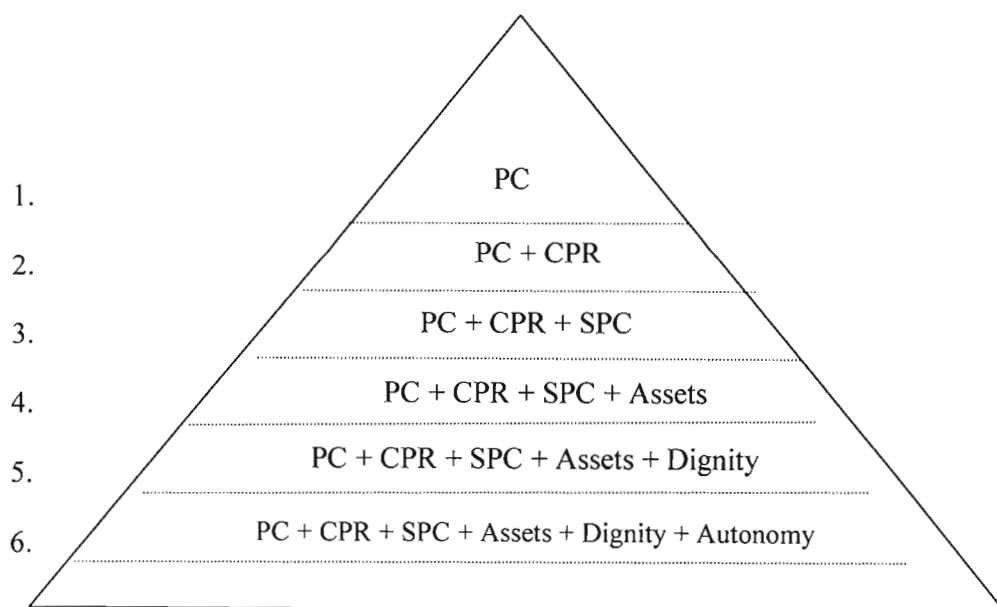
A narrow definition is often adopted by economists and policy analysts who have focused on money-metric measures of poverty, based on the assumption that a person's or household's material standard of living largely determines their well-being (Ceema and Falkingham, 2001). This definition of poverty is market based as it considers command over market purchased goods. For Lipton and Ravallion, 'poverty' exists when one or more persons fall short of economic welfare deemed to constitute a reasonable minimum (Lipton and Ravallion, 1995: 2553). But, as May points out, this definition requires more information on how basic needs are defined and by whom, what is an 'acceptable' minimal standard of living and who determines what is acceptable (May, 2000: 25).

According to Boltvinik (undated:1) the term poverty in daily use implies a comparison between conditions of person, family or human group, and the perception of the one who speaks or writes, about what is necessary to sustain life. The broad definition of poverty does not only focus on command over market-purchased goods,

but includes other dimensions of living standards such as longevity, literacy and healthiness, vulnerability, and powerlessness and lack of voice (Kanbur and Squire, 1999).

Figure 2.1 below illustrates a pyramid of poverty concepts as described by Baulch in 1996. The broadening definition of poverty is represented by a pyramid where income (consumption) is the only dimension at the top, gradually expanding to include other aspects of well being as one moves towards the base of the pyramid. The pyramid demonstrates the usual understanding of poverty such as income/consumption on line 1, 2, and 3 while the concept of vulnerability has been captured on line 4, which includes assets of the poor (such as human, physical, social, financial, and natural capital). The accumulation of dignity and autonomy on line 5 and 6 points to a broader definition of poverty including people's freedom from the necessity to perform activities involving labour and subservience and their ability to choose self-fulfilling and satisfying life styles. The introduction of autonomy on line 6 also includes a broader focus on the civil and political rights of the poor. Thus a full picture of poverty within a society needs to address all faces of human deprivation, which the conventional definitions and statistical measures of poverty often overlook. (Alam, 2004).

**Figure 2.1: A Pyramid of Poverty Concepts**



*Source: Baulch, 1996. Note: PC = private consumption; CPR = common property resources; SPC = state provided commodities*

The United Nations Development Programme in its 1997 Human Development Report sees poverty as denial of opportunities and choices that are most basic to human development to lead a long, healthy, creative life and enjoying a decent standard of living, freedom, self-respect and the respect of others (UNDP, 1997: 15).

From an income perspective a person is poor if and only if, her or his income level is below the defined poverty line. This is done by measuring the resources that a household commands, and comparing the magnitude and composition of these resources with the resources requirement to meet the set of basic needs (Boltvinik, undated: 4). The basic needs perspective treats poverty as deprivation of material requirement for minimally acceptable fulfilment of human needs including food. Poverty is thus characterized by the failure of individuals, households or entire communities to command sufficient resources to satisfy their basic needs. While with the capability perspective poverty is linked with the absence of some basic capabilities to function – a person lacking the opportunity to achieve some minimally acceptable levels of this functioning (UNDP, 1997: 16).

Another way of trying to understand what poverty means is to ask individuals to define poverty to get an idea what represents poverty. This is what is done in participatory poverty assessment (PPA). A PPA is a participatory research process that seeks to understand poverty from the perspective of a range of stakeholders and to directly involve them in planning follow-up action (Narayan, 2000: 14). The most important stakeholders involved in the research process are the poor. The South African Participatory Poverty Assessment Survey found that poverty definitions given by the poor differ from those given by the non-poor (May, 2000). The non-poor see poverty as lack of income while the poor associate poverty with isolation from the community, lack of security, low wages, lack of employment opportunities, poor nutrition, poor access to services, having many children, poor education opportunities and misuse of resources. This is similar to what was observed in the Tanzanian PPA in 2002/3. In this study, participants voiced different ideas about poverty that reflect their gender, age, culture, livelihood and life experiences (United Republic of Tanzania, 2004: 15). From that survey poverty could be described as ‘.....a situation in which households are placed below a socially defined minimum level of well being, usually manifest in hunger, sickness, powerlessness, illiteracy etc’ (United Republic of Tanzania,

2002). In a Ugandan PPA, poverty was also defined in both material and non-material forms and viewed as 'complex, multidimensional, cyclical, seasonal and context-specific problems (May, 2000: 26). In a Kenyan PPA in 1997 when a poor was asked what was poverty he simply said:

*'Don't ask me what poverty is because you have met it outside my house. Look at the house and count the number of holes. Look at my utensils and the clothes that I am wearing. Look at everything and write what you see. What you see is Poverty'.*

It is therefore not easy to get a precise definition of poverty that will suit every situation. This is clearly expressed by the definition of poverty given by the World Bank (World Bank, cited in van der Walt, 2000: 4):

*'Poverty is hunger. Poverty is lack of shelter. Poverty is being sick and not being able to see a doctor. Poverty is not being able to go to school and not knowing how to read. Poverty is not having a job, is fear for the future, living one day at a time. Poverty is losing a child to illness brought about by unclean water. Poverty is powerlessness, lack of representation and freedom.'*

Although thinking about has evolved since the turn of the last century, it is interesting to note that the definition of what poverty is has changed little over the last century, as the following definition by Godard in 1892 (Godard, cited in van der Walt, 2000:4) clearly indicates:

*'Roughly, we may define poverty as "An insufficiency of necessities"; or more fully, as "An insufficient supply of those things which are requisite for an individual to maintain himself and those dependent upon him in health and vigour." And the degree of poverty will obviously be determined by the extent of the insufficiency. Of course, this leads to the further question as to what things are requisite: and it must at once be stated that there is no sharply defined line between necessities and unnecessaries... Obviously, however, an adequate supply of wholesome food and suitable clothing, and a sanitary dwelling, with sufficient sleeping apartments, are amongst the first requisites. To these must be added the means of obtaining some amount of education. Recreation also, ...and leisure to enjoy it ... And freedom....*

## **2.3 Poverty Measurement**

Since it is not possible to give one definition of poverty, it is also not possible to have a single satisfactory measure of poverty. However, besides this difficult, poverty measurement is necessary as it helps in the construction of the poverty profile. Poverty profiles summarize poverty related information and attempt to identify the poor, in terms of where they live, the main characteristics of their poverty and why are they poor (Lok-Dessallien, undated). Poverty measurement also helps to develop indices that can be used to plan services within funding allocation, and to act as baseline information against which to monitor changes, as and when new policies are introduced and put into operation (Statistics South Africa, 2000: 81).

The biggest problem one encounters when trying to measure poverty or living standards in general is the lack of unique a measurement yardstick. Can money be adopted as the sole measuring yardstick in the study of poverty? This is a difficult question but in many countries, this is the official method for measuring poverty and the one most frequently used and it is the method promoted by the World Bank (Boltvik, undated: 5).

Poverty measurements methodologies can be classified according to whether or not they rely entirely on one variable (money or nutrition) as the yardstick. This divides the field into unidimensional and multidimensional methodologies (Boltvinik, undated). Poverty measurements can also be classified as absolute or relative.

### **2.3.1 Absolute and Relative Poverty**

With absolute poverty, the poor are materially deprived to the extent that their survival is at stake (May, 2000: 24). The Copenhagen Declaration defines absolute poverty as 'a condition characterised by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to social services. (United Nations, 1995). Absolute measures of poverty normally consider only one aspect or dimension of poverty, i.e. they are uni-dimensional.

On the other hand relative poverty is based on a comparison of poor people with others in that society. Its measure therefore, defines the segment of the population that

is poor in relation to the income of the general population (Blackwood and Lynch, 1994: 573). With this approach since poverty is not determined by the poverty line, every society with the exception of those where everyone receives exactly the same has poverty.

### 2.3.2 Measurement of Absolute and Relative Poverty

The most common measures of absolute poverty are the poverty rate, also called the headcount ratio, the poverty gap or poverty ratio, and an index measuring the severity or intensity of poverty.

According to Sen (1976), a good poverty measure must have the following attributes:

- *The focus axiom*: Poverty measures can only depend on the income of the poor.
- *Monotonicity axiom*: Reduction in income of any poor individual must increase the poverty measures.
- *Transfer axiom*: A transfer of income from a poor individual to a richer individual must increase the poverty measure.
- *Proportion of poor axiom*: If the proportion of the population which is poor grows/diminishes the index must rise/fall.
- *Population homogeneity axiom*: If two or more identical populations are pooled, the poverty index should not change.
- *Decomposability axiom*: The poverty index should be a weighted average of the poverty indices, applied to specific subgroups, within the population (with weights equal to the population share).

Besides the attributes mentioned above, a good poverty index must be easily interpretable and understood. This is the reason why an index like poverty severity is rarely used in public debate, though theoretically and statistically it is more sound than the poverty rate and poverty gap.

The poverty rate or the headcount ratio measures the number (or percentage) of the population that falls below the poverty line.

The rate is expressed as follows:

$$H = q/n$$

Where:  $H$  = poverty headcount

$q$  = number of people below the poverty line

$n$  = total number of people in the population

A major advantage of the headcount is that it is easy to calculate, understand and explain. The rate, however has come under several criticisms. For example, Sen (1976) criticized the poverty rate as insensitive to the extent of the shortfall of the poor's income relative to the poverty line. Consider the following examples: if every poor family's income is cut by half,  $H$  remains unchanged. Take from a very poor person and give not to a not very poor person,  $H$  also does not change. Take from a very poor person and give and give to an almost not poor person,  $H$  goes down! These examples imply that  $H$  (poverty headcount) is insensitive to the distribution among the poor. The measure does not indicate the extent of immiseration of the poor. In other words the measure does not satisfy the monotonicity axiom which requires that a reduction in income of a person below the poverty line must increase the poverty index.

The poverty gap or poverty ratio is the aggregate shortfall of the income of the poor from the poverty line, i.e. the total amount or income necessary to lift the poor to the poverty line. The poverty gap is often expressed as a percentage or ratio of the poverty line, where the average poverty gap per unit is expressed as a percentage of the poverty line. In other words, it measures the amount of money it would take to raise the income of the average poor person up to the poverty line. The poverty gap can be expressed as:

$$I = z - \mu$$

Where:

$I$  = amount of money required to raise the average of the average poor person up to the poverty line.

$z$  = poverty line

$\mu$  = average income of the poor

In 1981, Foster, Greer and Thorbecke introduced the class poverty measure (FGT) which is widely used and which captures the incidence (how many), the intensity

(how poor) and inequality (how unequal) (Blackwood and Lynch, 1994: 571). The class is defined as follows:

$$P(\alpha) = \frac{1}{N} \sum_{i=1}^k \left( \frac{z - y_i}{z} \right)^\alpha$$

Where  $y_i$  is the income of individual  $i$ ;  $z$  is poverty line;  $N$  is total population,  $k$  is the number of poor people and  $\alpha$  is a parameter which represents the degree of aversion to inequality among the poor.

If  $\alpha=0$   $P_0 = \frac{k}{N}$ , the Headcount Index (Incidence): the proportion of people below the poverty line.

If  $\alpha=1$   $P_1 = \frac{1}{N} \sum_{i=1}^k \frac{z - y_i}{z}$ , the Poverty Gap Index (Intensity) which is the average shortfall of the poor's income from the poverty line, averaged over the whole population.  $P_1 z$  gives us the per capita cost of eliminating poverty (ignoring incentive effects, inefficiency, etc).

If  $\alpha=2$   $P_2 = \frac{1}{N} \sum_{i=1}^k \left( \frac{z - y_i}{z} \right)^2$ , the Severity Index, sometimes Squared Poverty Gap or just FGT2 (Inequality). This weights incomes below the poverty line convexly and so captures the inequality of incomes among the poor. Incomes furthest from the poverty line carry more weight.

The above formula indicates that the poverty gap is equal to the headcount times the average income shortfall. Therefore this measure satisfies only two attributes of a good poverty index measure: the focus and monotonicity, but not the others. The major weakness of the index is that it does not take into account the distribution of income among the poor (Blackwood and Lynch, 1994: 571).

If ' $\alpha$ ' is assigned a value greater than 1, income distribution becomes more important and the measure now is called a poverty severity index. This measure is sensitive to the distribution among the poor as more weight is given to the poorest below the poverty threshold. The poverty severity index corresponds to the squared average distance of income of the poor from the poverty line, hence gives more weight to the poorest of the poor in the population.



One of the most common used relative measure of poverty is the average income of a specific percentage of the population at the lowest end of the income spectrum. For example the average income of the poorest 10, 20 or 40 percent of the population. The percentage of the population considered relatively poor is arbitrarily determined, but once established the percentage is used continuously.

A second relative measure which is not commonly used defines the number of people (or proportion of the population) whose income is less than or equal to the predetermined percentage of the mean income. For example the poor can be defined as those who have 50 percent or less of the mean income.

A major disadvantage of these measures is that they do not show the well-being of the 'poor'. Since there is no discreet measure, a person or a household may be relatively poor but absolutely poor and vice versa (Blackwood and Lynch, 1994: 572). These measures are not suitable for policy makers as it is not clear what a change in relative poverty really means. Note that the expenditure based food-basket adjusted for non-food expenditures can have a relativist aspect to it. The non-food component represents additional items deemed essential for the quality of life that is relative to standards of the society in which poverty is being measured.

### **2.3.3 The Poverty Line**

The definition of a poverty line has been changing with the changing definition of poverty. For a given standard of living standards, the poverty line is typically defined as the minimum income level required to purchase the socially determined essentials for living (Blackwood and Lynch, 1994:568). The Tanzania National Bureau of Statistics defines the poverty line on the same principles; it defines the poverty line as the minimum expenditure necessary to meet basic human needs (National Bureau of Statistics, 2002: 135). A person or a household living below this line is deemed poor while someone living above the line is considered 'non-poor'. Therefore the most obvious purpose of a poverty line is to distinguish the poor from the non-poor, but the line has other applications as indicated below. Poverty lines are also used to:

- Calculate poverty rates, which are in turn used to monitor and analyse poverty so that policy makers can be informed accordingly.

- Develop a poverty profile, which describes the characteristics of those in poverty. The profile also identifies correlates of poverty, which can be used by policy makers to reach the poor.
- In some countries a poverty line serve as a reference income or expenditure level to which state transfers are linked.
- A poverty line plays a political role by helping to maintain poverty as focus of public attention.

With absolute measures of poverty, the poor are defined as all those individuals or households who fall below some critical level required to maintain a minimum standard of living in some dimension or for some indicator of poverty (Van der Walt, 2004: 7). This dimension or indicator is assumed to be a good proxy for actual poverty.

The relative poverty line is simply determined from a percentage cut-off point in the welfare distribution, such as income (Lanjouw, 2000: 2). Often the relative poverty line is set at a percentage of median/mean income. Relative poverty lines make most sense where absolute deprivation is not a social norm. However even in societies where the majority of the people live in absolute poverty relative rates can still provide useful information concerning the characteristics of the poor. The relative poverty line has two disadvantages, firstly it is not very useful for poverty monitoring, because there is always a certain bottom percentage of the population, even if living standards for the whole population have gone up with time. Secondly relative poverty line does not allow for comparison of poverty across regions and lastly line is subjective as it is not clear why poverty should be defined in terms of one percentage point instead of another (Lanjouw, 2000: 3).

An absolute poverty line on the other hand, is clearly linked to a specific welfare level. This kind of poverty line could be based on some minimum wage level, the cost of a basket of goods considered to be essential to maintain a minimum standard of living, or, in the case of nourishment, the minimum calories and vitamins necessary for healthy living, or any other basis the researcher chooses (Van der Walt, 2004: 8). The main problem with the absolute poverty line lies in defining an adequate minimum standard of living. An adequate minimum may vary across regions or countries and over time, and so will energy intake and patterns of consumption. Climatic differences also generate different needs, but also within countries

individuals vary in their physical requirements (Ceema and Falkingham, 2001). That is why it is questionable whether an 'international' poverty line of \$1 a day is really practical across both time and space. Falkingham and Ceema (2001) argue that although international poverty lines allow easy comparison of poverty across countries, they should be used as a supplement to rather than a replacement for the national poverty lines.

These shortcomings of the international poverty line are also shared by Reddy and Pogge who argue that the World Bank approach to estimating the extent, distribution and trend of global income poverty is neither meaningful nor reliable (Reddy and Pogge: 2005). They observe that '*...The Bank uses arbitrary international poverty line that is not adequately anchored in any specification of real requirements of human being*' (Reddy and Pogge, 2005: 1).

Reddy and Pogge (2005) propose an alternative procedure which focuses not on whether the income/consumption of poor people is sufficient in relation to an abstract international poverty line, but rather on whether they are sufficient to achieve a set of basic needs. They propose a procedure which would involve constructing poverty lines in each country that possesses *common* achievement interpretation. Each poverty line would refer to the local cost requirements of achieving a specific set of ends and reflect the cost of purchasing commodities containing relevant characteristics that enable individuals to achieve the desired ends. In effect, the proposed approach would do away with an International Poverty Line, by focusing instead on a common poverty concept to be applied in all countries. If this procedure is adopted, it would also eliminate the need for Purchasing Power Parities (which are central to the existing money-metric approach) and avoid the many problems associated with these (Reddy and Pogge, 2005).

There are various ways of setting an absolute poverty line. For developing countries, the most important component of an absolute poverty line is generally the food expenditure necessary to attain some recommended food energy intake. A certain amount of non-food expenditure is added to get the final poverty line (Lipton and Ravallion, 1993: 2576). The process involves two main steps. Step one is choosing a minimum food basket to obtain a food poverty line and the second step is to add to the food poverty line an essential food non-food consumption.

Two common approaches are used in setting up the food poverty line: the least cost method and the expenditure approach. Although the two approaches are different, in practice setting a food poverty line involves a blending of the two (Lanjouw, 2000: 5). In both approaches decisions must be made about the minimum basket of goods required to 'survive' or have a decent standard of living.

The least-cost food poverty line is obtained by selecting basket of food items, which are plausibly consumed in a given setting and then calculating which basket yields the specified caloric minimum at the lowest cost, given the prevailing prices. The cost of this basket defines the food poverty line (Lanjouw, 2000: 5). The major advantage of this approach is that it does not require detailed information on household consumption. However, the approach has two shortcomings. Firstly, people have a strong preference regarding food and therefore this approach will almost certainly not accord with any person's actual eating habit. Secondly, the process of determining the least cost basket can become a complicated exercise.

On the other hand an expenditure-based food poverty line does not start with the costs of various food items, but starts with by examining the actual food consumption patterns of a segment of the population (Lanjouw, 2000: 6). Foods consumed by this segment are included in the basket, weighted by expenditure shares, and the quantities are then set so as to reach the minimum calorie level. This is the most commonly used method of constructing a food poverty line although it requires detailed household data on food consumption, which measures not only food expenditure but also quantities consumed. To avoid the problems inherent in the two approaches some important decisions have to be made. For example it would be unreasonable to set a food poverty line based on the cheapest possible basket – a diet of the staple that provides the cheapest calories – since other nutrients are also essential for survival and choosing the items to be included in the basket can be very arbitrary.

People or households that can afford basic food requirements but lack the resources needed to purchase basic clothing and shelter, for example would also be considered poor. There is a general agreement that minimum non-food items should be added to obtain the final poverty line, but there is less agreement about which items should be included. The first approach has the advantage of simplicity, as it does not require

detailed information about household consumption. All that is required is the list of chosen items and their prices. However the method is arbitrary as there is no objective standard for choosing the items to be included. In some cases, non-food items may be specified, but in most cases a minimum level of non-food expenditure is accommodated by scaling up the food poverty line by some specified multiple.

Scaling up the food poverty line is commonly done by two methods. The most commonly used method is to determine the average level of total expenditure of those people whose food expenditures are just equal to the food poverty line. This level of total expenditure is then used as the final poverty line. An alternative method suggested by Ravallion (Ravallion 1994 cited in Lanjouw, 2000: 9) is to determine the non-food expenditure of people whose total expenditure is equal to the poverty line. This amount is then added to the food poverty line to obtain a final poverty line.

One of the common reasons for setting a poverty line is to calculate poverty rates, which can be used to monitor change over time or differences across groups or regions. If this is the one of the purposes then welfare must be fixed across the group being compared. For example, if comparison is to be made between two different years and if there has been inflation between those years then it would be absurd to use the same nominal poverty line for both years. For comparison to make any sense, scaling must be done. Scaling is multiplying one or more group's welfare indicators by a constant so as to have them in the same units. Scaling can be done in two ways, either the poverty line can be adjusted, or, equivalently, the poverty line can be held constant and the welfare indicators which are being compared to the poverty line be adjusted (Lanjouw, 2000: 11).

In order to compare different households, one must make adjustments for different sizes and compositions of households. This is done on the recognition that the need for expenditure differs between children, working age adults and the elderly. The choice of 'equivalence scale', the term given to the adjustment factor, may have major implications both for the overall level of measured poverty and for which groups in the population are shown to suffer most.

The simplest (and commonest) approach is to ignore differences in composition and to divide total expenditure by the number of persons in the household. This *per capita*

adjustment assumes that there are no 'economies of scale' associated with household size. Thus a household of four persons is assumed to have twice the needs of a household of two (Ceema and Falkingham, 2001).

A widely accepted way of taking these economies into account is to adjust total expenditure using the following formula:

Adjusted expenditure = Total expenditure / [Household size A].

Where 'A' is a number between 0 and 1. For example, with 'A' equal to 0.5 (strong economies of scale), a household of four persons is assumed to have needs that are twice those of a one-person household, whereas with the per capita adjustment (A = 1.0, no economies of scale) their needs would be four times as high. Where there are moderate economies of scale, and A is equal to 0.75, it is assumed that a four person household has needs that are 2.8 times those of the one-person household (Ceema and Falkingham, 2001).

Although it is clear that household members do not require the same amount of the household's total resources in order to reach the same household welfare level and that household resources are not allocated equally among members, in most cases allocation is done by the simple per capita convention. However, there are alternative equivalence scales which, allocates household expenditure to household members of different ages and sex (Lanjouw, 2000: 13).

From the steps described above, it is clear that setting poverty lines incorporates normative assumptions and elements of arbitrariness which means that one should be careful about how the choice of a line may affect poverty comparison. Poverty lines are based on a discreet income level. Those falling below the poverty line are considered poor. But poverty does not end abruptly by giving few rands or shillings so that a poor household can move beyond the poverty line. Poverty should be conceived as a continuous function of varying gradations (Blackwood and Lynch, 1994: 569). Despite its shortcomings, the poverty line is still commonly used in poverty analysis mainly because of its simplicity.

## **2.4 Composite Measures of Poverty**

In the preceding sections we have seen a number of single indicators that can be used to measure the extent to which the population is experiencing poverty. These all focus on one area - mostly income and nutrition - but they can also focus on other areas like health and education. Theoretical considerations and the recognition that monetary measures fail to capture other important aspects of individual well-being, such as community resources, social relations, culture, personal security and the natural environment, have resulted in the development of a set of complementary indicators which aim to capture human capabilities (Sen, 1985, 1987; McKinley 1997; Micklewright and Stewart, 1999 cited in Blackwood and Lynch, 1994). To supplement these mostly money based measures a number of composite indicators have been developed that allow several indicators to be aggregated together to give a more general measure of poverty and living standards.

### **2.4.1 The Human Development Index (HDI)**

The Human Development Index is one of the commonest index that was produced by the United Nations Development Programme (UNDP). The Human Development Index measures the progress of the country in achieving development. The HDI measures the average achievement in a country in three basic dimensions of human development (UNDP, 1997:259):

- A long and healthy life, as measured by life expectancy at birth.
- Knowledge, as measured by the adult literacy (with two-thirds weight) and the combined primary, secondary and tertiary gross enrolment ratio (with one-third weight).
- A decent standard of living, as measured by GDP per capita (PPP US\$)

The index varies from 0 to 1 depending on the level of human development in the country. Countries with an HDI below 0.5 are classified as having low human development; countries with an HDI ranging from 0.5 to 0.79 are classified as medium while countries with an HDI ranging from 0.8 to 1 are classified as having high human development.

When the HDI was unveiled in 1990, the methodology for calculating it was slightly different from the way it is calculated today. In 1990 construction involved three major steps:

- To define a measure of deprivation that a country suffers in each of the three basic variables – life expectancy, literacy and (the log) GDP per capita. A maximum and a minimum values was determined for each of the three variables given the actual values. The deprivation measure then places a country in the range of zero to one as defined by the difference between the maximum and the minimum. Thus deprivation index, was calculated as:

$$\text{Deprivation Index} = \frac{\text{Maximum} - \text{Actual}}{\text{Maximum} - \text{Minimum}}$$

- The second step involved defining an average deprivation indicator. This was done by taking a simple average of the three indicators.
- The third step was to measure the HDI as one minus the average deprivation index (from step 2)

The HDI now is based on slightly different variables. Educational attainment is now based on adult illiteracy and the combined gross primary, secondary and tertiary enrolment. Minimum and maximum have been established for the calculation of HDI as follows:

- Life expectancy at birth: 25 and 85 years.
- Adult illiteracy rate: 0 percent and 100 percent.
- Combined gross enrolment ratio: 0 percent and 100 percent.
- Real GDP per capita (PPP\$): \$100 and \$40,000.

A performance in each dimension for each variable and which lies between 0 and 1 is calculated first by applying the following formula:

$$\text{Dimension index} = \frac{\text{Actual value} - \text{minimum value}}{\text{Maximum value} - \text{minimum value}}$$

The HDI is then calculated as a simple average of the dimensions indices.

Although the HDI is widely used it has been criticized for a number of reasons. When the HDI was unveiled in 1990 Human Development Report, the UNDP recognized the difficult in measuring human development and hoped that the HDI would open the debate that would result in refinements of the analytical framework and the empirical



inputs over time (UNDP, 1990: iii). Shortcomings of the HDI lie mostly in its measurement and the assumptions made in its calculation.

The other criticism of the index is whether the three variables are enough to measure human development and whether, they are really good measures. Critics of the index also ask if the index captures policy changes and why it does not say anything about inequality. Despite these shortcomings, the HDI has become one of the best known and most used indicator of human development.

#### **2.4.2 Human Poverty Index (HPI)**

The Human Poverty Indicator (HPI) is also one of the common composite measures of poverty. Rather than measure poverty by income alone, the HPI uses indicators of the most basic dimensions of deprivation: a short life, lack of basic education and lack of access to public and private resources. Short life is measured by the percentage of people who die before age 40, lack of education by the percentage of adults who are illiterate, and living conditions by a combination of the percentage of the population with access to health services, the percentage of the population with access to safe water, and the percentage of malnourished children under five. There are two HPI indices most commonly used. HPI-1 is a measure of absolute poverty used in Less Developed Countries and HPI-2 is a measure of relative poverty used in More Developed Countries. HPI -1 is measured using the variables mentioned above.

The HPI-1 measures poverty in Less Developed Countries. The variables used are those specified above.

Because human deprivation varies with the social and economic conditions of a community, the HPI-2 index has been devised for industrial countries. It focuses on deprivation in the same three dimensions as HPI-1, although with an adjusted set of criteria and one additional one - social exclusion measured by low incomes and long term unemployment. The variables for HPI-2 are: the percentage of people likely to die before age 60, the percentage of people whose ability to read and write is far from adequate, the proportion of people with disposable incomes of less than 50% of the median and the proportion of long-term unemployed (12 months or more).

The HPI provides a measure of the incidence of human poverty in a country or region, reflecting the proportion of the population that is affected by the various forms of deficiency included in the measure. It can also serve a useful function as a planning tool for identifying areas of concentrated poverty within a country.

### 2.4.3 The Sen Index

The Sen Index measures two aspects of consumption based poverty, absolute deprivation and inequality. This was the first measure to overcome the shortcomings that were associated with the earlier measure (Blackwood and Lynch, 1994: 571). The measure reflects the number of the poor, the extent of immiseration, and the distribution of income among the poor, which could not be reflected by the measures earlier mentioned. In other words the index satisfies the focus, the monotonicity and the weak transfer axioms.

The Sen Index is expressed as follows:

$$S = H [I + (1 - I) G_p]$$

Where:

S = Sen poverty index

$I = \sum(z - y_i/qz)$ ; the average income shortfall as a percentage of the poverty line.

$y_i$  = income the  $i^{\text{th}}$  poor household

$z$  = poverty line

$qz$  = number of incomes with households  $< z$

$H = q/n$ ; headcount ratio

$n$  = total number of households

$G_p$  = Gini coefficient among the poor,  $0 \leq G_p \leq 1$  (where 0 correspond with perfect equality (where everyone has the same income) and 1 corresponds with perfect inequality (where one person has all the income, and everyone else has zero income))

The Sen Index is biased towards policies that reduce the number of the poor. It is more sensitive to improvements in headcount than it is to reductions in the income gap or to distribution of income among the poor. According to this index therefore, the most efficient way to reduce poverty is to help first those poor who are close to the poverty line and those far below the poverty line at a later stage. This will be

unacceptable to egalitarians that would prefer to reduce poverty by reducing inequality among the poor. But unlike the headcount, it at least takes such inequalities into account.

## **2.5 Capabilities and Asset Approach**

The 'conventional' 'objective' approach to poverty identifies income/consumption as the best proxy for poverty (Ravallion 1992, cited in Moser, 1995: 22). But the 'subjective' 'participatory' approach reject the above approach as a narrow view as it fails to understand the complex, diverse, local realities in which the poor live (Chambers, 1995 cited in Moser, 1995: 22). Behind the simplified dualism approach to poverty measurement there is a far more complex picture. For example a review of poverty concept by Baulch uses a six level pyramid with private consumption at the pyramid top and private consumption, common property resources, state provided commodities, assets, dignity and autonomy at the pyramid bottom (Baulch, 1996). These conceptual debates have introduced new concepts in poverty measurement such as vulnerability, capabilities and assets.

### **2.5.1 Capability approach**

The capability approach is a concept mainly attributed to Sen and it identifies poverty in terms of the lives people can actually lead and the freedom they do actually have. This approach extends to concept of human poverty by drawing a distinct connection between development, freedom, and deprivation of human capabilities rather than just to income deprivation. Sen (1993, 1998) and others argued that the conventional approach to the measurement of poverty considers material goods and services as an end to the attainment of well-being, while in fact they are also the means towards achieving well being by allowing the individual to function well. In his paper in 1983, *Poor, Relatively Speaking*, Sen asks what the right focus of assessing welfare is. In his opinion, it is not the commodity, nor characteristics, nor utility but something called capability (Sen. 1983: 160). Sen gives the example of a bicycle, which is a *commodity* and has many *characteristics*. Having a bike gives the person the ability to move about in certain way that he may not be able to do without the bike. So the transportation *characteristic of the bike* gives the person the *capability* to move in a certain way. So there is, as it were a sequence from *commodity* (in this case a bike), to *characteristics* (in this case, transportation), to *capability to function* (in this case, the

ability to move), to *utility* (in this case, pleasure from moving). Sen argues that it is the third category – that of capability to function – that comes closest to the notion of standard of living. Capability may further be defined as the substantive freedoms an individual exercises to live a lifestyle she/he deems valuable. Capability approach emphasizes the outcome measures of well being (achievements) as opposed to the monetary approach by which monetary indicators indicate indirect measures of the outcome. The approach poses three main operational issues, namely the definition of these basic capabilities, measurement of these capabilities and aggregation (Kamanou, 2004). Most of the techniques under this approach have led to similar interpretation to minimal essential capabilities as being constituted by health, nutrition and education. In practice measurement is through functioning (e.g. life expectancy, education levels, morbidity etc.). It has been argued that aggregation conceals important information from an analytical and policy perspective, although the need to reduce large number amount of information is also desirable.

### **2.5.2 Asset Approach**

Conventional measures of poverty treat households as suffering from poverty by using criteria based on income, consumption, and nutrition. Households or persons lacking the minimum acceptable levels are considered poor. While these conventional measures may be appropriate for assessing human poverty they ignore the aspect of assets as a measure of welfare. Conventional measures usually treat poverty as a single concept (Reardon and Vosti, 1995: 1495). But as has been mentioned before, poverty is not only lack on income but also lack of the various assets and income flows derived from them. The assets approach in measuring poverty identifies what the poor have, rather than what they do not have, and in so doing focuses on their assets. Asset ownership is closely related to vulnerability, since assets are means of resistance that individuals, households or communities can mobilise and manage in the face of shocks. The more assets people have, the less vulnerable they are, and the less the assets, the greater their vulnerability. Households especially those in rural areas have assets that can be used to generate flows of product and/or cash income (Reardon and Vosti, 1995: 1497). According to Reardon and Vosti (1995) asset components of poverty can be grouped into five categories, and these are: *natural resources*, composed of water, ground cover and its biodiversity, *human resources endowment*, composed of education, health, nutritional status, skills, and number of

people; *on farm resources* (livestock, farmland, pastures, reservoirs, building, equipment); *off-farm resources* and *community-owned resources* such as roads, dams and social institutions. The above assets refer to rural households or communities.

However, although the vulnerability/asset ownership debate has mainly concerned the rural sector, urban poor people are also vulnerable. This has led to the identification of assets the urban poor have in sustaining insecurity. Moser (1995) identifies these into two major groups – tangibles and intangibles. Tangibles include assets such as labor and human capital, and housing, while the intangibles assets include household relations and social capital. These can be summarized as follows:

- Labor: Identified as the most important asset of poor people.
- Human capital: Health status, which determines people's capacity to work, and skills and education, which determine the return for their labor.
- Productive assets: For poor urban households the most important is often housing.
- Household relations: A mechanism for pooling income and sharing consumption.
- Social capital: Reciprocity within communities and between households based on trust deriving from social ties.

## **2.6 Development Index**

Using the information from the 1996 Census Statistics, South Africa developed two development indices, namely the Household Infrastructure Index and the Household Circumstances Index to describe the extent of development of different data in South Africa (Statistics South Africa: 74). Development indices are based on the statistical technique of factor analysis with rotation, which is applied to relevant variables from the census. This statistical technique reduces a large set of variables to a smaller set of components by grouping together those variables which co-vary or which are correlated (Statistics South Africa, 2000: 75).

The indices, once developed for different levels in the country may have many broad uses. The indices can be used to describe the level of development of different administrative areas in the country. They can also be used to plan services within

funding allocations, and to act as baseline information against which to monitor change, as and when new policies are introduced and put into operation. These can be measured at various administrative levels during inter-censal surveys (Statistics South Africa, 2000: 81).

Population censuses are an excellent source of information for developing the indices since the indices can be developed for small administrative areas. This is due to the fact that population census are particularly important for generation of small area statistics like villages and streets which is not easy or possible with other sample surveys.

The Household Infrastructure Index is directly related to improving the quality of life of people by ensuring that their basic needs, like access to clean water, sanitation and basic education, are met. The Circumstances Index, on the other hand is related to giving people more empowerment, for example, through job creation and population development programmes.

## **2.7 Non – Monetary Measures of Poverty**

After all those problems associated with measuring poverty based on income and expenditure data, analysts became concerned with identifying alternative measures of household welfare that are robust but are less data intensive and subject to smaller measurement error (Ceema and Falkingham, 2001). It is also true in developing countries that many aspects of well-being are not acquired by income. These include gifts and other needs which are obtained from common property resources. By using money metric measures, deprivation in these aspects may not be adequately accounted for (May, 2000). Finally, money metric measures reflect inputs to wellbeing rather than outcomes and therefore do not necessarily reveal an improvement or deterioration in quality of life or capabilities (Lipton and Ravallion 1997, cited in May, 2000). This has led to a search for alternative forms of measurement, emphasis being placed on measuring development outcomes directly by focussing on unfulfilled needs or capability shortfalls. Some of the capability poverty measures include:

- **Health and nutrition poverty:** Welfare of the household can be measured by looking at the nutritional status of children as a measure of outcome, as well as

on the incidence of specific diseases or life expectancy for different groups within the population.

- **Education poverty:** Based on the level of literacy in the country a threshold for illiteracy could be set as the 'poverty line'. In countries where literacy is close to universal, one might opt for specific test scores in schools or for years of education as the relevant indicators.
- **Subjective perceptions:** Such measures of poverty are based on questions to households about, their perceived situation, their judgment about minimum standards and poverty rankings in the community. On the basis of the answers, a 'poverty line' could be drawn.
- **Composite indices of wealth:** An alternative to using a single dimension of poverty could be to combine the information on different aspects of poverty. One might want to create a measure, which takes ownership of assets and household characteristics. A major limitation of this measure is that it is not possible to define and set a 'poverty line'. Analysis is through quintiles or other percentiles. One of the common measures in this group is the household asset index which is one of the focuses of this paper.

## **2.8 Household Asset Index**

Conventional approaches of measuring poverty such as the money metric approach, though commonly used are uni-dimensional. This plus other reasons specified above in this chapter have led to alternative ways of measuring poverty and analyzing poverty. One of these approaches is the asset index. DFID (2003) observes that asset approach is important because money metric measures are, data intensive and expensive to collect; only reflect narrow concept of poverty and are often not present in surveys or censuses that contain other outcome measure. With the asset index approach various household durable assets and condition are aggregated into one variable to proxy for household wealth. The socio-economic status therefore of the household is defined in terms of assets or household conditions, rather in terms of income or consumption.

## **2.9 Conclusion**

The chapter has explained in detail the difficulties one is likely to face when defining and measuring poverty. Despite the difficulties in defining poverty, there is a consensus that poverty is multidimensional and involves not only lack of money, but other aspects of human well being as well. However as Kanbur and Squire note this broadening definition does not change significantly who is counted poor (Kanbur and Squire, 1999: 1).

This chapter has looked in detail on how poverty is measured. The common measures of poverty, which, are market based, were explored citing their advantages and disadvantages. Their main advantages being their easy calculation and interpretation, although they fail to measure other aspects of non-monetary poverty. This has led to alternative measures of poverty, which are composite and non-monetary in nature. These include the famous Human Development Indicator, Human Poverty Index and Household Asset Index as a proxy indicator of poverty.



## **CHAPTER 3**

### **SOURCES OF DATA**

#### **3.1 Introduction**

Many sources of data can be used for poverty measurement and analysis. These sources include administrative sources, population censuses, household surveys, living standard measurement surveys and other multi topic surveys. Other sources are demographic and health surveys, employment and labour surveys, expenditure and income (household and budget surveys) and other related quantitative surveys. Qualitative studies like participatory poverty assessment are also good sources of information for poverty analysis. Data for this thesis comes from two main sources: the Tanzania Household and Budget Survey (HBS) that was held in 2000/01 and the Population and Housing Census that was held in 2002.

This chapter briefly explains the methodologies used in the survey and the census. Part one of the chapter explains about the HBS, covering the issues, coverage, limitation and problems associated with these kind of survey and data analysis. Part two is about the census covering almost the same topics like the previous as the HBS.

#### **3.2 2000/01 Household and Budget Survey**

##### **3.2.1 Coverage**

The 2000/2001 survey was designed in such a way as to provide estimates of key poverty measures for each of twenty regions of Tanzania Mainland (National Bureau of Statistics, 2002: 1). If fully implemented, a total of 27,864 households would have been interviewed. The reduction in sample during the survey was implemented by stopping fieldwork in the rural primary sampling units that were not part of the National Master Sample. The final sample then became 22,584 households (National Bureau of Statistics, 2002: 1). For this reason, some indicators could not be produced below national level.

##### **3.2.2 Data Collection**

Two methods are commonly used for data collection in income-expenditure surveys, the recall (retrospective) and the diary method. With the recall method respondents are asked retrospective questions regarding consumption while with the diary method consumption and expenditure are recorded on a daily basis (Pettersson, 2000: 559).

The 2000/01 HBS adopted a mixture of both when collecting consumption/expenditure information. The diary technique was used to record all transactions and consumptions for that household for one calendar month. This was done on regular basis by the interviewers. The recall method was used on purchase of non-food items over the twelve months preceding the survey (National Bureau of Statistics, 2002: 4).

### **3.2.3 The Questionnaire**

Besides expenditure, consumption and expenditure, the HBS also collected information on:

- Household members' education, economic activities and health status.
- Ownership of consumer goods and assets
- Housing structure and materials
- Distance to services and facilities, and
- Food security.

### **3.2.4 Limitations of Household Budget Surveys**

The first limitation of these kinds of survey is associated with the sample. The Household and Budget Survey was held on sample basis, as it would be extremely expensive to cover the whole population. That being the case, this survey, like any other sample survey is likely to be affected by sampling errors. . Sampling errors are those errors arising from sampling procedure used to select the sample. These errors, however, can be evaluated statistically. In general, sampling errors for the 2000/01 were reasonably small for national, urban and rural estimates. The reduction of the sample mentioned above did not introduce any bias into the estimates, though it increased sampling errors (National Bureau of Statistics, 2002: 3).

The second limitation is that of non-sampling errors. Non-sampling errors can be coverage or content errors. Coverage errors are those mistakes made during data collection and data processing. Non-response and dropout are generally higher with these kinds of survey because of fatigue on the part of respondents and respondents also feel that their private lives are being investigated. Content errors are those mistakes made by respondents when conducting interviews or by data entry operators. These mistakes are impossible to avoid completely. Evaluation of the 2000/01 HBS

identified a large number of problems in the data coming from the field (National Bureau of Statistics, 2002: 5). These included consumption unit miscoding, miscoding of transactions, out of range unit prices etc. There was also some evidence of age misreporting. Data validation and editing was needed to clean the information during data processing stage (National Bureau of Statistics, 2002).

Data collection techniques are also source of problems with income and expenditure surveys. The data collection techniques mentioned above have their own disadvantages. The retrospective method is highly affected by recall problem arising from a number of factors. For example, some people may go shopping daily while others do it less frequently. Items may also be subject to greater price fluctuations. All these will definitely lead to underreporting or over reporting of expenditure. Based on data from several countries Scott and Amenuvegbe found recall data are prone to large measurement errors some of which, but not all are random (Scott and Amenuvegbe, 1990 cited in Ceema and Falkingham, 2001). The diary method minimizes the problem of recall, but it has its own problems also. The method will be difficult to administer in countries or areas within a country where illiterate rates are high. Analysis of surveys has also found that poor households are less likely to use diaries and many households that are able to use them in fact do not (Deaton and Gosh, 2000). The fatigue effect is one of the possible reasons for this bearing in mind that the household has to fill the diary for a relatively long period like one calendar month, as was the case in Tanzania in 2000/01.

Besides the problems mentioned above they are also other practical issues associated with collecting income and expenditure information. The first major problem is a measurement resulting from underreporting and recall bias. The problem becomes even bigger when respondents think that information on income may be used for other purposes like tax collection.

Sensitivity on income is also likely to result in under-reporting. Income is a sensitive matter for many households, especially among the well-to-do, arising from suspicion that the information could be used for taxation purposes. Income from all sources must be recorded, which usually is not the case. Calculations on income are further complicated by gifts in cash and in kind, remittances and loans. Experiences from

these surveys support the claim by many people that household income is always under-estimated (Pettersson, 2000: 559).

In most rural areas, home produced foodstuffs account for a significant proportion of the household consumption. The value of such foodstuffs for households who are both producers and consumers is difficult to calculate. A similar problem arises when imputing the value of wage or transfer income when somebody is paid in kind. Valuation of durable goods requires information on prices when they were acquired and depreciation rates which may be difficult to determine. Valuing the imputed benefits of own housing, especially in rural or semi urban areas is another nightmare. Pricing of services is another problem in these surveys. For example how do you price expenditure on water, when it is supplied “free” through public system, when in another area households pay for it?

### **3.3 Food Poverty Line**

There are two common approaches of setting the food poverty line as elaborated in chapter two. Each approach has its advantages and disadvantages and to minimize problems associated with those approaches it was decided in Tanzania that an approach suggested by Ravallion and Bidani (1998) and Ravallion (1998) be adopted. Following this approach, the food poverty line in Tanzania is based on the food basket consumed by the poorest 50 percent of the population (National Bureau of Statistics, 2002: 135).

### **3.4 Basic needs Poverty Line**

The food poverty line was adjusted to allow for non-food consumption to give the basic need poverty line. This was done by calculating the share of expenditure that goes on food on the poorest 25 percent of households. Multiplying the food poverty line by the inverse of this share inflates it to allow for food consumption. The food share was found to be 73 percent.

### **3.5 2002 Population and Housing Census**

A population census contains information on all residents of a country. The census is carried out for all households to obtain basic information on the population, its demographic structure and its localities. Since the census covers the whole population it is costly and most developing countries like Tanzania carry it out once in a decade.

Coverage of the census is universal and as such the information collected is limited. Information on expenditure, income or consumption is generally not included. However, the census usually contains descriptive statistics of the housing stock, access to basic services such as water, electricity, and sanitation; information on education and employment patterns, and population statistics.

The population census, however has advantages over other sample surveys. The first and main advantage lies in its four main features, which are universality, simultaneity, individual enumeration and defined periodicity. The second advantage the censuses have over other sample surveys is that census are particular importance for the generation of small area statistics e.g. villages, streets etc. (UNFPA, 1996). Census data are also an important tool to check how representative other surveys are.

Data for the following chapter comes from the Tanzania Population and Housing Census that was held in 2002. The Census collected a range of information that can be used to estimate the welfare of the households from the national down to lower levels. The census in Tanzania however, like in many developing countries, did not collect information on income or consumption and therefore conventional means of measuring poverty are not possible with the census data. Although the census lacks income/expenditure or consumption information, other information collected can be used to measure and analyse poverty by alternative approaches other than income or expenditure.

### **3.5.1 Enumeration Procedures**

The 2002 Census was the fourth census to be conducted after independence in 1961. The last three were held in 1967, 1978 and 1988. The last census undertaken in August 2002 indicated a total population of 34.6 million people (Central Census Office, 2003).

Enumeration is a procedural activity, whereby the information about people is collected from the primary source. The unit of enumeration in the 2002 census was the person, but for the purpose of social and economic analysis this person was associated with a household and with specific living quarters. A household in the 2002 census was defined as a group of persons who lived together and shared living

expenses. Usually they were husband, wife and children. Other relatives, boarders, visitors and servants were included as members of the household if they were present in the household on the census night (Central Census Office, 2003: 51). The *de facto* approach where a person is enumerated where he/she spent the census night was used as an enumeration procedure. The reference night for the 2002 census was the night of 24/25 August 2002. Therefore a household was enumerated as it was on that particular date.

### **3.5.2 Census Questionnaires**

Two types of questionnaire were used for data collection - the short and the long questionnaire. The short questionnaire covered the whole population and had eight questions. The questions were on household members, sex, disability, citizenship, marital status and survival of parents. The long questionnaire, which covered about 20 percent of the population beside those eight questions from the short questionnaire, it also included extra 29 questions on immigration, education and literacy, economic status and employment, fertility, mortality housing condition and ownership of assets. (Census questionnaire is attached as appendix number 3).

### **3.5.3 Limitations of Census Data**

Census data all over the world have problems. The problems are of two kinds – coverage errors and contents errors. Coverage errors refer to under- or over enumeration, and mistakes made during data collection (measurement errors) and data processing. Content errors refer to response quality of specific questions. These arise from mistakes made by respondents when conducting interviews or by data entry operators. These mistakes are impossible to avoid completely.

Analysis in this paper is based on a total number of 1,228,153 households and the asset index is constructed from ownership of certain durable goods, building materials for the main house, toilet facilities and source of drinking water and availability of electricity. This information comes from the long questionnaire, which was administered on a sample basis. The ultimate sampling unit was the enumeration areas consisting of approximately 400 persons in urban areas and 800 persons in rural areas. The sample was drawn in such a way that estimation could be done down to district levels which are the lowest planning levels for the Government (Central Census Office, 2003: 24). In total 10,264 (about 20 percent) enumeration areas (EAs) were

sampled out the total 50,755 EAs. (Naimani, 2004). That being the case, the responses are likely to be affected by sampling errors, although these errors can be evaluated statistically.

### **3.6 Conclusion**

Many sources of data can be useful for poverty analysis and the evaluation of policy interventions. However each of these sources of has its advantages and disadvantages. No single source is a panacea for the required information at all time. This arises from the fact that the definition poverty is complicated and poverty means different things to different people. The effectiveness of each data source in measuring and analyzing can be increased substantially if different sources are combined. In the following two chapters, two sources of data, household and budget survey and population census are used to explain poverty measurement in Tanzania.

## CHAPTER 4

### POVERTY PROFILE

#### 4.1 Introduction

The main objective of this chapter is to present a country's poverty profile. The profile uses the information collected from the 2002 census to develop a picture of deprivation in 2002, and where possible changes in well being since 1988 census. Information from the 2000/01 Household and Budget Survey is also used to give an indicator of income poverty in the country. The profile covers only the 21 regions on the Mainland. I have not covered the five regions in Zanzibar since the last household and budget survey, which I will refer in this chapter and the following chapter, did not cover Zanzibar.

This chapter is structured as follows. Section two gives the background information on the profile. The section explains briefly the approach used in developing the profile and the choice of indicators to be included. Section three describes the population of Tanzania, highlighting the population size and annual population growth rates. A brief description of poverty levels in the country based on expenditure and percentage of population below the food and basic needs poverty lines is covered in section four. Section five explores the education and literacy indicators, comparing between sexes and location. Sections six and seven examine water/ sanitation and housing conditions respectively. Section eight is about access to electricity and section nine is the conclusion.

#### 4.2 Profiling Poverty

As discussed in chapter 2, a common method of profiling poverty in a society involves first establishing the poverty line. Once established, this line is used in conjunction with specific measures of poverty to develop an appropriate description of destitution in the society. Another approach of comparing relative well-being of predefined group is the poverty dominance approach (Bhorat, *et al*, 2004). With this approach, persons or households are not divided into poor and non-poor by the poverty line, but rather groups are measured against each other in terms of chosen indicators such as income levels or access to certain assets or services. Yet another way of analyzing poverty is to use asset index. An asset index is constructed using



data on ownership of durables and household characteristics. Provided a sufficiently broad class of asset indicator is used, the index should reflect differentiation of living standards across households (Bhorat, *et.al*, 2004).

My choice of indicators is based on a Poverty Monitoring Strategy that was released by the Government of Tanzania in 2001. Indicators in the strategy are related to the Millennium Development Indicators (MDGs) that were adopted in 2000 by the United Nations, which Tanzania ratified (United Republic of Tanzania, 2001: 1). The Master Plan identifies five types of indicators for a poverty monitoring strategy; these are: impact indicators, outcome indicators, proxy indicators, performance and input indicators (United Republic of Tanzania, 2001: 7). The poverty monitoring system emphasizes measurement of impact, outcome and proxy indicators for poverty monitoring, since the other two – output and input indicators – are covered in sector programmes and Public Expenditure Review/Mid Term Expenditure Framework (PER/MTEF) respectively (United Republic of Tanzania, 2001: 7). Out of eleven indicators listed under human capabilities in the Poverty Monitoring Master Plan, eight can be obtained from the census information. I have used those eight outcome indicators to build a profile for the country. I have also included building materials as a measure of modern housing conditions in the profile.

The profile does not include any information on health issues, as these are not covered directly by the census questionnaire in Tanzania. The profile also does not contain information on employment, as it is extremely difficult to obtain this kind of information with a population census. The United Nations observes that given the complexity of definitions, especially with the informal sector it is most likely that the census will yield unreliable results (United Nations, 1997: 90). Data on employment and occupation is best collected in labour or related sample surveys. However, to shed more light on poverty situation in the country, I have included information on mean expenditure per adult equivalence, percentage of population below the food and basic poverty lines by region although the source of data is not the census but rather the 2000/01 Household and Budget Survey. The profile is therefore based on the following indicators:

- Mean Expenditure per adult equivalence

- Percentage of population below the food poverty line
- Percentage of population below the basic needs poverty line
- Girls/boys ratio in primary education
- Girls/boys ratio in secondary schools.
- Transition rate from primary to secondary school
- Net enrolment rates in primary schools
- Gross enrolment rate in primary schools.
- Drop-out rate in primary school
- Literacy rate of population aged 15 years and above (adult literacy).
- Percent of population with access to safe water.
- Percent population living in houses with modern roofs, modern walls, modern floor and electricity

### **4.3 Population of Tanzania**

Tanzania is a union country between Tanzania Mainland (formerly Tanganyika) and the Islands of Zanzibar. Administratively the country is divided into twenty-six regions – 21 on the Mainland and five in Zanzibar, (see map 4.1 below). According to the last census of 2002 the population of Zanzibar was 981,754 persons a contribution of 2.8 percent to the total population of 34,443,603 persons (Central Census Office, 2003).

Table 4.1 below provides data from 1988 and 2002 census data showing the population of Tanzania Mainland by region. The table also shows the population growth rate and the percentage of rural population for the two periods. The table reveals that the population of Tanzania Mainland has been growing at a rate of 2.8 percent increasing from 22,533,758 in 1988 to 33, 416,849 in 2002. The 2002 data shows that the population is unevenly distributed, with the regional share to the total population ranging from 2.4 percent for Lindi to 8.8 percent for Mwanza. The same uneven distribution of population can also be observed for the 1988 census. In 2002 five regions, Mwanza, Shinyanga, Dar es Salaam, Mbeya and Kagera had a population of more than two million per region. Population in these five regions accounted for about 37 percent of the total population. The four regions around Lake Victoria (Kagera, Mwanza, Mara and Shinyanga) contributed to 27.4 percent of the total population although they cover only 13.4 percent of the total land area (Maduhu, 2004). The population of Tanzania is predominantly rural, although there had been a

steady increase in the urban population. The urban population increased from 13.8 percent recorded in 1978 census to 18.8 percent in 1988 to 23.1 percent in 2002. (Kulaba and Mkai, 2005). With the exception of Dar es Salaam, which is a major city in the country, in other regions the rural population was more than 75 percent.

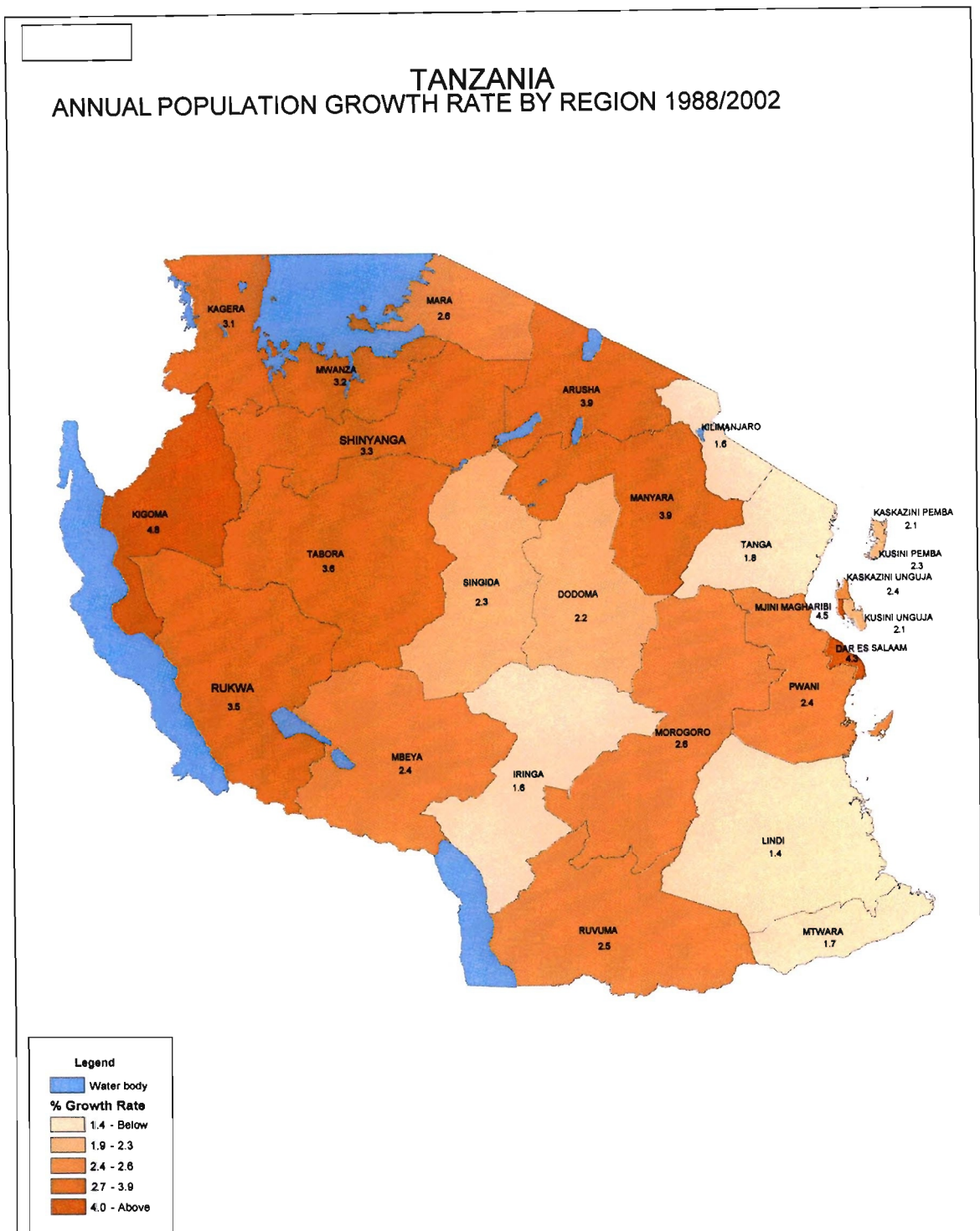
**Table 4.1: Tanzania Mainland Population and Growth between 1988 and 2002**

Region	Population		Per cent rural		Annual Growth Rates %	Percent to Total Population	
	1988	2002	1988	2002		1988	2002
Dodoma	779,868	1,692,025	81.2	87.4	2.3	3.5	5.1
Arusha	1,352,225	1,288,088	87.6	68.7	4.0	6	3.8
Kilimanjaro	1,235,277	1,376,702	84.8	79.1	1.6	5.5	4.1
Tanga	1,876,776	1,636,280	82.4	81.6	1.8	8.3	4.9
Morogoro	1,279,931	1,753,362	78.9	73.0	2.6	5.7	5.2
Pwani	639,182	885,017	84.6	78.9	2.4	2.8	2.6
Dar es Salaam	1,360,850	2,487,288	11.4	6.1	4.3	6	7.4
Lindi	642,364	787,624	84.7	84.0	1.4	2.9	2.4
Mtwara	887,583	1,124,481	86.0	79.7	1.7	3.9	3.4
Ruvuma	779,868	1,113,715	88.1	84.8	2.5	3.5	3.3
Iringa	1,280,262	1,490,892	90.0	82.8	1.5	5.7	4.5
Mbeya	1,476,261	2,063,328	81.8	79.6	2.4	6.6	6.2
Singida	793,887	1,086,748	91.2	86.3	2.3	3.5	3.2
Tabora	1,042,622	1,710,465	85.7	87.1	3.6	4.6	5.1
Rukwa	704,050	1,136,354	85.8	82.4	3.6	3.1	3.4
Kigoma	853,263	1,674,047	87.2	87.9	4.8	3.8	5
Shinyanga	1,763,960	2,796,630	93.2	90.8	3.3	7.8	8.4
Kagera	1,313,639	2,028,157	94.5	93.8	3.1	5.8	6.1
Mwanza	1,876,776	2,929,644	81.4	79.5	3.2	8.3	8.8
Mara	952,616	1,363,397	89.5	81.4	2.5	4.2	4.1
Manyara	-	1,037,605	-	86.4	3.8		3.1
<b>Tanzania Mainland</b>		<b>33,461,849</b>	<b>82.0</b>	<b>77.4</b>	<b>2.8</b>	<b>100</b>	<b>100</b>

Sources: 2002 Population and Housing Census: Volume II: Age and Sex Distribution  
 2002 Population and Housing Census : Volume I: General Report  
 1988 Population Census. National Profile. The Population of Tanzania: The Analytical Report

Map 4.1 below shows the annual population growth rates by region between 1988 and 2002. The map shows that regional population annual growth rates ranged from 4.8 percent in Kigoma to 1.5 percent in Iringa. The big annual growth rate for Kigoma is mainly due to an influx of refugees from Burundi and the Republic of Congo (Tenende, 2004: 206).

**Map 4.1: Annual Population Growth Rates by Region 1988/2002**



Source: Central Census Office, 2003

#### 4.4 Incidence of Consumption-based Poverty

Although poverty is multidimensional, but reducing income/hunger poverty is a priority among developing countries including Tanzania. That is why even goal number one of MDGs is about reducing income poverty and hunger. The goal states:

- Reduce by half the proportion of people living on less than a dollar a day.
- Reduce by half the proportion of people who suffer from hunger

Table 4.2 and maps 4.2 to 4.4 below shows poverty levels by regions from the 2000/01 HBS. Column two of Table 4.2 below shows the mean monthly expenditure per capita in Tanzania Shillings. Columns three and four show the percentage of individuals below the food and basic needs poverty line respectively. The table shows that mean expenditure per capita was 10,120 Tanzania Shillings. The average mean expenditure was higher for Dar es salaam (21,900 TShs.) and Mbeya (12,600 Tshs.) and lowest for Rukwa (6,700 Tshs.), Singida (6,900 Tshs.) and Kigoma (7,300 Tshs.).  
(Note: 1 US\$ is equivalent to 1200 Tshs.)

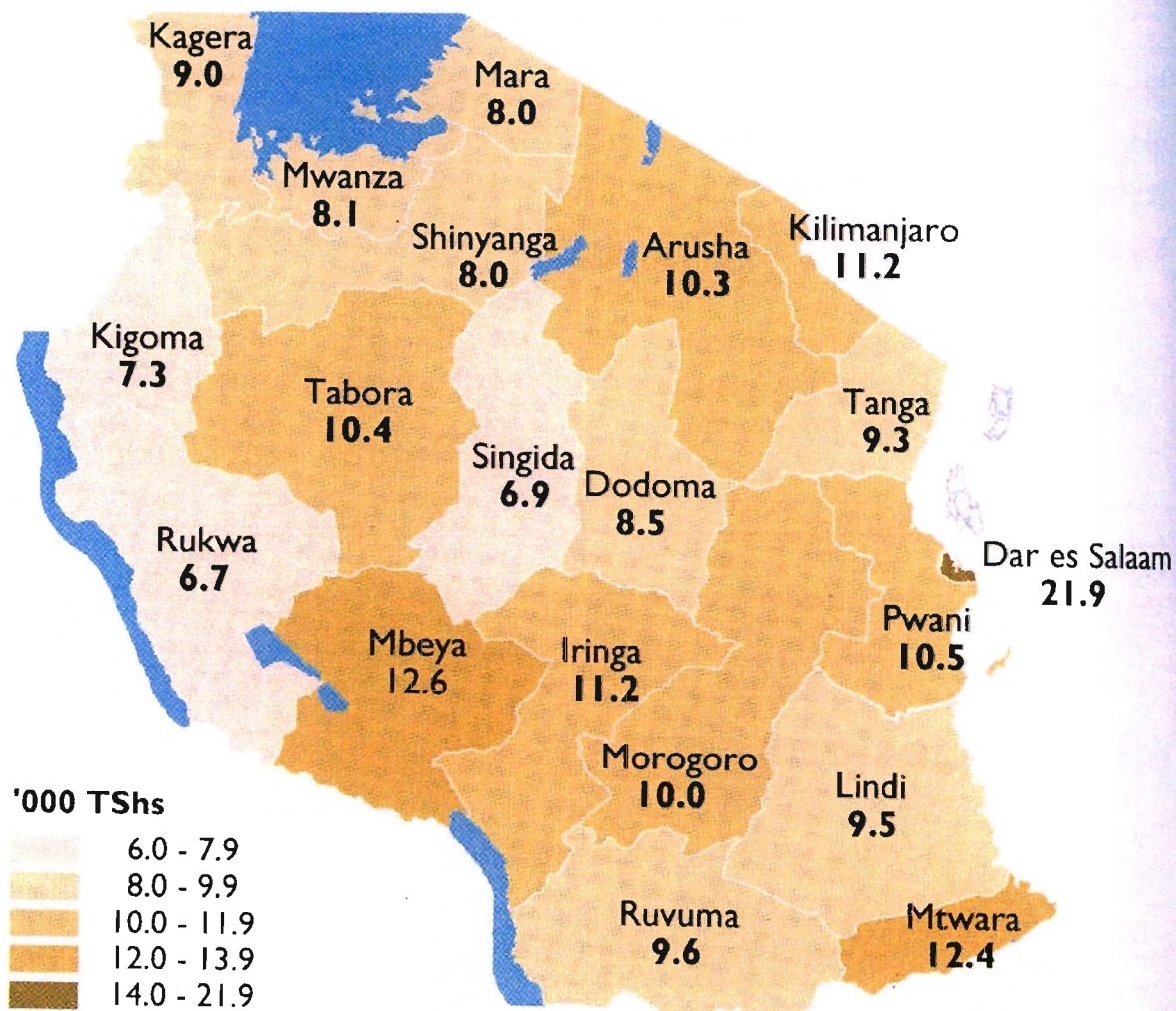
Column two shows that about 19 per cent of Tanzanian were living below the food poverty line in 2000/01, while about 36 percent of individuals were living below the basic needs poverty line. For both poverty lines, Dar es Salaam had the lowest level of poverty (7.5 percent and 17.6 percent below food and basic needs poverty line respectively).

**Table 4.2: Poverty Levels by Regions: HBS 2000/01**

Region	Mean Monthly Consumption Expenditure per Capita ('000 TSHS)	Percentage of individuals below the food poverty line	Percentage of individuals below the basic needs poverty line
Dodoma	8.5	13.1	34.3
Arusha	10.3	25.1	38.8
Kilimanjaro	11.2	11.1	31.3
Tanga	9.3	11.4	36.5
Morogoro	10.0	13.6	29.4
Pwani	10.5	27.4	46.2
Dar es Salaam	21.9	7.5	17.6
Lindi	9.5	33.3	53.0
Mtwara	12.4	16.8	38.0
Ruvuma	9.6	27.4	41.3
Iringa	11.2	10.3	28.9
Mbeya	12.6	7.8	20.6
Singida	6.9	27.9	55.2
Tabora	10.4	8.9	26.0
Rukwa	6.7	11.8	31.0
Kigoma	7.3	20.9	37.5
Shinyanga	8.0	22.0	42.0
Kagera	9.0	17.5	28.6
Mwanza	8.1	30.2	47.9
Mara	8.0	36.4	45.6
Manyara	-	-	-
<b>Tanzania Mainland</b>	<b>10.1</b>	<b>18.7</b>	<b>35.7</b>

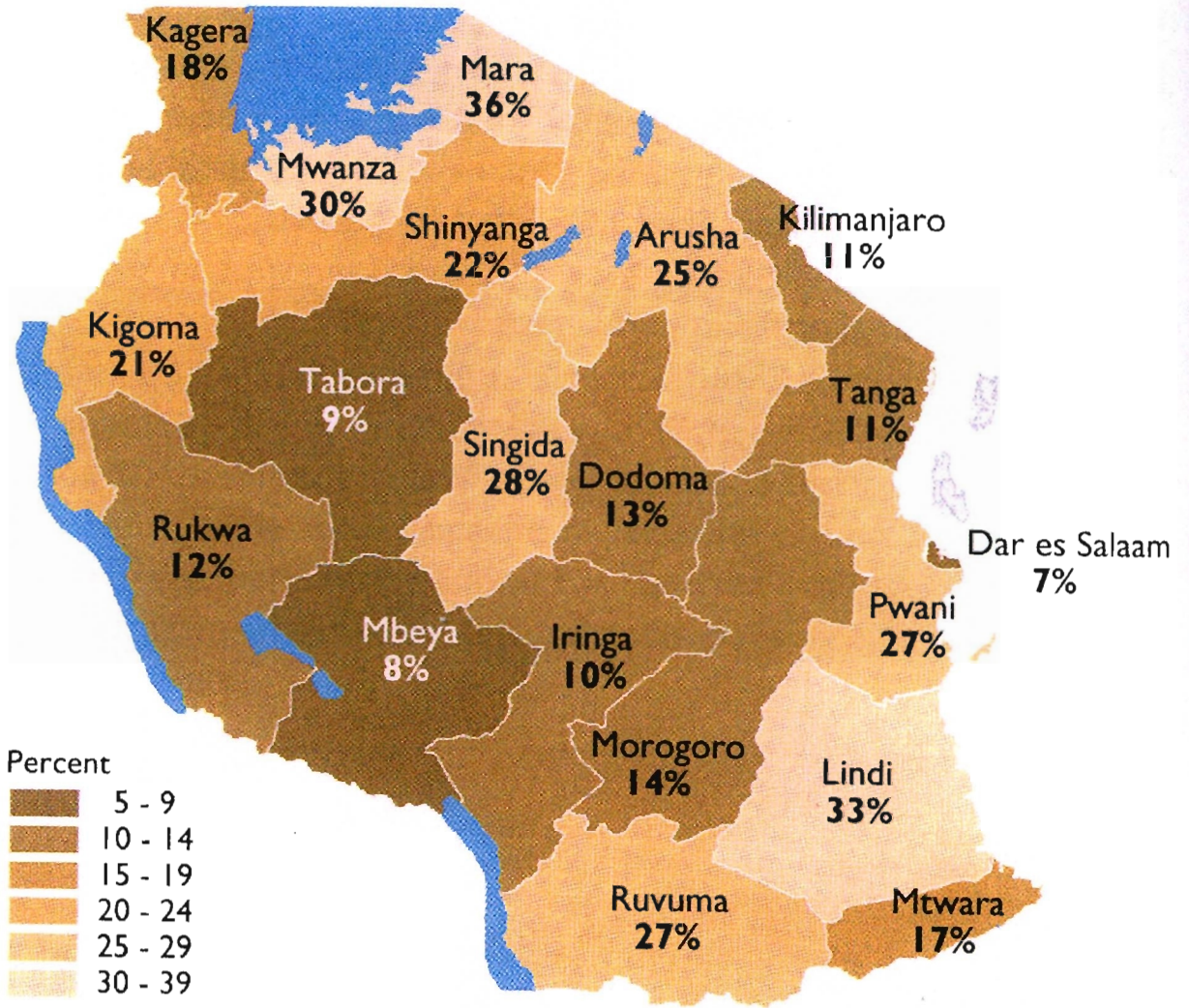
Source: National Bureau of Statistics, 2002: Household Budget Survey 2000/01

**Map 4.2: Mean Monthly Consumption Expenditure per Capita**



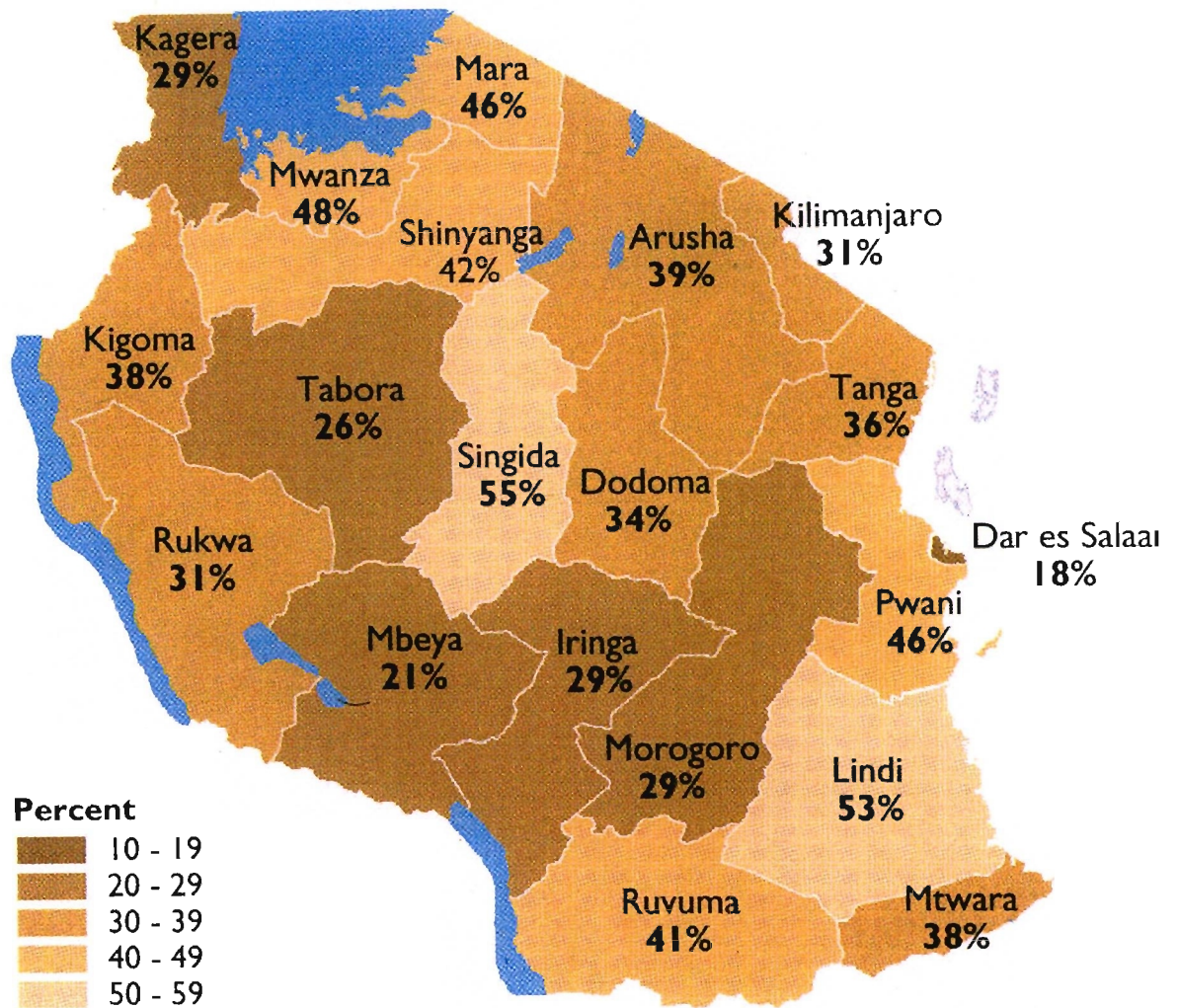
*Source: National Bureau of Statistics, 2002*

**Map 4.3: Percentage of the Population Below the Food Poverty Line**



*Source: National Bureau of Statistics, 2002*

**Map 4.4: Percentage of Population below the Basic Needs Poverty Line**



Source: National Bureau of Statistics, 2002

#### 4.5 Education Indicators

Education is an essential component of human capital as it plays an important role in the economic growth and development of a country. Studies of the rates of returns to education attribute a positive value to the rates of returns from primary education. Goal number two of the MDGs stresses the importance of primary education in eliminating poverty. The goal states that:

*Goal 2: Ensure that by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.*

*Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015*



Six indicators of education; girls/boys ratio in primary and secondary schools, transition from primary to secondary schools, adult literacy rate, net and gross primary enrolment rates (NER and GRR respectively) and drop-out rates are discussed in this section, based on the 2002 census. Some indicators are disaggregated by sex and location and where possible the trend between 1988 and 2002 is also examined.

**Table 4.3: Education and Literacy Indicators by Regions: 2002 Census**

Region	Girls/boys ratio – Primary schools	Girls/boys ratio – Secondary schools	Transition Rate- Primary to Secondary	Literacy Rate – pop. 15 and above	NER	GRR	Drop out rate in primary schools
Dodoma	96.6	73.1	14.6	62.7	62	88.7	6.2
Arusha	95.2	88.4	23	72.7	71	91.9	5.5
Kilimanjaro	96.2	104.8	20	88.1	90	113.6	10.4
Tanga	94.6	78.2	16.8	73.3	70	95.5	11.1
Morogoro	95.4	68.9	11.6	69.9	67	121.9	8.9
Pwani	90.3	66	17.3	58.9	60	82.6	8.2
Dar es Salaam	102.5	81.3	38.4	90.7	85	110.1	7.1
Lindi	94.1	61.4	13	59.3	57	82.2	10.8
Mtwara	100.2	73.2	11.4	61.3	66	90.3	11.1
Ruvuma	96.7	63.6	16.5	77	73	101	8.6
Iringa	98.3	78.6	11	76.7	81	107.3	7.2
Mbeya	99.4	68.2	13.6	70.3	76	103.8	9.5
Singida	96.5	69.2	11.7	54	68	97.3	8.2
Tabora	91.5	69.3	13.5	54	52	70.1	8.9
Rukwa	90.5	56.9	11.8	61.7	57	80	10.4
Kigoma	92.3	56.1	15.1	63.8	69	95.6	8.2
Shinyanga	96.1	56.3	9.5	56.6	56	78.7	7.8
Kagera	95.4	60.8	18.5	67.4	72	96.3	9.3
Mwanza	95	60.7	18.5	68.6	69	94.5	9.9
Mara	91.8	51.5	14.2	73.9	78	107.1	9.8
Manyara	96.2	59.5	15.4	62.1	60	86.8	6.3
<b>Tanzania Mainland</b>	<b>95.9</b>	<b>71.6</b>	<b>16.6</b>	<b>69.4</b>	<b>69.0</b>	<b>95.1</b>	<b>8.0</b>

*Source: Calculated by the Author from 2002 Tanzania Population and Housing Census.*

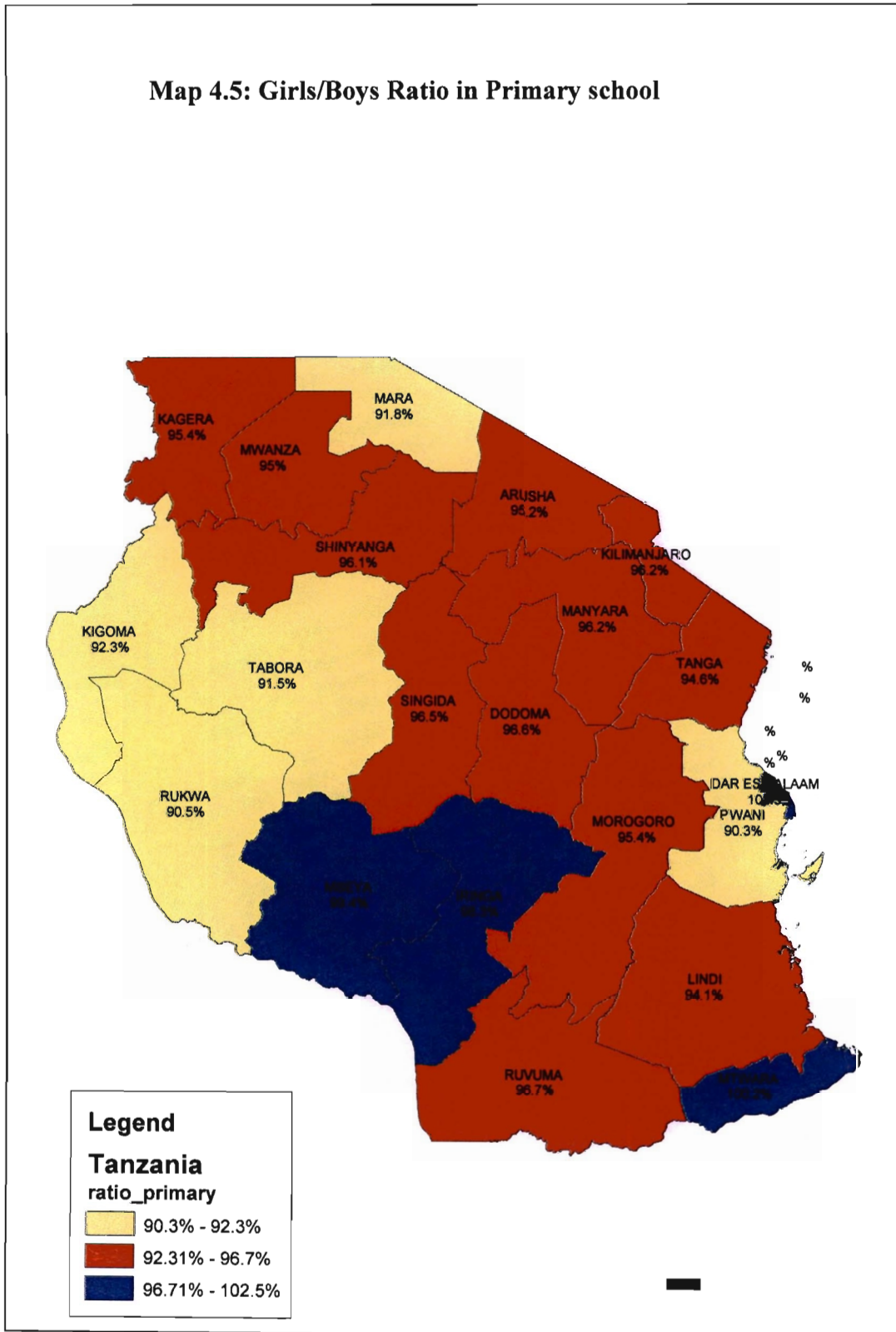
#### **4.5.1 Girls/Boys Ratio in Primary and Secondary Schools**

The Girls/Boys ratio in primary/secondary schools is defined as the total number of girls in primary/secondary schools over the total number of boys in primary/secondary schools. Table 4.3 and Maps 4.5 and 4.6 below show the progress made by the country and regions in achieving the above target. Overall much progress

has been made in eliminating gender disparity in primary education. Data shows that for every 100 boys attending primary school there were 96 girls also attending. In every region the ratio was more than 90 percent, ranging from 90 percent in Pwani to 102 in Dar es Salaam.

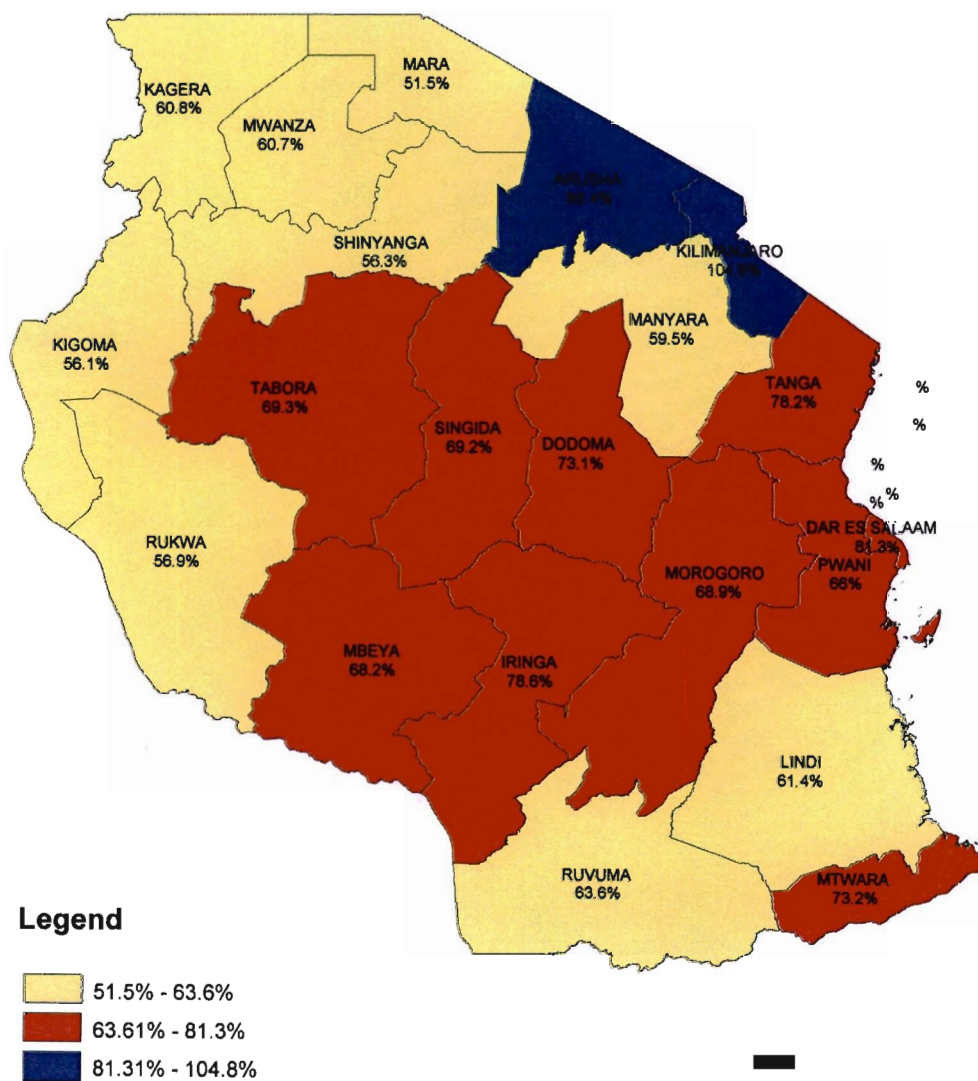
Most girls seem to stop at primary level, as the ratio of girls to boys in secondary education suddenly drops at secondary level. (see Map 4.6 below). Overall at secondary for every 100 boys attending we have only 76 girls. It is only Kilimanjaro where the ratio of girls/boys is more than 100. Fourteen regions had a ratio of girls/boys of below 70 percent.

**Map 4.5: Girls/Boys Ratio in Primary school**



Source: By the Author for 2002 Population and Housing Census

**Map 4.6: Girls/Boys Ratio in Secondary school**



Source: By the Author for 2002 Population and Housing Census

#### 4.5.2 Transition from Primary to Secondary Schools

I have defined transition rate from primary to secondary as the number of students who are in their final year in primary schools over the total number of students in their first year in secondary schools. The transition from primary to secondary is generally low in the country. The Vice President's Office, which is responsible for poverty reduction strategies in the country, observes in its report by stating that '.....that despite the growth of private secondary schools, the pace of transition to secondary schools is low and that there are large disparities in enrolment in secondary and tertiary levels (Vice President' Office, 2005: 11). Table 4.3 above shows that the overall transition rate for the country was 17 percent. Only three regions, Dar es Salaam (38 percent), Arusha (23 percent) and Kilimanjaro (20 percent) had more than 20 percent of their continuing to secondary level. The relative transition rates in these regions is an indicative of the large number of secondary schools in these regions as compared to the rest.

#### 4.5.3 Net Enrolment Rates

Net Enrolment Rate (NER) is defined as the number of children aged 7-13 who are attending primary school divided by the total number of children in that age group. The 7-13 age group is the official primary school age in Tanzania, which extends for seven years. In trying to achieve goal number two of the MDGs, Tanzania set targets of reaching 90 percent NER by the year 2003 and 100 percent by the year 2010. (United Republic of Tanzania, 2004:7). These targets were based on 2000/01 estimates from the Ministry of Education, which estimated the NER to be 59 percent. To make sure that these ambitious targets are met the Government started implementing the Primary Education Development Programme in 2002.

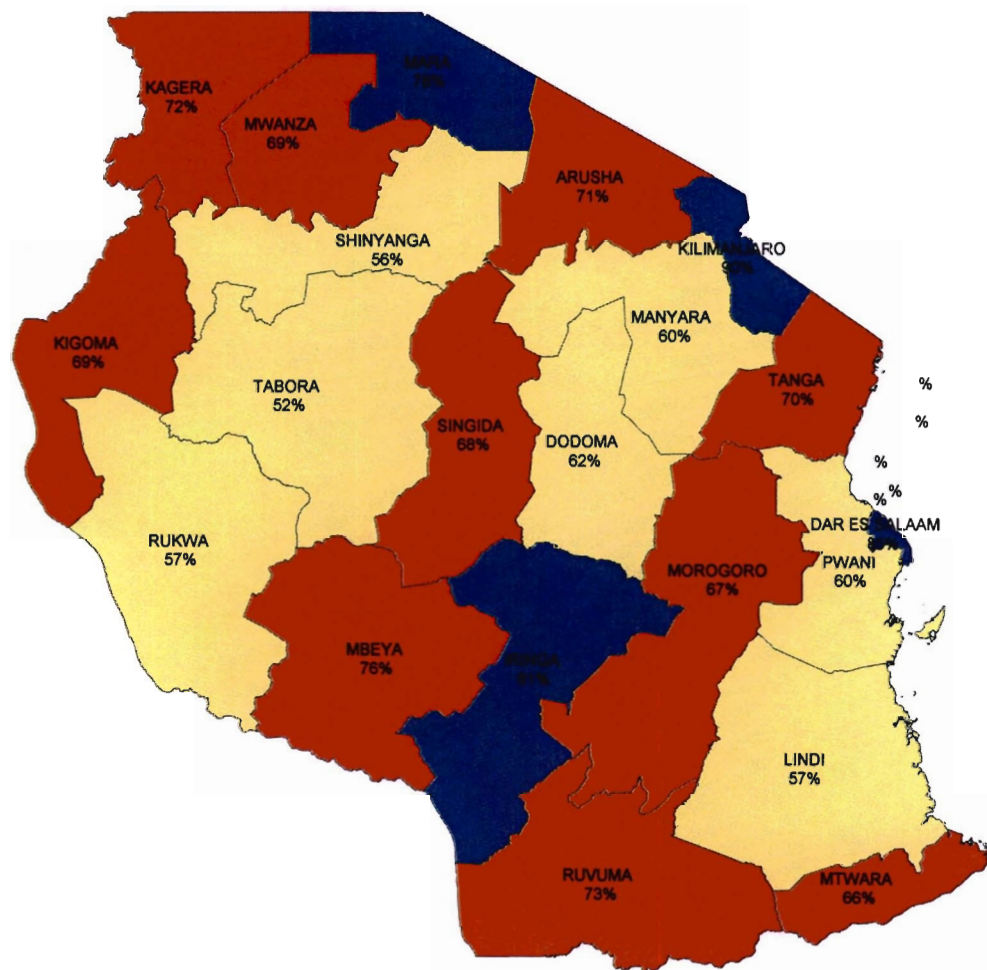
*Target number three of goal number two: Ensure that by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.*

Table 4.3 above shows that the NER for the country was 69 percent, indicating a 21 percent shortfall in achieving a NER of 90 percent by the year 2003. There had been a gradual fall of NER from 1978 to 2002. In 1978 NER was 84 percent. The rate fell by 5 percent to 78 percent in 1988 (Kapinga and Ruyobya, 1994). The high rates of NER

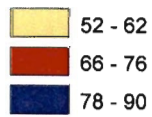
in 1978 can be explained by the implementation of Universal Primary Education that was introduced in 1977. With the implementation of the Primary Education Development Programme, enrollment has quickly picked up again reaching 88.5 percent in 2003 (United Republic of Tanzania, 2004:7).

Table 4.4 and map 4.7 below shows NER and GER by regions in 2002. Results indicate that there were wide variations between regions. The highest NER was recorded in Kilimanjaro (90 percent) followed by Dar es Salaam (85 percent). Five regions had NER of 60 percent and below and these were: Manyara (60 percent), Pwani (60 percent), Lindi (57 percent), Shinyanga (56 percent) and Tabora (52 percent).

**Map 4.7: Net Primary Enrolment Rate**



**Legend**



Source: By the Author for 2002 Population and Housing Census

While the NER between sexes was almost equal (68 percent for males and 70 percent for females), there is a marked difference between rural and urban population. Table 4.4 below indicates that the NER for the urban population was 84 percent compared to only 65 percent in the rural areas. The table also reveals almost the same pattern with GER. The GER for urban areas was 103 percent compared to only 90 percent in the rural areas.

**Table 4.4: NER and GER by Sex and Location**

REGION	NER					GER				
	Total	Male	Female	Rural	Urban	Total	Male	Female	Rural	Urban
Dodoma	62	61	64	59	87	89	90	88	86	111
Arusha	71	71	71	64	91	92	93	91	85	112
Kilimanjaro	90	90	91	90	90	114	114	113	115	109
Tanga	70	69	70	67	84	95	96	95	93	110
Morogoro	67	66	69	63	79	122	91	90	87	102
Pwani	60	59	60	56	72	83	85	80	79	96
Dar es Salaam	85	85	85	75	86	110	112	108	100	111
Lindi	57	57	58	55	70	82	83	81	80	97
Mtwara	66	65	67	64	72	90	90	90	89	96
Ruvuma	73	73	74	71	86	101	102	100	99	113
Iringa	81	80	82	80	87	107	109	106	107	109
Mbeya	76	76	77	73	89	104	106	102	102	112
Singida	68	65	70	65	84	97	98	97	95	111
Tabora	52	52	53	48	82	70	72	68	66	105
Rukwa	57	57	57	54	73	80	84	76	76	99
Kigoma	69	70	69	68	78	96	99	93	94	105
Shinyanga	56	54	79	54	57	79	80	77	77	103
Kagera	72	72	72	71	81	96	99	94	96	103
Mwanza	69	68	70	66	83	94	97	92	92	108
Mara	78	78	78	77	86	107	111	103	106	110
Manyara	60	58	62	58	79	87	87	87	85	102
<b>Total Mainland</b>	<b>69</b>	<b>68</b>	<b>70</b>	<b>65</b>	<b>84</b>	<b>95</b>	<b>95</b>	<b>92</b>	<b>90</b>	<b>108</b>

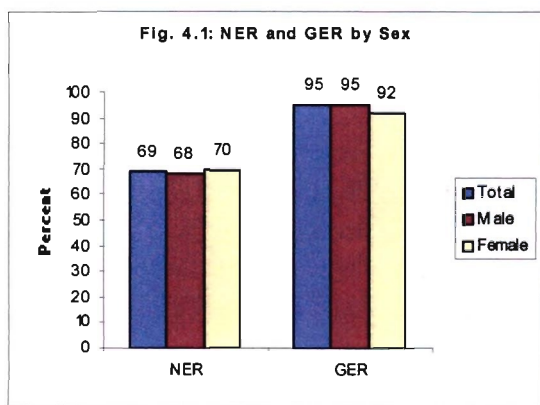
*Source: Calculated by the Author from 2002 Tanzania Population and Housing Census.*

#### 4.5.4 Gross Enrolment Rates

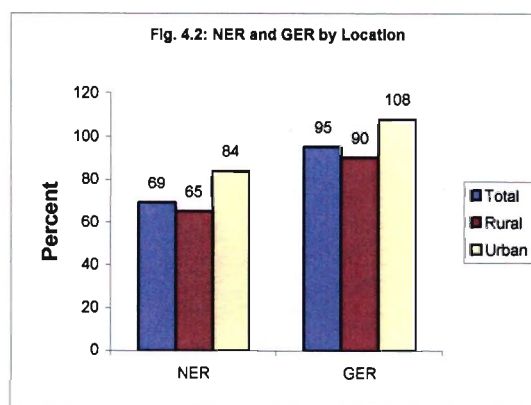
The Gross Enrolment Rate (GER) is defined as the number of children who are attending primary school regardless of their ages divided by the total population aged 7–13 years. The Government target was to reach a GER of 100 by the year 2003 (United Republic of Tanzania, 2004:7). Table 4.4 above indicates that by 2002 the average GER was 95 for all Mainland regions. By the year 2002, six regions, Kilimanjaro (114 percent), Morogoro (122 percent), Iringa (107 percent), Mbeya (103 percent) and Mara (107 percent) had a GER of more than 100 percent indicating a large number of children aged more than 13 years in primary schools. Only two regions, Shinyanga (78 percent) and Tabora (70 percent) had a GER of less than eighty



percent. Table 4.4 above shows the variations of GER among sexes and location. Table indicates that GER was higher among males (95 percent) than among females (92 percent). GER was also significantly higher in urban (108 percent) than in rural areas (90 percent). However following the implementation of the Primary Education Development Programme in 2002, the GER surpassed the target of 100 percent, reached 105.3 percent and 106.3 percent in 2003 and 2004 respectively (Vice President’s Office, 2005: 11).The differences in NER and GER among males and females in rural and urban areas is summarized by Figures 4.1 and 4.2 below.



Source: 2002 Tanzania Pop. Census



Source: 2002 Tanzania Pop. Census

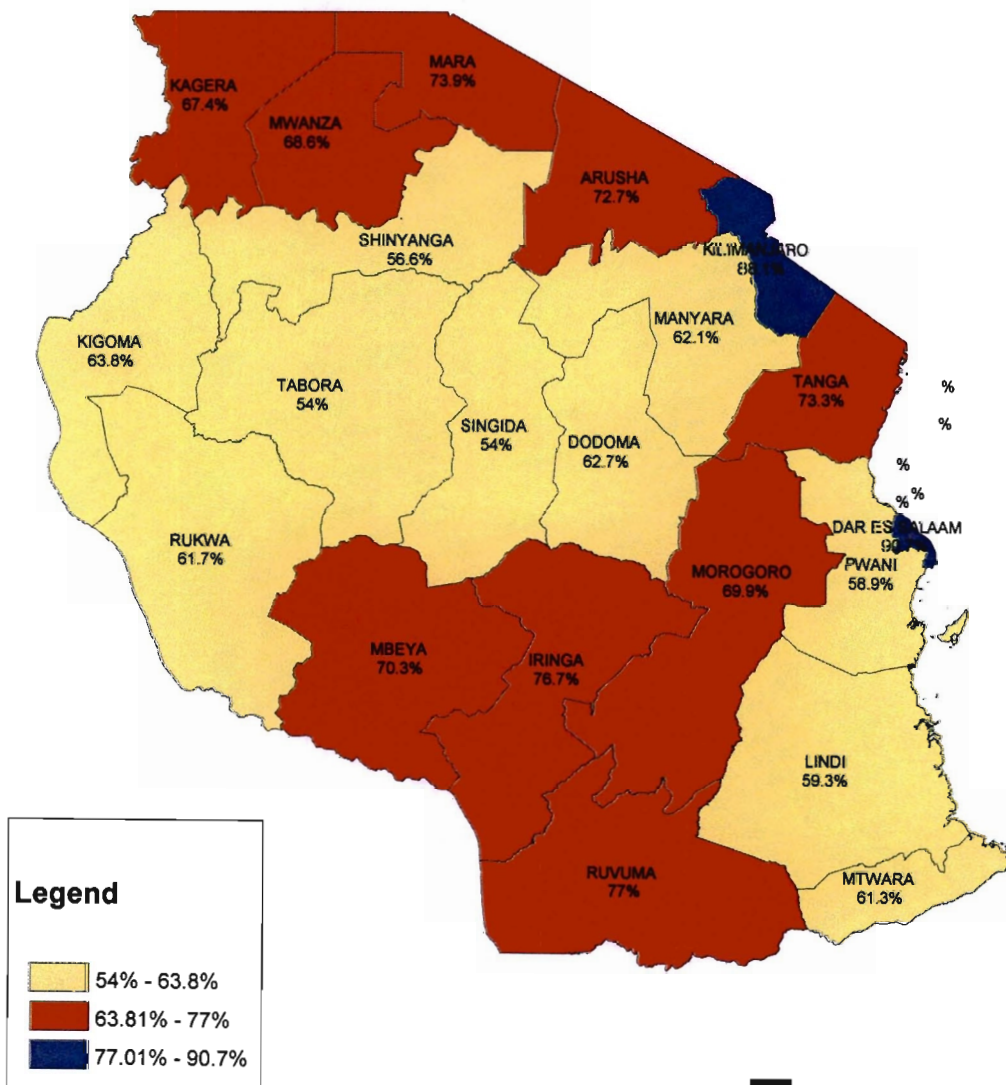
#### 4.5.5 Drop-out Rates

Data indicates that about 8 percent of children dropped out of primary school before finishing the compulsory seven years. The target was to reach a drop-out rate of 3 percent by the year 2003. Table 4.3 above indicates that by the year 2002 none of the 21 regions had reached that target. The drop-out ranged from about 6 percent in Arusha to 11 percent in Mtwara.

#### 4.5.6 Adult and General Literacy Rates

Adult literacy is defined as the percentage of the population aged 15 years and above who read and write in any language, while general literacy refers to the population aged 10 and above. Table 4.5 and Map 4.8 below indicates that 69 percent of the population aged 15 and above was literate in 2002. Literacy rates show a substantial differences by regions, with Dar es Salaam (91 percent) recording the highest rates followed by Kilimanjaro (88 percent) and Iringa and Ruvuma (77 percent each). The lowest rates were recorded in Tabora and Singida (54 percent each).

**Map 4.8: Literacy for pop. Aged 15 and above**



Source: By the Author for 2002 Population and Housing Census

Adult literacy rates in 2002 were generally higher among males than among females. Table 4.5 below shows that literacy rate for males (75 percent) was 13 percent higher than that for females (62 percent). Literacy rates for males ranged from 63 percent in Tabora to 94 percent in Dar es Salaam. On the other hand rates for females ranged from 46 percent in Tabora to 87 percent in Dar es Salaam. Literacy rates were also significantly higher in urban than in rural areas. The rates in urban areas (87 percent) were 24 percent higher in rural areas (64 percent).

**Table 4.5: Literacy Rates by Sex and Location: 2002 Census**

REGION	Literacy Rates				
	Total	Male	Female	Rural	Urban
Dodoma	62.7	70.6	55.8	58.7	87.7
Arusha	72.7	78.5	67.4	60.8	94.7
Kilimanjaro	88.1	91.6	85.2	86.6	93.4
Tanga	73.3	81.1	66.5	69.4	88.5
Morogoro	69.9	78.4	61.7	64.3	83.6
Pwani	58.9	69.1	49.6	54.6	74.0
Dar es Salaam	90.7	93.9	87.4	72.4	91.8
Lindi	59.3	69.5	50.6	56.5	73.1
Mtwara	61.3	70.4	53.7	58.6	72.0
Ruvuma	77.0	83.1	71.5	74.5	90.1
Iringa	76.7	85.9	69.3	73.9	89.0
Mbeya	70.3	79.5	62.4	65.2	89.4
Singida	54.0	62.8	46.0	49.4	82.3
Tabora	54.0	62.8	46.0	49.4	82.3
Rukwa	61.7	72.7	51.7	58.5	76.2
Kigoma	63.8	74.4	55.2	60.7	79.4
Shinyanga	56.6	67.2	47.2	53.4	84.2
Kagera	67.4	74.9	60.6	65.8	87.1
Mwanza	68.6	77.2	60.5	62.9	87.7
Mara	73.9	83.9	65.8	71.1	85.5
Manyara	62.1	68.7	55.2	58.1	84.1
<b>Total Mainland</b>	<b>69.4</b>	<b>77.5</b>	<b>62.1</b>	<b>63.5</b>	<b>87.6</b>

*Source: Calculated by the Author from 2002 Tanzania Population and Housing Census.*

The literacy rate for the population aged 10 years and above has increased from 61.2 in 1988 to 70.4 in 2002 (Kapinga and Ruyobya, 1994). Dar es Salaam and Kilimanjaro had a literacy rate of about 90 percent in 2002, while two regions, Shinyanga (58 percent) and Tabora (54 percent) were the only two regions with literacy rate below 60 percent.

## 4.6 Water and Sanitation

MDGs goal number seven and target ten and eleven states:

*Goal seven: Ensure environmental sustainability.*

*Target ten: Halve by 2015, the proportion of people without sustainable access to safe water and basic education.*

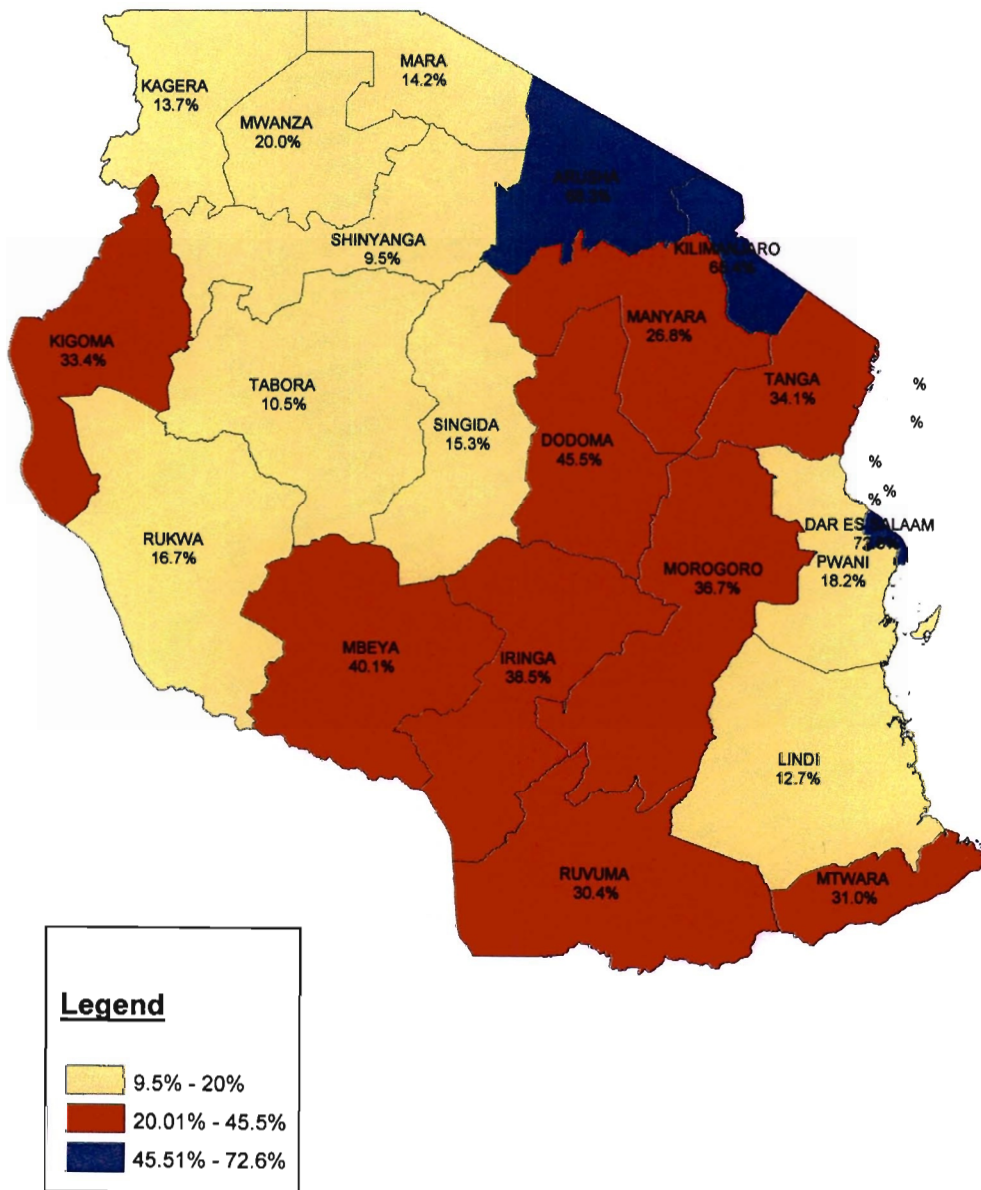
*Target eleven: Have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers*

### 4.6.1 Safe Water

Out of the eight sources specified in the census questionnaire I have considered only piped water to be the safe source. Other source were: protected well, unprotected well, protected spring, unprotected spring, river/stream, pond, lake, rain water, water vendors or other unspecified sources. Table 4.6 below indicates that only 30 percent of the population was getting water from a safe source – piped water. The proportion of households using piped water as a major source of drinking water has almost remained the same since 1988. In the 1988 census, 31 percent of households were reported as using piped water as a major source of drinking water (Musyani, 1994: 173).

Table 4.6 and Map 4.9 below shows that the number of households using safe a source of drinking water differs by regions, from only 8 percent in Shinyanga to 73 percent in Dar es Salaam. Nine regions had less than 20 percent of their households using safe water for drinking and only three regions – Dar es Salaam (73 percent), Arusha (66 percent) and Kilimanjaro (64 percent) had more than 50 percent of their population using safe water for drinking.

**Map 4.9: Percent of households using safe water**



*Source: By the Author for 2002 Population and Housing Census*

#### **4.6.2 Sanitation**

Pit latrine – both traditional and ventilated pit latrines – were the most common type of toilet facilities in the country as 88 percent of the population were using this type of sanitation. Nine percent of the population had no toilet facilities at all and only 3 percent were using flush toilets. The percentage of the population with no toilet facilities varies from 1 percent and less in Dar es Salaam, Ruvuma and Iringa to as high as 18 percent in Mara, 20 percent in Tabora and 22 percent in Manyara. There has been no improvement in toilet facilities since 1988 census. Three percent of the households were using flush toilets, 85 percent were using pit latrines and 12 percent had no toilet facilities at all (Musyani, 1994: 181).

#### **4.7 Housing Conditions**

As an indicator of good housing respondents were asked to state the building materials used for roofs, walls and floors of their main buildings. Table 4.6 below indicates that slightly below than 50 percent of the population were living in houses with modern roofing materials. (modern roofing materials in this paper refer to iron sheets, tiles, concrete and asbestos). The difference between regions is pronounced, as it ranges from about 90 percent in Dar es Salaam and Kilimanjaro to 23 percent in Rukwa and 21 percent in Lindi and Tabora

The situation is even worse with walls and flooring materials. Only 28 percent of the population were living in houses with modern walls. (modern wall building materials refers to stones, cement bricks and baked bricks). In two regions the population living in a house with modern walls was less than 10 percent (Lindi, 8 percent and Tabora, 6 percent). Only a quarter of the population was living in houses with modern floors and only one region – Dar es Salaam (87 percent) had more than 50 percent of its population living in houses with modern floors (modern Roofing Materials refers to cement or tiles).

**Table 4.6: Housing Conditions**

Regions	Percent Households with safe water	Sanitation			Houses with modern roofs	Houses with modern walls	Houses with modern floor	Houses with elec.
		Flush	Pit latrine	No facility				
Dodoma	45.5	2.4	87.5	10.1	40.9	22.3	14.9	5.7
Arusha	65.9	7.3	72.6	20	62.6	25.3	32.4	16.1
Kilimanjaro	64.3	5.7	92.1	2.1	89.8	42.1	44.4	16.1
Tanga	33.4	4.8	84.9	10.2	48.6	18.7	24.1	9.2
Morogoro	34.7	4.1	92.3	3.5	45.2	32.5	21.7	7.7
Pwani	17.3	1.1	88.3	10.5	33.2	12	18	4.7
Dar es Salaam	72.6	17.2	81.7	1	96.5	90.1	87.4	42.3
Lindi	12.1	0.9	93.2	5	21.4	7.6	8.9	3.3
Mtwara	30.8	0.5	95	4.5	28.5	10.2	10.3	2.8
Ruvuma	29.9	1.3	97.8	0.9	41.7	70.8	20.4	3.8
Iringa	37.4	2.6	96.9	0.5	48.5	37.9	26.6	6.2
Mbeya	38.3	2	95.9	2.1	50.3	41.6	24	5.6
Singida	14.1	0.7	89.4	9.8	24.6	5.9	8.9	3.4
Tabora	8	0.9	79.5	19.5	21.3	6	12	4.2
Rukwa	15.8	1	92.3	6.7	22.7	37.7	14.5	3.2
Kigoma	33.7	1	96.6	2.3	33.7	36.9	13	2.8
Shinyanga	8.2	0.9	85.1	14	31.9	5.7	9.8	3.3
Kagera	12.6	0.9	85.1	14	56.3	15.3	13.9	2.8
Mwanza	16	3.1	85.4	11.4	46.8	14.7	22.3	5.1
Mara	13.3	1.8	80.4	17.7	37.6	21.4	19	5.1
Manyara	25.5	0.5	77.5	21.7	32.5	18.1	12.8	4.1
<b>Tanzania Mainland</b>	<b>30.4</b>	<b>3.3</b>	<b>87.5</b>	<b>9.1</b>	<b>46.2</b>	<b>27.6</b>	<b>24</b>	<b>9.0</b>

Source: Calculated by the Author from 2002 Tanzania Population and Housing Census.

#### 4.8 Access to Electricity

The majority of households have no access to electricity supply. Table 4.6 above indicates that only 9 percent of households reported having electricity. With the exception of three regions – Arusha (16 percent), Kilimanjaro (16 percent) and Dar es Salaam (42 percent) the rest of the regions had less than 10 percent of the households with electricity in their homes. The availability of electricity has slightly improved since the 1988 census when 6.3 percent of households reported having electricity in their houses (Musyani, 1994: 185).

#### 4.9 Conclusion

This chapter has considered a range of indicators of well being, reflecting on many dimensions of poverty. Comparisons have been made across the regions and trends examined. The results show wide variation between regions, sexes and locations.

Indicators for males are generally better of when compared to that for females. Likewise, urban population is relatively better when compared to their counterparts in rural areas. Although some progress has been made in some areas, especially in primary education and literacy, in general the country still lags behind in attaining the MDGs.

Information in this chapter has demonstrated that any analysis of poverty in Tanzania should combine the conventional income/expenditure approach to poverty with appropriate measures of services (assets) accessed by the population. These indicators are necessary markers for the degree and extent of “entitlement deprivation” in the society.



## **CHAPTER 5**

### **THE HOUSEHOLD ASSET INDEX**

#### **5.1 Introduction**

As shown in Chapter 2 conventional approaches of measuring poverty e.g. money metric, though commonly used are uni-dimensional. This plus other reasons specified in chapter two have led to alternative ways of measuring poverty and analyzing poverty. One of these approaches is the asset index DFID (2003) observes that asset approach is important because money metric measures are, data intensive and expensive to collect only reflect narrow concept of poverty and are often not present in surveys or censuses that contain other outcome measure. With the asset index approach various household durable assets and conditions are aggregated into one variable to proxy for household wealth. The socio-economic status therefore of the household is therefore defined in terms of assets or household conditions, rather in terms of income or consumption.

This chapter is organized as follows. Section two elaborates on how the household asset index is constructed. The section looks at different options available for assigning weights and explains why the principal component was adopted. Sections three elaborates on how the household asset index is constructed. The section also explains how recoding of the original variables was done before the data reduction exercise. Section three gives the results. Section four explains why the index is a reliable proxy for household wealth. Section five explores the limitation and shortcomings of the asset index as a proxy for household wealth. Section six is a brief poverty profile based on ownership of durable goods and housing conditions. Section seven ranks the region based on the percentage of households in the bottom 40 percent of the asset index and compares this rank with the population below the basic needs poverty line from the Household and Budget Survey. Section eight is the conclusion.

#### **5.2 Construction of an Asset Index**

As mentioned in the introduction, the index is constructed by aggregating various asset ownership indicators and housing conditions into one variable. The resulting index is used as a proxy for household wealth (Filmer and Pritchett, 1999). The census questionnaire in Tanzania was limited in the sense that it did not ask other

important questions like ownership of land, an important indicator in poverty analysis. Censuses in other countries also include questions on ownership of expensive items like cars. Ownership of cars and other expensive items like television sets though important may not be crucial for a country like Tanzania where many people cannot afford them. Therefore construction of the index in this study is based on ownership of: radio, telephone, bicycle, wheelbarrow, charcoal/electric smoothing iron and electricity in the house. Housing conditions included in the construction of the index are: building materials for roof, walls, and floor, source of energy for lighting and cooking, source of drinking water, number of rooms used for sleeping and toilet facilities.

The first problem one encounters in aggregating these indicators is the problem of weighting. How should the weights be assigned?

### **5.2.1 Assigning Weights**

The simplest way would be to assign equal weights and therefore limit the aggregation to a linear index. Although the approach looks simple, it is arbitrary (Filmer and Pritchett, 1999: 116). Such an approach assumes that the welfare value of the different assets is the same, which of course is not true. For example ownership of a radio and having a car have different welfare values for a household.

The second option would be to estimate the current values of a household's assets using explicit and implicit "values" as weights. This approach is only possible if the prices of various assets are available. Unfortunately, this approach could not be adopted, as the census in Tanzania like in many countries does not contain information on values and prices.

The third option is to simply enter all of the assets variables separately in a linear multivariate regression equation. This approach deals with the problem of 'controlling' for wealth in estimating the impact of non-wealth variables. It does not, however, identify the wealth effect as many assets can have both a direct and indirect effect on outcomes and there might also be interactions that make an asset more valuable if you own complementary assets – for example an electric iron and electricity in the house for example (Falkingham and Ceema, 2001: 18).

There are also less common approaches used to determine weights. An example is the consultative approach that was adopted in Bolivia in the construction of the index of Fulfilment of Basic Needs. When constructing a Human Vulnerability Index in Maldives, not only equal weights were applied to the variables, but perception weights were also used (UNDP and Ministry of Planning and National Development, 1999). However, although these methods are an improvement they still involve subjective decisions regarding the welfare value of each component (Falkingham and Ceema, 2001: 18).

The common approach used for weighting purposes is the principal component analysis (PCA). This was the observation of the participants in a seminar organised by DFID, Healthy System Resource Centre in 2003. Participants concluded that (DFID, 2003: 3)

*PCA continues to be the most commonly accepted form of weighting asset indices. However, [other] approaches offers an interesting alternative. More research on the alternative approaches, using the same datasets is needed. However one needs to balance the complexity of the statistical method against transparency and thus acceptability by policy makers and practitioners and the desired outcome of local ownership*

Filmer and Pritchett constructed an asset index from the National Family Health Survey (NFHS) in Indian states by using the same method of principal component analysis (PCA). They found that the asset index was robust, produced internally coherent results and provided a close correspondence with State Domestic Product (SDP) and poverty rate data (Filmer and Pritchett 1999). Sahn and Stifel used factor analysis (FA) to construct weight for the index and found that the asset index is a valid predictor of a manifestation of poverty – child health and nutrition (Sahn and Stifel, 2003). In analyzing changes in living standards in Uganda, Younger considered poverty measures that are defined across household expenditure *per capita* or household assets, etc. and found that the comparison were robust to the choice of poverty line, poverty measures, and sampling errors (Younger, 2003).

The PCA has also been used successfully by other research groups. One of these groups of researchers is the Consultative Group to Assist the Poor (CGAP). CGAP

has developed a Microfinance Poverty Assessment as a tool to measure poverty levels of Microfinance institutions' clients. The tool uses the PCA as a weighting technique in creating the poverty index. Four case studies conducted in Asia, Africa and Latin America in 1999 produced the desired results, and since then the tool has been used successfully in a number of countries, including Bolivia, Mali, Mexico, Nepal and South Africa (Carla H., *et. al.*, 2003).

In an effort to aggregate the poverty profile of microfinance organisation clients in Limpopo, South Africa, van de Ruit and May used the principal components method to construct the poverty index of these clients. Different variables ranging from the quality and quantity of food consumed, ownership of durable assets and demographic were weighted using the principal component method with satisfactory results (van de Ruit C., and May J., 2003)

The weighting procedure in this analysis is based on this approach (PCA), although as will be shown later, other data reduction techniques can also be used.

Principal component analysis (PCA) is a way of identifying patterns in data and expressing the data in such a way as to highlight their similarities and differences. The main application of PCA as with the factor analysis technique is to reduce the number of variables and to detect structure in the relationship between variables i.e. classifying variables (StatSoft, 1984). The new variables are called principal components, and are defined as linear combinations of the original variables. The PCA is also used indirectly to transform data through rewriting the data with properties the original data did not have (Wulder, 2004)

According to Filmer and Pritchett (2001), principal component analysis can be expressed mathematically as follows:

Suppose we have a set of N variables,  $a^*_{1j}$  to  $a^*_{Nj}$ , representing the ownership of N assets by each household j. Principal components starts by specifying each variable normalized by its mean and standard deviation (s.d) e.g.

$$a_{1j} = (a^*_{1j} - a^*_1) / (s^*_1)$$

Where  $a^*_1$  is the mean of  $a^*_{1j}$  across households and  $S^*_1$  is its s.d.

Selected variables are expressed as linear combinations of a set of underlying components for each household  $j$  as: (for  $j = 1 \dots j$ )

$$\begin{aligned}
 a_{1j} &= v_{11}A_{1j} + v_{12}A_{2j} + \dots + v_{1n}A_{nj} \dots\dots\dots \\
 a_{Nj} &= v_{n1}A_{1j} + v_{n2}A_{2j} + \dots + v_{nn}A_{nj} \dots\dots\dots \text{(equation 1)}
 \end{aligned}$$

Where

$A_s$  = Components

$v_s$  = Coefficients on each component for each variable (they are constants across households)

Because only the left-hand side of each line is observed, the solution to the problem is indefinite. Principal components overcomes this problem by finding the linear combination of the variables with maximum variance – the first principal component  $A_{1j}$  – and then finding the second linear combination of the variables, orthogonal to the first, with maximal remaining variance, and so on.

The “scoring factors” from the model are recovered by inverting the system implied by equation 1 above, and yield a set of estimates for each of the  $N$  principal components (for  $j = 1, \dots, j$ )

$$\begin{aligned}
 A_{1f} &= f_{11}a_{1j} + f_{12}a_{2j} + \dots + f_{1n}a_{nj} \\
 \dots & \\
 A_{Nj} &= f_{N1}a_{1j} + f_{N2}a_{2j} + \dots + f_{Nn}a_{nj} \dots\dots\dots \text{equation (2)}
 \end{aligned}$$

The first principal component, expressed in terms of the original variables, is therefore an index for each household based on the expression:

$$A_j = \sum f_i (a_{ji} - a_i) / S_i \text{ (Summation from } i = 1 \text{ to } i = n) \dots\dots\dots \text{equation (3)}$$

Where:

- $A_j$  is an asset index for each household ( $j = 1, \dots, n$ )
- $f_i$  is the scoring factor for each durable asset of household ( $i = 1, \dots, n$ )
- $a_{ji}$  is the  $i$  th asset of  $j$  th household ( $i, j = 1, \dots, n$ )
- $a_i$  is the mean of  $i$  th asset of household ( $i = 1, \dots, n$ )

$s_i$  is the standard deviation of  $i$  th asset of household ( $i = 1, \dots, n$ )

PCA is a data reduction method as it identifies a relatively small number of factors that can be used to represent relationship among sets of many interrelated variable. The fundamental principle of PCA is to express two or more variable by a single factor. PCA combine into single factor variables that are correlated with another which is also largely independent of other subsets. Some of the variables used in the construction of household asset index in this thesis may be highly correlated. For example a flush toilet is highly correlated with presence of piped water in the house.

How many factors do we want to extract? As more consecutive factors are extracted, less and less variability is accounted for (StatSoft, 1984). The decision of when to stop extracting factors basically depends on when there is only very little "random" variability left. StatSoft (1984) points out that the decision is arbitrary, although some guidelines have been developed. Two main criteria are commonly used; the Kaiser criterion and the scree test. Kaiser developed the Kaiser criterion in 1960 (Kaiser, 1960 cited in StatSoft, 1984). With these criteria only factors with eigenvalues greater than 1 are retained. In other words, with this approach, unless a factor extracts at least as much as the equivalent of one original variable, we drop it. (Eigen values express the variance of the new factors that were successively extracted). This approach is probably the one most widely used. A scree test is the graphical method that was first produced by Cattell (Cattell, 1966 cited in StatSoft, 1984). With this method, eigenvalues are plotted in a simple line plot and a place where the smooth decrease of eigenvalues appears to level off is taken as a cut-off point.

Researches have shown that both approaches do quite well under normal condition that is when there are relatively few factors and many cases. In this study, the number of cases is relatively few; 15 variables and the cases are many - over 1 million at national level. The method adopted for this study is based on both approaches - a scree test and Kaiser criterion.

## 5.2.2 Recoding of Variables

Before running the principal factor analysis using SPSS, new variables had to be generated because factor analysis requires interval variables. This was done by recoding original variables in the census questionnaires to new variables as indicated in table 5.1 below:

**Table 5.1: Recoding of Variables**

Census Question	Original Codes	New Codes
Building materials for roof	Iron sheets = 1 Tiles = 2 Concrete = 3 Asbestos = 4 Grass = 5 Grass and mud = 6 Others = 7	Modern materials = 1 (Iron sheets, tiles, concrete, asbestos) Poor materials = 0 (Grass, grass and mud, others)
Building materials for walls	Stones = 1 Cement bricks = 2 Sun-dried bricks = 3 Baked bricks = 4 Poles and mud = 5 Timber = 6 Grass = 7 Others = 8	Modern materials = 1 (Stones, cement bricks, baked bricks) Poor materials = 0 (the rest)
Building materials for floor	Cement = 1 Mud = 2 Timber = 3 Tiles = 4 Others = 5	Modern materials = 1 (Cement, tiles) Poor materials = 0 (the rest)
Number of rooms for sleeping	Numbers ranged from 1 to 99	Enough space = 1 (3 rooms and above) Crowded = 0 (1 or 2 rooms)
Main source of energy for cooking	Electricity = 1 Kerosene = 2 Gas = 3 Firewood = 4 Charcoal = 5 Not Applicable = 6 Others = 7	Modern source = 1 (Electricity, kerosene, gas) Poor source sources = 0 (the rest)
Main source of energy for lighting	Electricity = 1 Hurricane lamp = 2 Pressure lamp = 3 Firewood = 4 Candle = 5 Wick lamp = 6 Solar = 7	Modern source = 1 (Electricity, pressure lamp, solar) Poor source sources = 0 (the rest)

<b>(Table 5.1: Recoding of Variable continued)</b>		
Main source of drinking water	Other = 8	Modern source = 1(Piped water) Poor source sources = 0(the rest)
	Piped water = 01	
	Protected well = 02	
	Unprotected well = 03	
	Protected spring = 04	
	Unprotected spring = 05	
	River/stream = 06	
	Pond = 07	
	Lake = 08	
	Rain water = 09	
	Water vendors = 10	
Toilet facilities	Others = 11	Toilet = 1(Flush, pit, VIP) No facility = 0(the rest)
	Flush toilet = 1	
	Pit (traditional) = 2	
	Pit (ventilated -VIP) = 3	
	No facility = 5	
	Others = 6	

The other steps in constructing the index are:

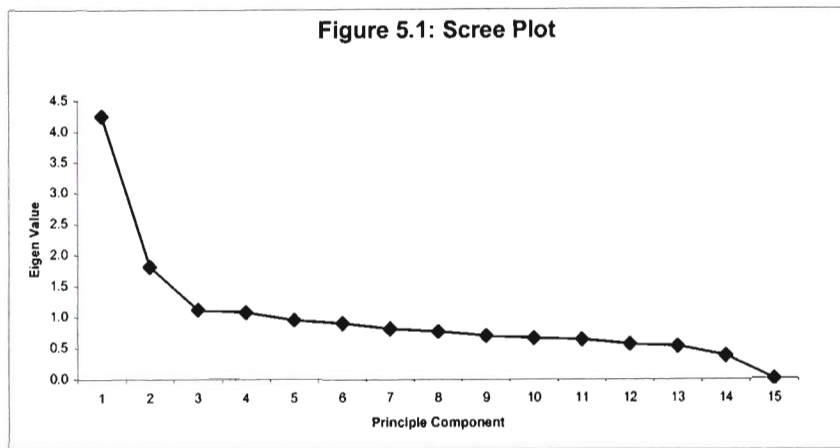
- Assigning weight to each variable by principal component method explained above.
- Aggregating the weights to create an index for each household.
- Once the index has been created, households are sorted by the index, and cut-off values for percentiles of population established. Households are then assigned to a group on the basis of their value on the index. For simplicity purposes I have referred the bottom 40 percent as “poor” the next 40 percent as “middle” and the top 20 percent as “rich”. This classification does not follow any of the usual definitions of poverty.
- Several social indicators of the population in those three categories i.e. “poor”, “middle” and “rich” are calculated and compared. The expectation is that households in the “rich” category should fare better when compared to other two groups.

### 5.3 Results

The principal component analysis extracted four principal components with eigen value of equal or greater than one. The first component with an eigen value of 4.282 explained 28.3 of the variation in the 15 asset variables. (See appendix 5.1). A plot of eigen value versus the principal components reveals that a smooth decline appears to level after the first component (See figure 5.1 below) indicating that the remaining



principal components do not explain much about the variables. Based on this argument, household wealth can be explained by the first four principal components alone. Variables with large magnitude weights in the principal component vector are more important than others and variables with similar magnitude are correlated. In this exercise, roofing material (0.679), wall material (0.643), floor material (0.770) and source of energy for lighting (0.663) have the highest magnitude weight and hence they are more important in explaining the welfare of the household.



*Source: By the Author from Tanzania 2002 Population Census*

Table 5.2 below shows the scoring factors from the principal components analysis for the 15 variables. Scoring factors (column 2), mean (column 3) and Standard Deviation SD (column 4) has been obtained by principal component analysis without rotation. (see appendix 5.2 and 5.3). Column 5 of the table is obtained by dividing column 2 by column 4 i.e. scoring factor over standard deviation required because the factor scores that are generated are standardized. A standardized score is a dimensionless quantity derived by subtracting from the individual score and then dividing the difference by the sample standard deviation. The score represents the number of standard deviations between the individual score and the mean, and it is negative when the individual score is below the mean, positive when above.

To obtain columns 6 to 8, households were sorted by the asset index and cut-off values established. Households were assigned to a group on the basis of their value on the index. I have referred the bottom 40 percent households as “poor”, the following 40 percent as “middle” and the top 20 percent as “richest”.

All the fifteen asset variables take only the value of 0 and 1, and therefore the weights in column 5 have an easy interpretation. A move from 0 to 1 changes the index by scoring factor/standard deviation reported in column 5. A positive value means a relative higher index than the household without and a negative value means a relatively lower index. For example a household that has modern roofing material has an asset index 1.359 higher than one that does not; owning a radio raises a household asset index by 1.015 and so on. On the other hand owning a hand-hoe lowers the asset index by 0.703 units.

**Table 5.2: Scoring Factors and Summary Statistics for Variables entering the Computation of the First Principal Component**

Variable (1)	Scoring Factors (2)	Mean (3)	SD (4)	Scoring Factor/SD (5)	Means		
					Poorest 40% (6)	Middle 40% (7)	Richest 20% (8)
Material for roof	0.679	0.525	0.499	1.359	0.079	0.750	0.993
Material for wall	0.643	0.310	0.463	1.390	0.035	0.344	0.809
Material for flooring	0.770	0.307	0.461	1.669	0.001	0.304	0.942
Source of water for drinking	0.474	0.378	0.485	0.978	0.114	0.476	0.730
Owning a radio	0.506	0.537	0.499	1.015	0.256	0.649	0.897
Owning a telephone	0.444	0.032	0.177	2.507	0.000	0.004	0.155
Owning a bicycle	0.202	0.350	0.477	0.424	0.256	0.388	0.475
Owning a wheelbarrow	0.348	0.152	0.359	0.970	0.035	0.172	0.351
Owning a smoothing iron	0.283	0.045	0.208	1.357	0.003	0.039	0.144
Owning electricity	-0.703	0.747	0.435	-1.617	0.000	0.758	0.224
Owning a hand hoe	-0.703	0.747	0.435	-1.617	1.000	0.758	0.224
Number of rooms	0.249	0.305	0.460	0.541	0.203	0.337	0.457
Energy for cooking	0.336	0.040	0.196	1.716	0.000	0.021	0.158
Energy for lighting	0.663	0.121	0.326	2.035	0.000	0.040	0.530
Toilet facilities	0.501	0.056	0.231	2.172	0.000	0.013	0.258

Source: Calculated by the Author from Tanzania 2002 Population Census

## 5.4 Reliability of the Index

The major objective of constructing the household asset index is to tackle the challenge of assessing the economic status of households when income or consumption data are not available. The following section explains if this intended objective is really achieved. This paper adopts two ways to test the reliability of the index - robustness and coherence.

### 5.4.1 Robustness

According to Filmer and Pritchett (2001), for robustness the index must produce very similar classification when different subset of variables is used in its construction. Table 5.3 below shows the percentage of households classified in the poorest 40 percent when all assets are used, compared with indices based on: all variables except those related to source of drinking water, toilet facilities, availability of electricity and ownership of six durable assets alone. These assets are radio, telephone, bicycle, wheelbarrow, smoothing iron and a hand hoe. Column two shows that only 9 percent of households classified as poor moves to the middle category and no household moves to the richer 20 percent when fewer variables are used in the construction of the index. When only ownership of assets is considered (column 3) almost no household would be classified as rich as only 0.5 percent moves to the middle category.

**Table 5.3: Classification Differences of the Poorest 40 Percent**

	Base Case: All 15 variables	All 15 variables except drinking water, toilet facilities and electricity	Only 6 variables; ownership of durable assets
Poorest 40%	100.0	90.9	99.5
Middle 40%	0.0	9.1	0.5
Richest 40%	0.0	0.0	0.0
Total	100.0	100.0	100.0

*Source: Calculated by the Author from Tanzania 2002 Population Census*

Another method for testing for robustness can be derived from the rank coefficients, which compares the degree to which the two methods produce the same ranking of households (Filmer and Pritchett, 2001: 119). Under this approach three types of

indices were produced using the above classification in table 5.3. The three indices were used in ranking the households and these rankings were then tested for Spearman's correlation. Spearman's correlation is a non-parametric test for the strength of the relationship 'r' between pairs of variables. Values of "r" range from +1 (perfect correlation), through 0 (no correlation), to -1 (perfect negative correlation). In general terms, correlation coefficients:

- Up to 0.33 are considered to indicate **weak** relationships
- Between 0.34 and 0.66 indicate **medium** strength relationships
- Over 0.67 indicate **strong** relationships.

Appendix 5.4 shows that the Spearman rank between index 1 and index 2 is close to one (more than 0.9) in all regions. The correlation between index 1 and index 3 is also high – ranges between 0.75 to 0.87 indicating that adding more variables in constructing the index only increases the similarity of the ranking. In other words the index produces very similar classification when different subset of variables is used.

Using a different methodology for deriving weights makes an additional check. The same procedure is repeated but this time unweighted least square method is used to produce the weights instead of the principal component. The unweighted least squares method produces, for a fixed number of factors, a factor pattern that minimizes the sum of the squared differences between the observed and reproduced correlation matrices (ignoring the diagonals) (Norusis, 1990: 327). The first factor derived by this method yields a household ranking that has a 0.988 Spearman rank correlation with a ranking derived from principal components (see appendix 5.4). In every region the correlation is almost perfect i.e. close to 1, as it ranges from 0.994 to 0.999. According to Filmer and Pritchett this indicates that results drawn from the asset index approach are robust to whether one picks one or the other of these methods (Filmer and Pritchett, 2001: 119).

#### **5.4.2 Internal Coherence**

Columns 6 to 8 of Table 5.1 compare the average ownership of each asset across the poor, middle and rich households. Large differences are found across groups for almost all assets. The use of modern materials for roofing is almost 100 percent (99.3 percent) for the rich compared to only 7.9 percent for the poor. Likewise for wall

materials, the average is 81 percent for rich households compared to 3.5 percent for the poor. On the other hand, ownership of a hand-hoe is 100 percent among the poor compared to only 22.4 among the rich households an indication that poor households mostly depend on small-scale agriculture for survival. Table 5.3 to 5.7 below also confirms this coherence as for every indicator chosen households classified as rich by the asset index perform much better than those households classified as poor.

### **5.5 Limitations of the Asset Index**

Alternative ways of measuring poverty, which include the asset index approach, are necessary because income expenditure surveys are expensive to conduct and only reflect a narrow dimension of poverty. However, these approaches have their shortcomings. The following section outlines the shortcomings and limitations of the asset index approach when used as a proxy for household wealth.

The following clarifications must be clearly understood to avoid confusion. Firstly, the asset index is not a proxy for current consumption expenditure nor is it a measure of current welfare or of poverty (Filmer and Pritchett, 2001: 116). This observation must be clear because other analysts like Montgomery *et al* (2000) have found that the asset index is a weak predictor of consumption per adult although they also admit that hypothesis tests based on proxies are likely to be powerful enough to warrant consideration. Likewise Sahn and Stifel (2001), using data from 12 separate LSMSs (Living Standard Measurement Surveys) also found the correlation of their asset index with household expenditure to be weak. The asset index however must be viewed - as Filmer and Pritchett (2001: 166) put it - as "... a proxy for something unobserved: household's long-run economic status". Household asset indices is strictly limited to providing *relative* analyses of welfare, e.g. the characteristics of those households in the bottom 20% of the distribution versus those in the top 20%. Asset indices can say nothing about levels of absolute poverty (Falkingham and Namazie, 2001:19). As mentioned before Tanzania census data in 2002 did not contain any information on ownership of land, livestock and other agricultural equipment, which are very important in determining the current welfare of a household.

The first major shortcoming of the index is that many of the currently used indicators used by this thesis are heavily correlated with urban/rural residence and differences at

the community level rather than the household level (e.g. access to electricity or piped water) with the result that the distributional analysis based on the whole population may not adequately capture differentials within and between areas (DFID, 2003). Provision of such services tends to cover all members of the community irrespective of their wealth, and the reverse is obviously true. In a country like Tanzania, where there is a significant difference between rural and urban areas in terms of services like electricity and piped water, the index may tend too much to reflect rural/urban variables rather than household-specific variables. Construction of the household asset index in this thesis, for example, is mostly likely to favour urban areas where piped water, flush toilets and electricity (main source for cooking and lighting) are available. Associated with this is how to treat household based indicators assets and services that are shared or publicly owned. For example the question in a census on source of drinking water for the household simply asked the source (What is the main source for household?) but did not ask if this source was private, shared or publicly owned.

Another shortcoming, which needs further research, is the issue of understanding how households are re-ranked within the distribution depending upon the assumptions used. The asset index approach does not take into account the size or composition of the household in assigning weights, i.e. households are treated as equal, which is not correct. Studies have found that larger household sizes are associated with greater incidence of poverty, as measured by household consumption or income per person. Child/adult ratios are also larger in poor households (Lipton and Ravallion, 1995: 2586). The Household and Budget Survey in Tanzania in the year 2000/01 revealed that headcount ratio increased with household size. The survey also found that households with higher proportion of dependents – that is, children under 15 years and adults 65 years and over, were more likely to be poor (National Bureau of Statistics, 2002: 90). While there is extensive research on the impact of equivalence scale (explained in Chapter two) for money metric indicators, there is no parallel literature for asset-based indicators.

Asset ownership based on information from a census or other demographic surveys does not reflect the *quantity* nor *quality* of durable goods owned by the household and it could be argued that those better off may have better quality or technological

advanced equipment than those less well off. For example, a colour television is definitely more expensive and of better quality than a black and white television. The quality of building materials should also be a matter of concern here. While for example some houses are built using baked bricks, which are industrially produced, and hence of better quality some households use locally produced baked bricks of poor quality. Households may also have more than one radio or television and this is not reflected in the data. The index also treats ownership of assets and housing conditions as equivalent, even though they may have different meaning. For example urban slum dwellers often live in brick and concrete houses, but in far worse conditions than rural families in thatched or tin houses (Deaton, 1997, cited in Falkingham and Namazie, 2001:18). However, ownership of assets, taken in conjunction with information on basic services and housing conditions, is unlikely to affect the final picture of welfare (Falkingham and Namazie, 2001:16).

Lastly is the issue of weighting. While principal component analysis continues to be the most commonly used form of weighting, it is not optimal because there may be other methods that possess superior statistical properties (Filmer and Pritchett, 2001: 166). In the multidimensional analysis of changes in living standards in Uganda, Younger (2003) used a factor analysis approach to assign weights because he is convinced that although the technique is similar to principal components, it has certain statistical advantages. Interestingly there is little difference in the two alternative approaches; the Spearman rank coefficient for indices created using the two methods was found by Sahn and Stifel (2001) to be about 0.98. To test for coherence a different weighting, unweighted least squares method was adopted. The method produced a Spearman rank correlation of 0.988 with ranking derived from PCA indicating a very strong relationship (see page 76).

## **5.6 Short Poverty Profile**

This section analyses the characteristics of households based on chosen poverty indicators. The main objective of this section is once again to prove the coherence of the asset index and to show that the index is an excellent predictor of welfare among households. For the purpose of this paper, I have included only materials used for building the main house (roof, wall and floor) used by the households, services available to the households (safe water and electricity) and ownership of some durable assets. The same classification used before in this chapter of “arbitrarily” classifying

the bottom 40 percent of the household as “poor”, the middle 40 as “middle” and the top 20 percent as “rich” is also used here.

### **5.6.1 Housing**

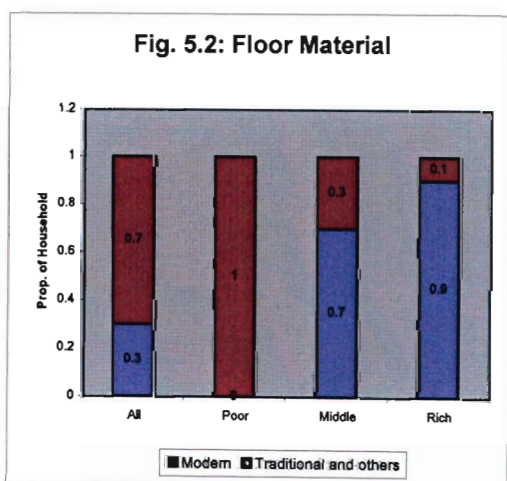
Housing quality is often judged on the type of flooring material that is used (May, 2003: 30). For the purpose of this analysis I have also included wall and roof material as a proxy for housing quality. Table 5.4 below, which is summarized in figures 5.2 to 5.4, shows the differences in building materials between the three quintiles. The table indicates that mud was the most common type of flooring material used by the population accounting for 69 percent of the households. Among the rich 20 percent, cement was more common (94 percent) and almost 100 percent of the households in the poor category had mud as flooring material. The same observation is made for roofing and wall material respectively. Only 8 percent of the poor households had modern materials as roofing material (iron sheets, tiles, concrete, and asbestos) compared to 75 percent in the middle category and 96 percent among the rich households. Turning to wall materials, the table shows that poles/mud and sun dried bricks were the most common wall materials. Among the poor, poles and mud accounted for over 50 percent of the households (53 percent), followed by sun dried bricks (41 percent). Among the rich cement bricks and sun dried bricks were more common representing 48 and 30 percent of the households respectively.



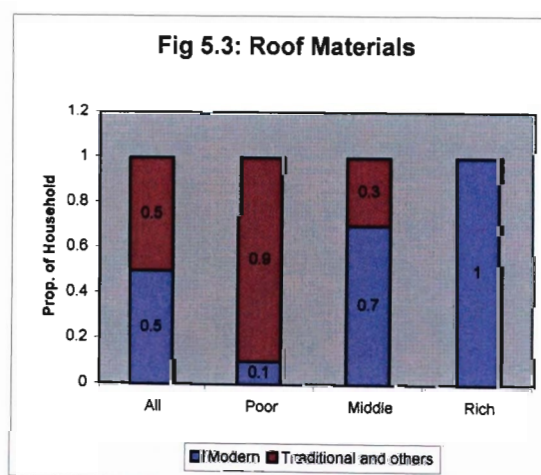
**Table 5.4: Percentage of Households and Building Materials**

Floor Material	All	Poorest 40%	Middle 40%	Rich 20%
Cement	30.6	0.1	30.3	94
Mud	68.8	99.2	69.1	5.6
Timber	0.4	0.4	0.4	0.1
Tile	0.1	0.0	0.1	0.2
Others	0.2	0.2	0.2	0.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Roofing Materials</b>				
Iron sheets	51.5	7.9	74.3	95.5
Tiles	0.5	0.0	0.5	1.7
Concrete	0.2	0.0	0.0	1.0
Asbestos	0.3	0.0	0.1	1.1
Grass	37.8	71.7	21.3	0.7
Grass and mud	9.5	19.9	3.6	0.0
Others	0.3	0.5	0.1	0.0
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Wall Materials</b>				
Stones	1.2	0.0	1.6	2.7
Cement bricks	13.1	0.0	9.0	48.1
Sun dried bricks	33.2	40.7	35.9	12.3
Baked bricks	16.8	3.5	23.8	30.1
Poles and mud	33.7	52.7	28.2	6.0
Timber	0.5	0.1	0.9	0.6
Grass	1.0	2.2	0.2	0.0
Others	0.5	0.8	0.4	0.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

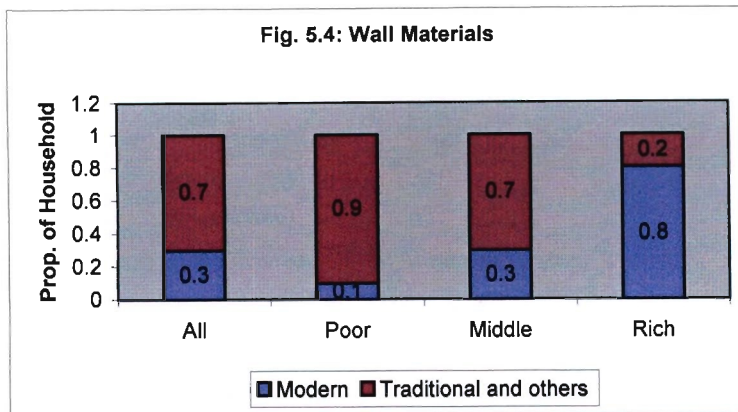
Source: Calculated by the Author from 2002 Population and Housing Census



Source: By the Author from 2002 Census



Source: By the Author from 2002 Census



*Source: By the Author from 2002 Census*

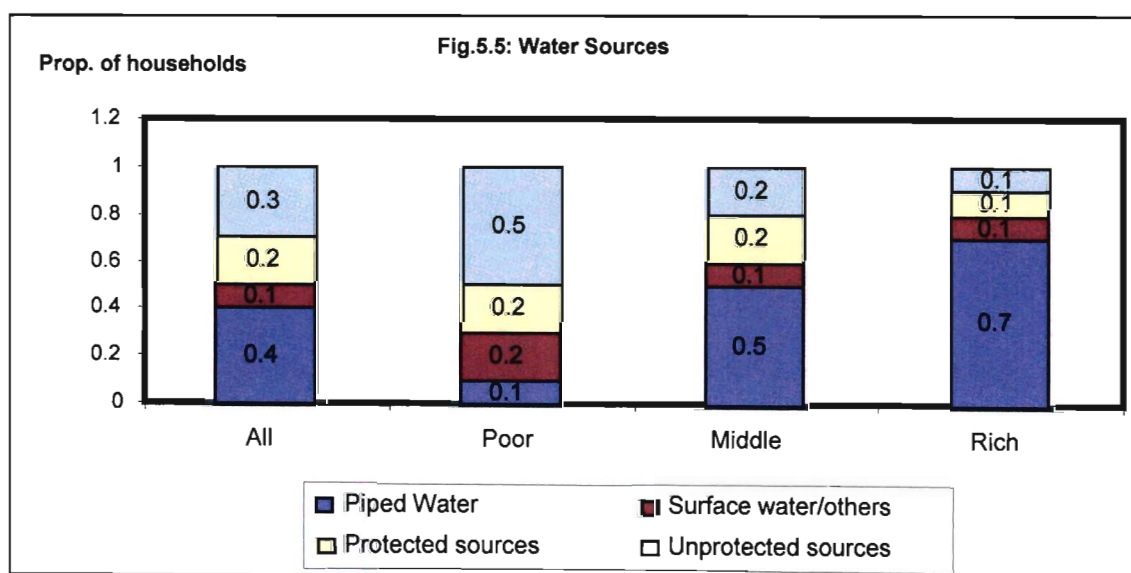
### 5.6.2 Facilities and Services

Access to essential facilities and services is an important measure of well being and is frequently given as priorities of the poor in studies using qualitative methodologies (SA-PPA, 1998 cited in May, 2003: 30). Table 5.5 below (summarized in figure 5.5), shows the percentage of households by major source of drinking water, toilet facilities and availability for electricity for the three quintiles. Data shows that unprotected wells were the major source of drinking water among the poor, while piped water is the major source among the middle class and the rich. Almost three quarters of the rich households used piped water and another 10 percent used protected well as a major source of drinking water. Turning to toilet facilities Table 5.5 below shows that flush toilets were non-existent among the poor and less than 1 percent of the households in the middle class had flush toilets. The table finally reveals that almost 100 percent of poor households had no electricity compared to 56 percent among the rich households.

**Table 5.5: Percentage of Households, Source of Drinking Water, Toilet Facilities and Availability of Electricity**

Source of Drinking Water	All	Poorest 40%	Middle 40%	Rich 20%
Piped water	37.8	11.4	47.6	73.0
Protected well	14	15.7	13.9	10.6
Unprotected well	24.7	40.1	18.2	5.9
Protected spring	5.3	6.3	5.6	2.6
Unprotected spring	4.1	6.2	3.4	1.3
River/stream	8.4	13.6	6.2	2.2
Pond	2.5	4.2	1.7	0.6
Lake	1.1	1.4	1.1	0.5
Rain water	0.4	0.6	0.3	0.3
Water vendors	1.5	0.4	2.0	2.9
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Toilet Facilities</b>				
Flush toilet	3.5	0.0	0.4	16.6
Traditional toilet	86	84.5	93.5	73.7
VIP	2.2	0.0	0.9	9.2
No toilet	8.3	15.4	5.1	0.5
Others	0.1	0.1	0.1	0.0
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Electricity</b>				
Available	10.1	0.1	3.3	43.9
Not available	89.9	99.9	96.7	56.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: Calculated by the Author from 2002 Population and Housing Census



Source: By the Author from Tanzania 2002 Population Census

### 5.6.3 Ownership of Assets

Table 5.6 below shows the ownership of assets by quintiles. With the exception of a hand hoe where the ownership among the poor is universal (100 percent), ownership of other assets is much higher among rich than poor households. For example, while 16 percent of households own a telephone the ownership is zero among the poor. Ninety percent of rich households own a radio compared to only 26 percent among the poor.

**Table 5.6: Percentage of Households by Ownership of Assets**

Asset	All	Poorest 40%	Middle 40%	Rich 20%
Radio	53.9	25.6	64.9	89.7
Telephone	3.3	0.0	0.4	15.5
Bicycle	35.2	25.6	38.8	47.5
Wheelbarrow	15.2	3.5	17.2	35.1
Smoothing iron	4.6	0.3	3.9	14.4
Hand hoe	75.0	100.0	75.8	75.0

*Source: Calculated by the Author from 2002 Population and Housing Census*

### 5.7 Regional Differentials

Table 5.7 below shows the percentage of households in the bottom 40 percent of the index by regions. Note that the bottom 40 percent in this thesis are arbitrary regarded as poor, although this does not differ significantly with the findings of the Household and Budget Survey in 2000/01. In that particular survey some 36 percent of Tanzanians fell below the basic needs poverty line (National Bureau of Statistics, 2002). The table shows that seven regions – Kilimanjaro, Dar es Salaam, Ruvuma, Arusha, Mbeya, Iringa and Mwanza had less than 40 percent of their households classified as “poor”. Seven regions – Tanga, Dodoma, Kagera, Morogoro, Mara, Kigoma and Shinyanga ranged between 40 and 50 percent while the rest had more than fifty percent of their households classified as poor.

The table also shows the comparison between the percent of households in the bottom 40 percent of the asset index and the percentage of the population below the poverty line measured using consumption (as per 2000/01 HBS). The ranking of regions differs, and this may be explained by the fact that whereas the poverty line is based on current welfare, the household asset index measures something else. The discrepancies can also be explained by both the shortcomings of both the asset index and of the conventional income measures. Regions that perform better are those with

relatively better infrastructure in terms of water and electricity and which are more urbanized (refer to the poverty profile in Chapter 4). Out of fifteen variables used in the construction of the asset index, five are related in one way or the other with availability of electricity or piped water. The asset index also does not take into account the urban- rural differences in terms of how the same need may be met in different ways and therefore regions, which are relatively more urban like Dar es Salaam, are likely to perform better.

Three regions, Dodoma, Shinyanga and Pwani, retain their positions on both rankings. However there are significant differences for some of the regions. Tabora, which was ranked number three below the poverty line falls to number sixteen by the asset index. Likewise Rukwa, which was ranked number eight, falls to number seventeen. This may be explained by the fact that only a few variables have been used in the construction of the asset index in this thesis. The variables are mainly based on housing conditions and availability of electricity, water and sanitation and they ignore other aspects of asset ownership like land and livestock. On the other hand, Arusha, Ruvuma and Mwanza perform much better on the asset index as compared to the poverty line. Mwanza and Arusha are the second and third largest cities in Tanzania after Dar es Salaam, which means the infrastructure of these regions is relatively more advanced than in most regions in the country. Ruvuma also fares better in terms of housing conditions (see Chapter 4) as compared to other regions.

Five of seven regions with 40 percent of households in the bottom 40 percent of the asset index, also appear in the list of regions with a large percentage of the population below the national average basic needs poverty line. The two worst regions by asset index, Singida and Lindi are also the worst by basic need poverty line.

**Table 5.7: Distribution of Households in the Bottom Forty Percent of the Asset Index and Percentage of Population below the Basic Need Poverty line by Region**

Region	Asset Index		Poverty Line		Differences in Rankings (5)=(2)– (4)
	Percent of Pop. In the bottom 40 percent (1)	Rank (2)	Percent of Pop. Below the Poverty Line (3)	Rank (4)	
Kilimanjaro	9.5	1	31.3	7	-6
Dar es Salaam	16.5	2	17.6	1	1
Ruvuma	27.6	3	41.3	14	-11
Arusha	27.8	4	38.8	13	-9
Mbeya	30.3	5	20.6	2	3
Iringa	33.4	6	28.9	5	1
Mwanza	38.8	7	47.9	18	-11
Tanga	41.6	8	36.5	10	-2
Dodoma	42.9	9	34.3	9	0
Kagera	43.0	10	28.6	6	4
Morogoro	43.4	11	29.4	4	7
Mara	43.9	12	45.6	17	-5
Kigoma	45.2	13	37.5	12	1
Shinyanga	48.8	14	42.0	15	-1
Pwani	51.1	15	46.2	16	-1
Tabora	52.8	16	26.0	3	13
Rukwa	54.4	17	31.0	8	11
Mtwara	57.9	18	38.0	11	7
Singida	58.9	19	55.2	20	-1
Lindi	59.4	20	53.0	19	1
Manyara	43.4	-	-	-	
<b>Tanzania Mainland</b>	<b>40.0</b>		<b>36</b>		

*Source: Author's Calculations and National Bureau of Statistics, 2002*

## 5.8 Conclusion

This chapter has explained in detail an asset based alternative to the conventional use of expenditure or income in defining well being in poverty. The major objective of the chapter was to see if ownership of assets and housing conditions can be used to measure economic welfare and rank welfare, especially in a developing country like Tanzania where there is limited capacity to collect consumption, expenditure and price data. The results have shown that indeed the household asset index is robust and coherent and thus can be used as a proxy measure of poverty.

## CHAPTER 6

### CONCLUSION AND RECOMMENDATIONS

#### 6.1 Conclusion

(Difficulties encountered in defining poverty have been elaborated. The thesis has shown how the definitions of poverty have been changing over time, from the narrower approach which defines poverty using money metric measures to a much broader definition which includes other dimensions of living standards such as longevity, literacy, healthiness and risks and vulnerability. Different approaches can be used to measure and analyse poverty although no single measure satisfies all the needs at all times. In many developing countries like Tanzania however, the money metric measure is the “official” method for measuring poverty, as it is the most frequently used and it is the method promoted by the World Bank.

Evidence from the literature review indicates that attempts have been made in Tanzania to develop other tools, beyond household income and expenditure, for assessing household socio-economic positions although improvements can be made. The study has shown that, while poverty measurement and analysis in many developing countries like Tanzania is mostly based on conventional ways, alternative ways do exist and can be used to supplement those conventional ways or can be used as alternative in the absence of data on income/expenditure or consumption information collected from expenditure – income surveys. Attempts have been made in Tanzania to analyse and measure poverty in broader terms. The release of the Human Development Reports and the Participatory Poverty Assessment in 2002 and 2003 is a good example of these efforts.

The poverty profile reveals that despite Tanzania’s achievement in eradicating poverty and attaining millennium development goals, differentials between regions, locations and sexes do exist. There are wide variations among regions, with some regions well above the national average and others well below.

The study uses Tanzania’s 2002 Population and Housing Census to construct a household asset index. Variables included in the construction of the index are housing conditions and ownership of durable asset. The biggest problem in aggregating the

variables is the issue of weighting. While there are several options available, this study adopts principal component analysis to assign weights to variables. However there are other data reduction techniques that can also be used to produce the same or better results. As Filmer and Pritchett observes "...the principal component approach is a pragmatic response to data constraint problem.....the approach is not "optimal" because there may be other methods that possesses superior statistical techniques" (Filmer and Pritchett, 2001: 116)

Three different tests were applied to test the index for robustness. All three tests produced the same conclusion that the index was robust to the asset included. The results also reveal that the index produces internally coherent results because average asset ownership and housing conditions differ markedly across poor, middle and rich households. Furthermore the index proves to be a good predictor of other welfare indicators. In summary the household asset index constructed from the population census information proves to be a reliable indicator of a household's long-run economic status.

The results however, have shown a "mismatch" with classification of population based on poverty line. As explained before this may have been the result of limited variables used in the construction of the asset index or other shortcomings of the asset index or conventional measures of poverty, or both. Further research in this area is therefore important before reaching important conclusions. The research should focus on areas like: what variables should be included in the construction of the index, weighting techniques and how public assets should be treated. Other important area for further research would be on rural-urban differentials.

The biggest disadvantage of the asset index is that it is only limited to providing relative analysis of welfare and it can not say anything about levels of absolute poverty (Falkingham and Namazie, 2001:19).

## **6.2 Recommendations**

The main objective of this study was to explore the use of proxy indicators for poverty measurement and analysis as an alternative tool for measuring household living standards and identifying the poor in Tanzania. The thesis has shown that



alternative data do exist in the country and that these can be used in the absence of sufficient data on income and expenditure to produce an alternative window on poverty. Three major recommendations can be made from the study.

Firstly, it is recommended that the use of proxy indicators for poverty measurement and analysis should also be given a priority in the country. Though the poverty monitoring system recognizes the importance of proxy indicators for poverty monitoring, but it has not been receiving the attention it deserves. This is illustrated by the absence of poverty issues in the analysis of the Demographic and Health Surveys that were held in 1991/92, 1996 and 2004. Poverty analysis is also absent in the 1994 Knowledge and Attitude Practice Survey, the 1999 Tanzania Reproductive and Child Survey, the 2002 Population and Housing Census and the 2004/05 Tanzania HIV Indicator Health Survey. Although the main objectives of the above mentioned surveys were not poverty measurement, the surveys (and the census) collected information on housing condition and ownership of assets that could have been used to construct the asset index and hence analyze the relationship between poverty and the focus of the study being undertaken.

Associated with this, the poverty monitoring system should also harmonize the type of questions in different surveys and researches. In a country like Tanzania where more than 70 percent of its population live in rural areas ownership of land or livestock could be included in the questionnaires. This move would not only increase the robustness of the asset index, but would also allow comparisons and trends analysis between studies.

Secondly, it is recommended here that Tanzania should emulate South Africa and other countries that have developed development indices with the population and housing census data. Population censuses have the big advantage over other surveys that they can produce small area statistics. Development indices developed for different administrative levels would help policy makers to identify the areas which are most deprived and hence needing more attention. The indices can also be the basis for the allocation of funds by the Government. This move would not only remove the disparity in development between different areas but would also answer critics who

argue that some parts of the country are favored by the Government when it comes to funds allocation.

Lastly it is recommended here that staff at the National Bureau of Statistics (NBS) which is the authoritative source of statistics pertaining to socio-economic conditions on Mainland Tanzania, and a reference in the country for statistical methodologies and standards (United Republic of Tanzania, 2001: 31), be trained in on poverty analysis and measurement.. As an employee of the National Bureau of Statistics, I know that the office lacks capacity on poverty analysis issues. Lack of capacity in this area may explain the absence of literature on proxy indicators in the country although data is available. This view is also shared by the poverty monitoring system in the country which observes that “...NBS is well provided with staff trained in demography.....The capacity of the NBS could be strengthened in a number of key areas, in order to contribute to the debate on poverty....” (United Republic of Tanzania, 2001: 31).

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**Appendix 1: Revised Poverty Indicators and Targets**  
**Education Indicators, Base line and Targets**

Indicator	Baseline		Targets	
	Estimate	Year	2003	2010
Percentage of the population below the basic needs poverty line	59	2000 [1]	90	100
Primary gross enrolment ratio (%)	78	2000 [1]	100	
Ratio of girls/boys in primary	0.98	2000 [1]	1.00	
Ratio of girls/boys in secondary	0.85	2000 [1]	0.90	
% of cohort completing std 7	70	2000 [1]		
Primary dropout rate (%)	6	2000 [1]	3	
% students passing PSLE	22	2000 [1]	50	
Transition rate std 7 to form 1 (%)	16	2000 [1]	28	
Literacy rate of pop aged 15+	17	2000-01 [2]		100
Literacy rate of pop aged 15-24	82	2000-01 [2]		

**Health Outcome and Nutrition Indicators, Base line and Targets**

Indicator	Baseline		Targets		
	Estimate	Year	2003	2010	2025
Total fertility rate	5.6	1997[1]			
Infant mortality rate	99	1997[1]	85	50	20
Ratio of the IMR of the poorest quintile to the IMR of the richest	1.25	1997[1]			
Under-five mortality rate (MDG)	147	1997[1]	127	79	
HIV prevalence in age group 15-24 (%)	Male: 8 Female: 13	2000[2]			
% of children born to HIV+ mothers who					
Life expectancy at birth	52	1988[3]		52	
<b>Nutrition in the under fives:</b>					
Stunting (moderate-severe, %)	44	1999[1]		20	
Wasting (moderate-severe, %)	5	1999[1]		2	
Under-weight (mod.-severe, %)	29	1999[1]			



### Health Service Indicators, Base line and Targets

Indicator	Baseline		Targets	
	Estimate	Year	2003	2010
Annual no. of outpatient visits per capita	Gov 1.3 All 2.3	-		
Health facility users' satisfaction (%)	Gov. 66 All 71	-		
Total number of family planning acceptors (new and old users)		-		
Births attended by doctor, nurse or skilled midwife (%) (MDG)	36	-		80
Births taking place in govt health facility (%)	44	-		
DTP(Hb)3 immunization coverage (%)	DHS 81 MoH 76	≈90(2002)	85	
TB treatment completion (%)	78	-		

Source: United Republic of Tanzania, 2004: Poverty Reduction Strategy: The Third Progress Report 2002/03



<b>B: WATU WOTE</b>		Mtu wa 1	Mtu wa 2	Mtu wa 3	Mtu wa 4	Mtu wa 5	Mtu wa 6
<b>10 MAHALI ALIPOZALIWA</b>							
Je (jina) alizaliwa/ulizaliwa wapi?							
JAZA GERESHO LA MKODI IKIWA ALIZALIWA TANZANIA NA GERESHO LA NCHI IKIWA ALIZALIWA NJE YA TANZANIA		00:00	01:00	02:00	03:00	04:00	05:00
<b>MAGERESHO YOTE YAMEONYESHWA KWENYE KARATASI NYINGINE</b>		06:00	07:00	08:00	09:00	10:00	11:00

<b>11 MAHALI ANAPOISHI</b>							
Kwa kawaida (jina) anaishi/unalishi wapi?							
JAZA GERESHO LA MKODI IKIWA ANAISHI TANZANIA NA GERESHO LA NCHI IKIWA ANAISHI NJE YA TANZANIA		00:00	01:00	02:00	03:00	04:00	05:00
<b>MAGERESHO YOTE YAMEONYESHWA KWENYE KARATASI NYINGINE</b>		06:00	07:00	08:00	09:00	10:00	11:00

<b>12 MAHALI ALIPOISHI 2001</b>							
Je (jina) alikuwa/ulikuwa anaishi/unalishi wapi mwaka 2001?							
JAZA GERESHO LA MKODI IKIWA ALIISHI TANZANIA NA GERESHO LA NCHI IKIWA ALIISHI NJE YA TANZANIA		00:00	01:00	02:00	03:00	04:00	05:00
<b>WALE WOTE WENYE UMRI CHINI YA MWAJKA MMOJA ("00" KATIKA SWALI LA "05") WAJAZIWE GERESHO "998"</b>		06:00	07:00	08:00	09:00	10:00	11:00

**C: ELIMU: WATU WENYE UMRI WA MIAKA 5 AU ZAIDI**

<b>13</b> Je (jina) unajua/anajua kusoma na kuandika katika lugha ya Kiswahili, Kiingereza, Zote mbili, Kiswahili na Kiingereza au lugha nyingine yoyote?	Kiswahili	(1)	(2)	(3)	(4)	(5)	(6)
	Kiingereza	(1)	(2)	(3)	(4)	(5)	(6)
	Zote mbili	(1)	(2)	(3)	(4)	(5)	(6)
	Lugha Nyingine	(1)	(2)	(3)	(4)	(5)	(6)

<b>14</b> Je, kwa hivi sasa (jina) unasoma/anasoma, uliachia/aliachia, umemaliza/amemaliza au hujawahi/hajawahi kwenda shule?	Anasoma	(1)	(2)	(3)	(4)	(5)	(6)
	Allachia	(1)	(2)	(3)	(4)	(5)	(6)
	Amemaliza	(1)	(2)	(3)	(4)	(5)	(6)
	Hajawahi	(1)	(2)	(3)	(4)	(5)	(6)

**IWAPO JIBU NI 'HAJAWAHI' NENDA HADI SWALI LA 16**

<b>15</b> Je (jina) umemaliza/amemaliza, unasoma/anasoma, uliachia/aliachia darasa la ngapi?							
		00:00	01:00	02:00	03:00	04:00	05:00
		06:00	07:00	08:00	09:00	10:00	11:00
		12:00	13:00	14:00	15:00	16:00	17:00
		18:00	19:00	20:00	21:00	22:00	23:00
		24:00	25:00	26:00	27:00	28:00	29:00
		30:00	31:00	32:00	33:00	34:00	35:00
		36:00	37:00	38:00	39:00	40:00	41:00
		42:00	43:00	44:00	45:00	46:00	47:00
		48:00	49:00	50:00	51:00	52:00	53:00
	54:00	55:00	56:00	57:00	58:00	59:00	

**D: AJIRA: WATU WENYE UMRI WA MIAKA 5 AU ZAIDI**

<b>16</b> Je (jina) ulikuwa/alikuwa unafanya/anafanya kazi gani katika kipindi cha miezi 12 liliyopita?	12	7	12	7	12	7	12	7	12	7
	miezi	siku	miezi	siku	miezi	siku	miezi	siku	miezi	siku
<b>17</b> Katika kipindi cha siku 7 zilizopita?	Alifanya kazi ya kulipwa muda wote	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Alifanya kazi ya kulipwa kwa msimu	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Alifanya kazi muda wote bila malipo	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Alifanya kazi ya msimu bila malipo	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Alifanya kazi muda wote kwa manufaa yake mwenyewe	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Alifanya kazi ya msimu kwa manufaa yake mwenyewe	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Hakufanya kazi lakini anatafuta kazi	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Hatafuti kazi lakini yuko tayari kufanya kazi	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Mwanafunzi muda wote	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Alifanya kazi za nyumbani zisizo za kiuchumi (km kupika)	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Hakufanya kazi/mzee sana/mgonjwa/hajilwezi	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Mwingine	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)
	Sijul	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)

**KAMA GERESHO NI 7 AU ZAIDI KWENYE SWALI LA 17 NENDA SWALI LA 21**

		Mtu wa 1	Mtu wa 2	Mtu wa 3	Mtu wa 4	Mtu wa 5	Mtu wa 6
<b>MASWALI YA 18 - 20 YAJIWIWE NA WATU WOTE WENYE MAGERESHO 01 - 06 KWENYE SWALI LA 17</b>							
18 Je (jina) ulikuwa/alikuwa kama mwanjiri, mwanjiriwa, kujajiri mwenyewe siyo kwenye kilimo, kujajiri mwenyewe kwenye kilimo, kazi za nyumbani bila malipo, mwanafunzi anayejifunza kazi (apprentices) au vipi?	Mwanjiri	01	02	03	04	05	06
	Mwanjiriwa	07	08	09	10	11	12
	Kujajiri mwenyewe kwenye kilimo	13	14	15	16	17	18
	Kujajiri mwenyewe kwenye kilimo	19	20	21	22	23	24
	Kazi za nyumbani bila malipo	25	26	27	28	29	30
	Mwanafunzi anayejifunza kazi (apprentices)	31	32	33	34	35	36
Wengineo							
Asiyetajwa							
19 Je (jina) ulifanya/alifanya kazi gani kuu katika kipindi cha siku 7 zilizopita?							
<b>MAGERESHO YOTE YAMEONYESHWA KWENYE KARATASI NYINGINE</b>							
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01-79							
01-80							
01-81							
01-82							
01-83							
01-84							
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01-93							
01-94							
01-95							
01-96							
01-97							
01-98							
01-99							
01-100							

<b>E: WANAWAKE WENYE UMRI WA MIAKA 12 NA ZAIDI</b>												
21 Je (jina) umezaa/amezaa watoto hai wangapi wa kiume na wangapi wa kike wanaoishi/wanaishi na wewe/eye hapa nyumbani? (IKIWA HAKUNA MTOTO ANAYEISHI PENGINE JAZA '00')	Mtu wa 1		Mtu wa 2		Mtu wa 3		Mtu wa 4		Mtu wa 5		Mtu wa 6	
	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE
	01	02	03	04	05	06	07	08	09	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31	32	33	34	35	36
	37	38	39	40	41	42	43	44	45	46	47	48
22 Je (jina) umezaa/amezaa watoto hai wangapi wa kiume na wangapi wa kike wanaoishi mahall pengine? (IKIWA HAKUNA MTOTO ANAYEISHI PENGINE JAZA '00')												
Mtu wa 1		Mtu wa 2		Mtu wa 3		Mtu wa 4		Mtu wa 5		Mtu wa 6		
HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	
01	02	03	04	05	06	07	08	09	10	11	12	
13	14	15	16	17	18	19	20	21	22	23	24	
25	26	27	28	29	30	31	32	33	34	35	36	
37	38	39	40	41	42	43	44	45	46	47	48	
23 Je (jina) umezaa/amezaa watoto hai wangapi wa kiume na wangapi wa kike ambao kwa bahari baya wamefariki? (IKIWA HAKUNA MTOTO ALITEFARIKI JAZA '00')												
Mtu wa 1		Mtu wa 2		Mtu wa 3		Mtu wa 4		Mtu wa 5		Mtu wa 6		
HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	HIKE	
01	02	03	04	05	06	07	08	09	10	11	12	
13	14	15	16	17	18	19	20	21	22	23	24	
25	26	27	28	29	30	31	32	33	34	35	36	
37	38	39	40	41	42	43	44	45	46	47	48	

24 Je (Jina) umezaa/amezaa watoto hai wangapi wa kiume na wangapi wa kike katika kipindi cha miezi 12 iliyopita? (UJWA HAKUNA MTOTO JAZA "0". USIMULIZE MAMA MWENYE UMRI WA MIKA 50 NA ZAIDI)	Mtu wa 1		Mtu wa 2		Mtu wa 3		Mtu wa 4		Mtu wa 5		Mtu wa 6	
	MHE	MKE	MHE	MKE	MHE	MKE	MHE	MKE	MHE	MKE	MHE	MKE
10	10	10	10	10	10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11	11	11	11	11	11
12	12	12	12	12	12	12	12	12	12	12	12	12
13	13	13	13	13	13	13	13	13	13	13	13	13
14	14	14	14	14	14	14	14	14	14	14	14	14

**F: MASWALI YA VIFO KATIKA KAYA**

25 Je, kuna kifo chochote kilichotokea katika kaya hii katika kipindi cha miezi 12 iliyopita? **Ndiyo** (1) **Hapana** (2)

**KAMA JIBU NI HAPANA NENDA SWALI LA 29 ILI KUHAKIKISHA VIFO VILİYOTOKEA ANDIKA IDADI YA VIFO KWENYE KISANDUKU**

26 Namba ya vifo	(1)	(2)	(3)	(4)	(5)	(6)
11	11	11	11	11	11	11
12	12	12	12	12	12	12
13	13	13	13	13	13	13
14	14	14	14	14	14	14
15	15	15	15	15	15	15
16	16	16	16	16	16	16
17	17	17	17	17	17	17
18	18	18	18	18	18	18
19	19	19	19	19	19	19

**G: MASWALI YANAYOHUSU NYUMBA**

29 Paa la nyumba yako kuibwa unayolishlirmezekwa na nini?	30 Kuta za nyumba yako kuibwa zimejengwa na nini?	31 Je, nyumba yako kuibwa unayolishlirmezekwa na nini?	32 Je, kaya yako ina nyumba vingapi vya kulala?	33 Mnatumia nishati/gani kuu kwa kupikia?	34 Mnatumia nishati/taa gani kuu kwa kuangazia/kuonea?	35 Je, ni mini chanzo kikomo cha maji mnapotumia lwa kuwya katika kaya hii?	36 Je, kaya yako inatumia chvo cha aina gani?	37 Je, kaya yako ina vitu vilivyavyo?
Bati (1) Vigae (2) Jega (3) Akabasi (4) Makuti/Byasi (5) Nyasi na Udongo (6) Nyingine (7)	Mawe (1) Matofali ya Simeni/saraji (2) Matofali ya Udongo (3) Matofali Yaliyochomwa (4) Mti na Udongo (5) Mibao (6) Makuti/Byasi (7) Nyingine (8)	Simeni/saraji (1) Udongo (2) Mibao (3) Vigae (4) Nyingine (5)	0 (1) 1 (2) 2 (3) 3 (4) 4 (5) 5 (6) 6 (7) 7 (8) 8 (9) 9 (10)	Umeme (1) Majuta ya taa (2) Gesi (3) Kuni (4) Mkaa (5) Nyingine (6) Habaiki (7)	Umeme (1) Karabai (2) Kandili (3) Kuni (4) Mchumaa (5) Kibatani (6) Sola (7) Nyingine (8)	Maji ya Bomba (1) Kuna Kichululwa (2) Kuna Kichululwa (3) Chemchem (4) Inayotuzwa (5) Chemchem (6) Inayotuzwa (7) Mtu/Ejoto (8) Lambo/Bwawa (9) Ziwa (10) Maji ya Mwa (11) Wazua Maji (12) Maji Mwingine (13)	Choe Cha Kavuta (1) Choe Cha Sheme (2) Ch Kavuta (3) Kuna (4) Hakuna Choe (5) Nyingine (6)	Radio (1) Simu (2) Ririkishi (3) Jembe la Miano (4) Toroli (5) Pasi ya Mkaa (6) Ulenema (7) Benema (8)

**H: JUMLA YA WATU**

Wanazume	Wanazake	JUMLA	TAREHE
(1)	(2)	(3)	(4)
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19

JINA LA MSIMAMIZI

TAREHE YA KUKAGUA DODOSO



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<b>Appendix 5.1: Total Variance Explained</b>						
<b>Component</b>	<b>Initial Eigenvalues</b>			<b>Extraction Sums of Squared Loadings</b>		
	<b>Total</b>	<b>% of Variance</b>	<b>Cumulative %</b>	<b>Total</b>	<b>% of Variance</b>	<b>Cumulative %</b>
1	4.242	28.28	28.28	4.24	28.28	28.28
2	1.803	12.02	40.30	1.80	12.02	40.30
3	1.118	7.45	47.75	1.12	7.45	47.75
4	1.069	7.13	54.88	1.07	7.13	54.88
5	0.948	6.32	61.20			
6	0.890	5.93	67.13			
7	0.800	5.33	72.46			
8	0.754	5.03	77.49			
9	0.683	4.55	82.04			
10	0.644	4.30	86.34			
11	0.623	4.16	90.49			
12	0.551	3.67	94.16			
13	0.515	3.44	97.60			
14	0.360	2.40	100.00			
15	0.000	0.00	100.00			

*Source: Calculated by the Author from 2002 Population and Housing Census*

#### **Appendix 5.2: Component Matrix**

<b>Variable</b>	<b>Component</b>			
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Material for roof	0.679	0.105	-0.185	0.340
Material for wall	0.643	0.181	-0.013	0.228
Material for flooring	0.770	0.202	-0.084	0.193
Source of water for drinking	0.474	0.269	-0.126	0.143
Owning a radio	0.506	-0.288	0.023	0.358
Owning a telephone	0.444	0.065	0.551	-0.346
Owning a bicycle	0.202	-0.515	0.212	0.399
Owning a wheelbarrow	0.348	0.572	-0.230	0.033
Owning a smoothening iron	0.283	-0.236	0.329	-0.072
Owning electricity	-0.703	0.478	0.350	0.385
Owning a hand hoe	-0.703	0.478	0.350	0.385
Number of rooms	0.249	-0.437	0.288	0.258
Energy for cooking	0.336	0.398	0.038	-0.115
Energy for lighting	0.663	0.252	0.223	-0.114
Toilet facilities	0.501	0.197	0.413	-0.204

*Source: Calculated by the Author from 2002 Population and Housing Census*

### Appendix 5.3: Descriptive Statistics

Variable	Mean	Std. Deviation	Analysis N
Material for roof	0.525	0.499	1228153
Material for wall	0.310	0.463	1228153
Material for flooring	0.307	0.461	1228153
Source of water for drinking	0.378	0.485	1228153
Owning a radio	0.537	0.499	1228153
Owning a telephone	0.032	0.177	1228153
Owning a bicycle	0.350	0.477	1228153
Owning a wheelbarrow	0.152	0.359	1228153
Owning a smoothening iron	0.045	0.208	1228153
Owning electricity	0.747	0.435	1228153
Owning a hand hoe	0.747	0.435	1228153
Number of rooms	0.305	0.460	1228153
Energy for cooking	0.040	0.196	1228153
Energy for lighting	0.121	0.326	1228153
Toilet facilities	0.056	0.231	1228153

Source: Calculated by the Author from 2002 Population and Housing Census

### Appendix 5.4: Spearman Rank Correlation

Region	Base (All variables)	Index 2	Index 3	Index 4 (Based unweighted least squares)
Dodoma	1	0.978	0.821	0.999
Arusha	1	0.985	0.878	0.997
Kilimanjaro	1	0.975	0.804	0.994
Tanga	1	0.979	0.774	0.998
Morogoro	1	0.979	0.758	0.999
Pwani	1	0.985	0.771	0.998
Dar es Salaam	1	0.982	0.796	0.995
Lindi	1	0.976	0.802	0.998
Mtwara	1	0.955	0.784	0.998
Ruvuma	1	0.977	0.804	0.998
Iringa	1	0.978	0.822	0.998
Mbeya	1	0.978	0.817	0.997
Singida	1	0.980	0.841	0.999
Tabora	1	0.990	0.831	0.998
Rukwa	1	0.976	0.755	0.998
Kigoma	1	0.976	0.789	0.999
Shinyanga	1	0.987	0.833	0.998
Kagera	1	0.987	0.813	0.998
Mwanza	1	0.986	0.817	0.998
Mara	1	0.986	0.818	0.998
Manyara	1	0.917	0.835	0.998
<b>Total</b>	<b>1</b>	<b>0.997</b>	<b>0.808</b>	<b>0.998</b>

Source: Calculated by the Author from 2002 Population and Housing Census